CHAPTER 9 PROFLOW MODULE

MODULE OVERVIEW

Purpose

The purpose of ProFlow is to apply printable material directly onto the stencil alleviating the need for squeegees and a paste dispenser. This system is derived from the material transfer technology DirEKt Imaging.

The ProFlow system is an optional replacement to the squeegee and paste dispenser systems.

ProFlow is a self contained unit with the following advantages:

- Fully sealed unit keeping the printable material in optimum condition.
- Cassette option easily changed for replacement units.
- Rechargeable unit option.
- Retention system keeping stencil surfaces clean.
- Reduction in printable material wastage.
- Reduction in under screen cleaner paper and solvent usage.

Elements

The main units of ProFlow comprise:

- ProFlow Printhead Mechanism
- ProFlow Pressure Mechanism
- ProFlow Transfer Head

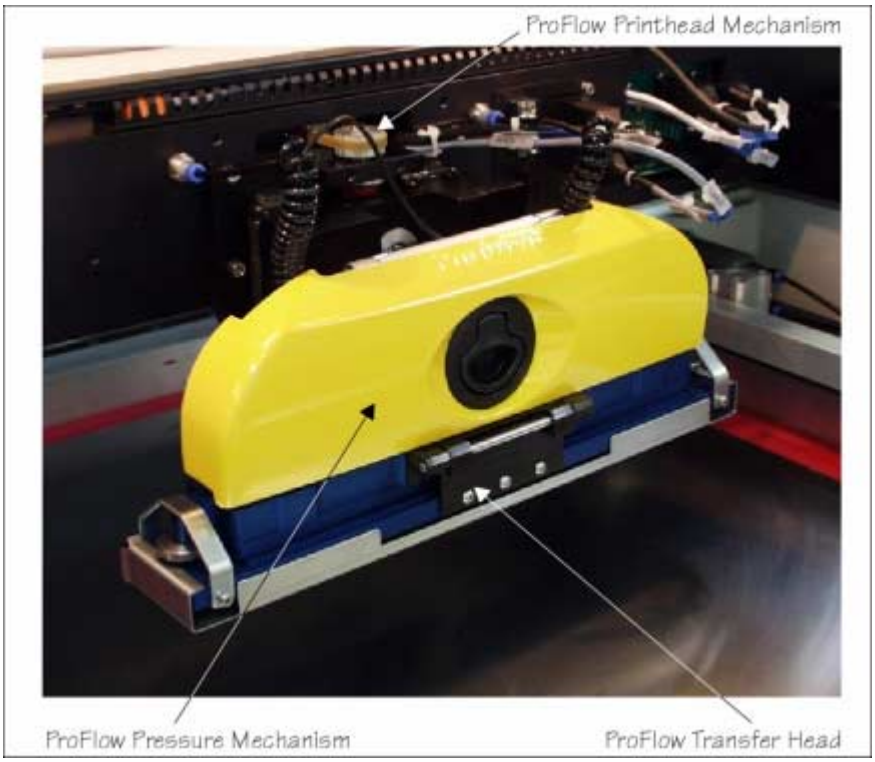


Figure 9-1 ProFlow Fitted to the Machine

The main components of each unit consist of the following:

Pressure Mechanism
- Pneumatic Actuators, (2 positions)
- Pressure Regulator (manually controlled or remotely mounted Software Controlled Air Regulator - SCAR)
- Pressure Gauge (manually controlled regulator option)
- Air Pilot Valve (manually controlled regulator option)
- Cassette Low Sensor
- Piston Crosshead

Transfer Head
- Conditioning Chamber (single or dual chamber)
- Cassette Carrier or Rechargeable Unit Option
- Cassette (optional)
- Retention System

Configuration The following optional configurations of ProFlow are available for use on this machine:

Pressure Mechanism Two types of optional pressure mechanism are available:

- Manual controlled pressure settings
- Software controlled pressure settings

Cassette The ProFlow cassette is available in 300mm size only (capacity approximately 800g - 850g solder paste).

Transfer Head The table below lists the types of optional transfer head units, and sizes available, for use with ProFlow.

Transfer Head Type	Transfer Head Sizes (mm)					
	150	300	350	400	450	500
Cassette Type (single conditioning chamber)		✓	✓	✓		
Cassette Type (dual conditioning chamber)		✓	✓	✓		
Rechargeable Type (single conditioning chamber)		✓	✓	✓	✓	✓
Rechargeable Type (dual conditioning chamber)	✓	✓	✓	✓	✓	✓

NOTE
All of the above cassette transfer heads are fitted with the standard 300mm cassette and 300mm piston crosshead. A dedicated piston crosshead is required for each rechargeable transfer head size.

Operation

ProFlow operates in the Y and Z axes (horizontal and vertical planes).

The unit is raised and lowered to the screen by means of the special ProFlow printhead mechanism stepper motor.

A downward force is applied to the ProFlow transfer head directly onto the stencil which provides:

- A positive seal between the transfer head and stencil eliminating leakage above the stencil.
- Improved gasketing effect to give the best possible seal between stencil and board.

The horizontal movement, driven by the machine print carriage motor, moves the unit across the stencil in a forward and reverse direction (Y axis). A print cycle may consist of a single movement in the Y axis, (forward or backwards).

Paste pressure (pneumatic pressure), either manually or software controlled, is applied to the piston crosshead exerting a force onto the print material which, in turn, forces print material into the ProFlow conditioning chamber and into the stencil apertures.

As the unit moves across the stencil, the trailing wiper within the transfer head, lifts the print material from the screen surface creating a rolling movement of material within the conditioning chamber. The volume of material, under pressure from the piston crosshead, is kept at a constant level within the chamber.

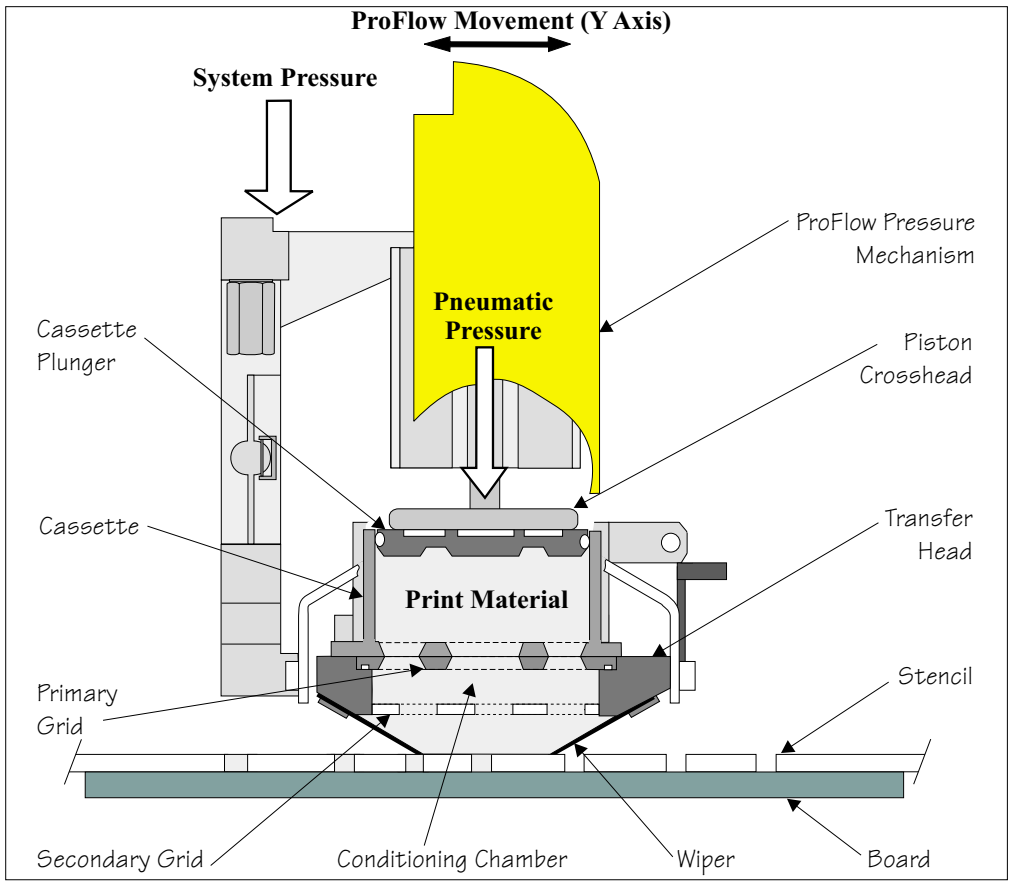
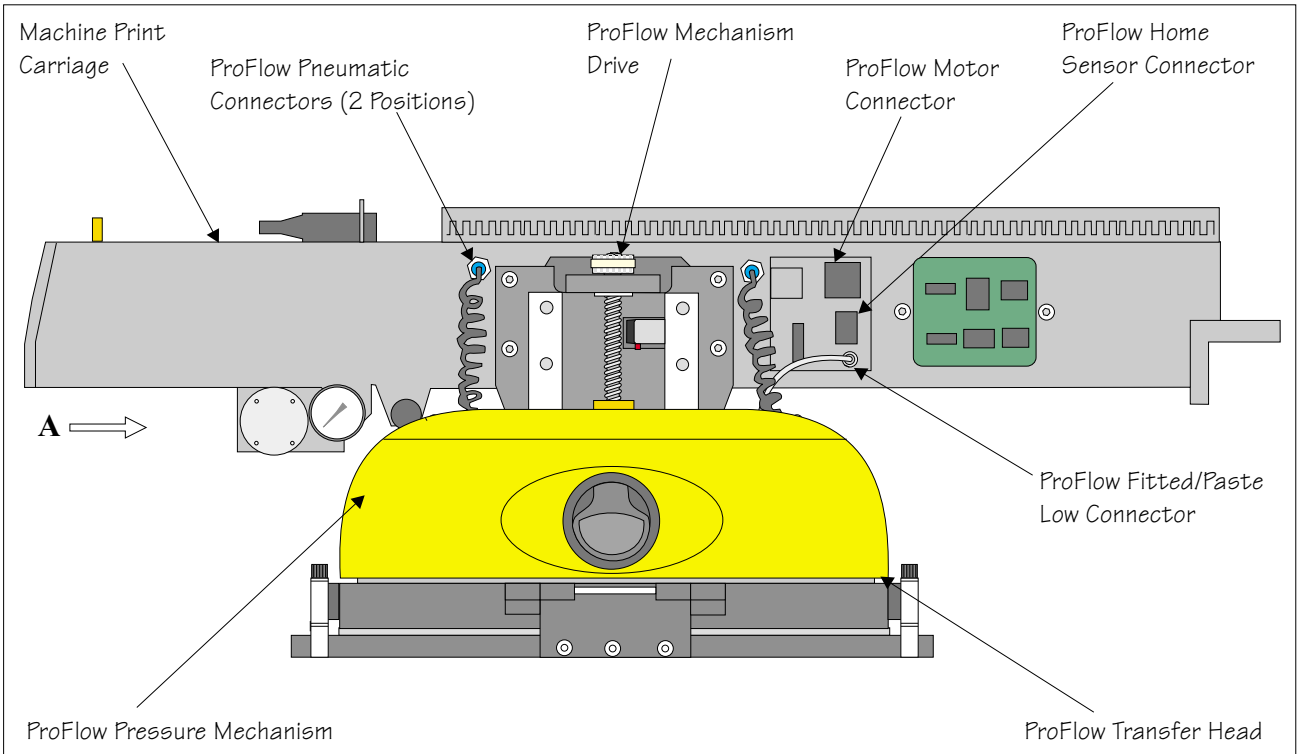
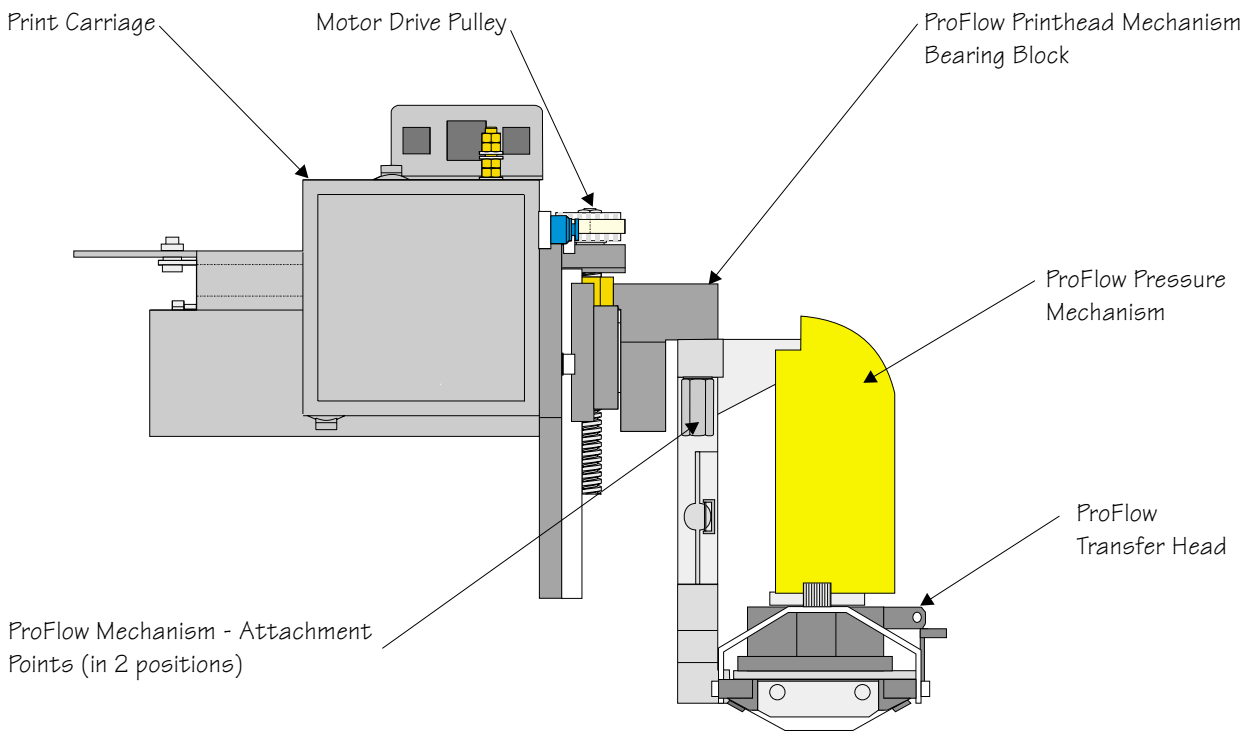


Figure 9-2 ProFlow Cross Section (with Cassette Option)



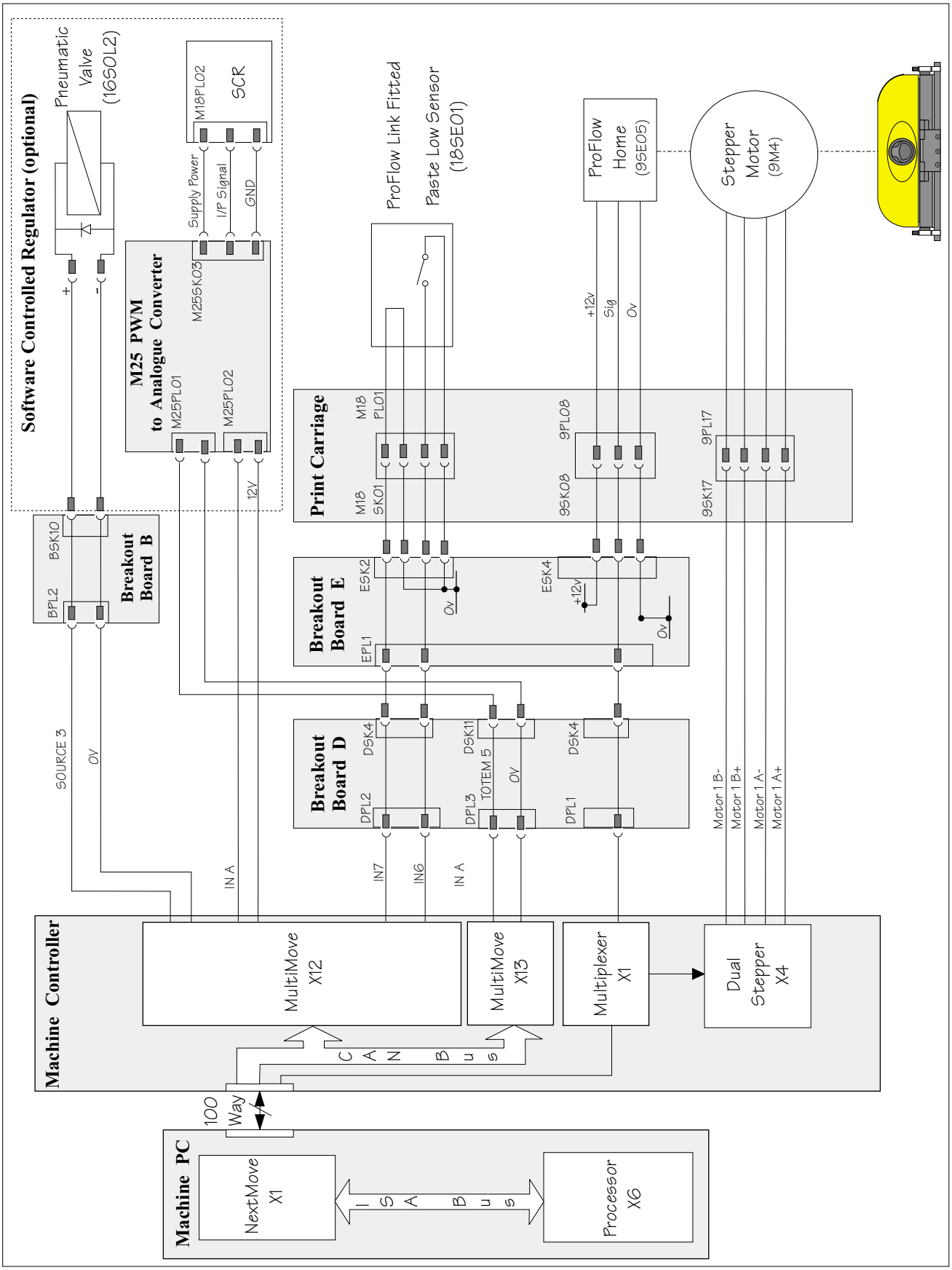
Front View of Print Carriage Showing ProFlow Fitted (cassette option)



View on Arrow A (air line omitted for clarity)

Figure 9-3 ProFlow Fitted to Machine

ELECTRICAL SCHEMATIC



MECHANICAL DETAIL

General

The ProFlow unit is fitted to the printhead mechanism by means of two securing bolts.

ProFlow Pressure Mechanism

The primary function of the pressure mechanism is to provide an adjustable downward force (pneumatic pressure) onto the transfer head paste system. This pressure (paste pressure) is set either manually or by software control depending upon pressure mechanism option fitted, (refer to Pneumatic Supply paragraph of this section and Adjustments and Settings Section of this chapter for further information).

Details of the pressure mechanism elements are listed in the Pressure Mechanism Elements Figure and table below.

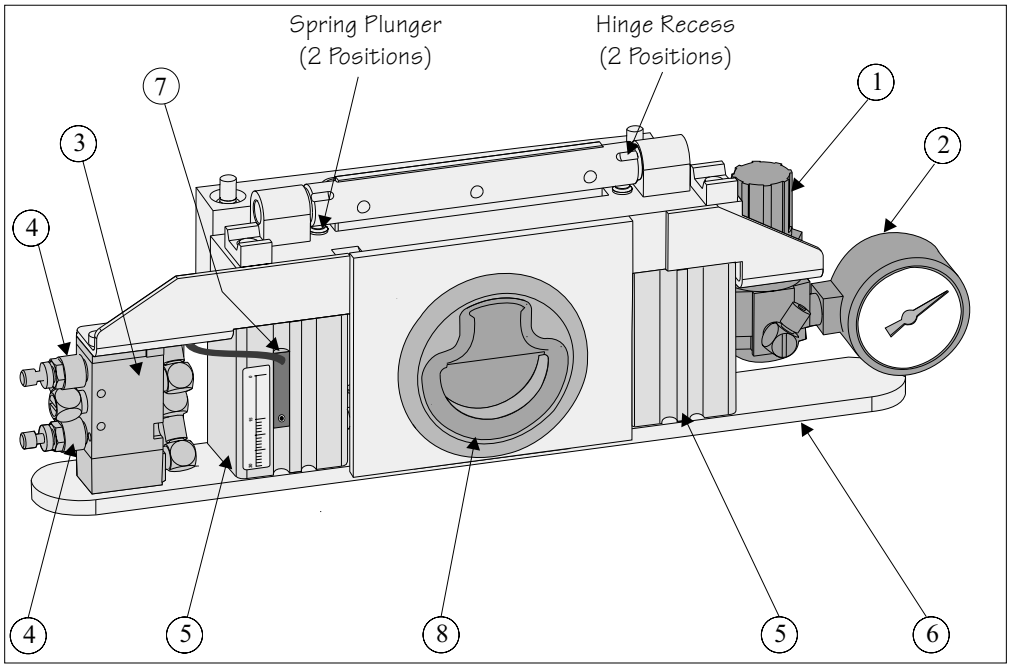


Figure 9-4 Pressure Mechanism Elements (cover removed)

Item	Description
1	Pressure Regulator (manual option only)
2	Pressure Gauge (manual option only)
3	Air Pilot Valve (manual option only)
4	Flow Restrictor (manual option only)
5	Pneumatic Actuators (2 Positions)
6	Piston Crosshead
7	Cassette Low Sensor
8	Flush Pull Latch

The ProFlow pressure mechanism is fitted to the printhead drive mechanism bearing block by the two securing bolts, Figure - Pressure Mechanism Raised for Access below refers.

NOTE
Prior to fitting the ProFlow unit to the machine, ensure that the correct (ProFlow) printhead mechanism is fitted to the print carriage, refer to Replacement Procedures Section of this chapter for further details.

Access for the fitting of the ProFlow transfer head and replacement of the optional cassette is made by pulling the flush pull latch on the pressure mechanism. The pressure mechanism is swung on a hinge upwards and is held in the raised position by means of spring plungers locking into the hinge pin recesses, (Pressure Mechanism Elements Figure refers).

Access to the pressure regulator option is gained by removing the yellow pressure mechanism cover (held in place by two retaining clips and two magnets).

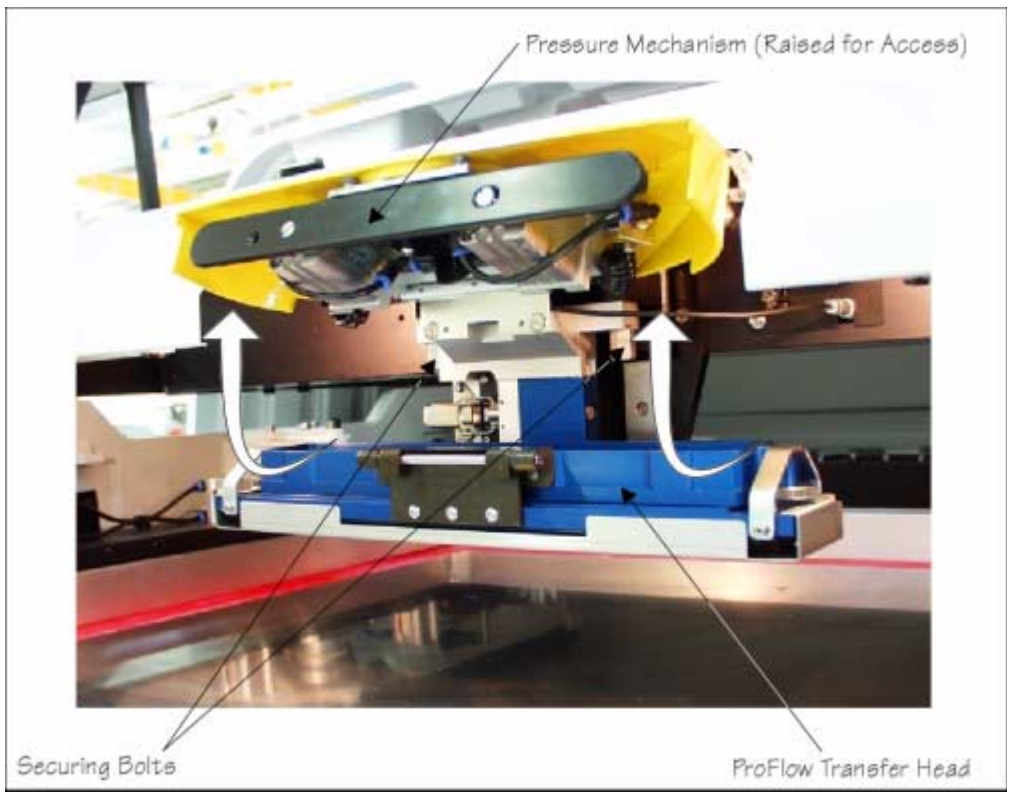


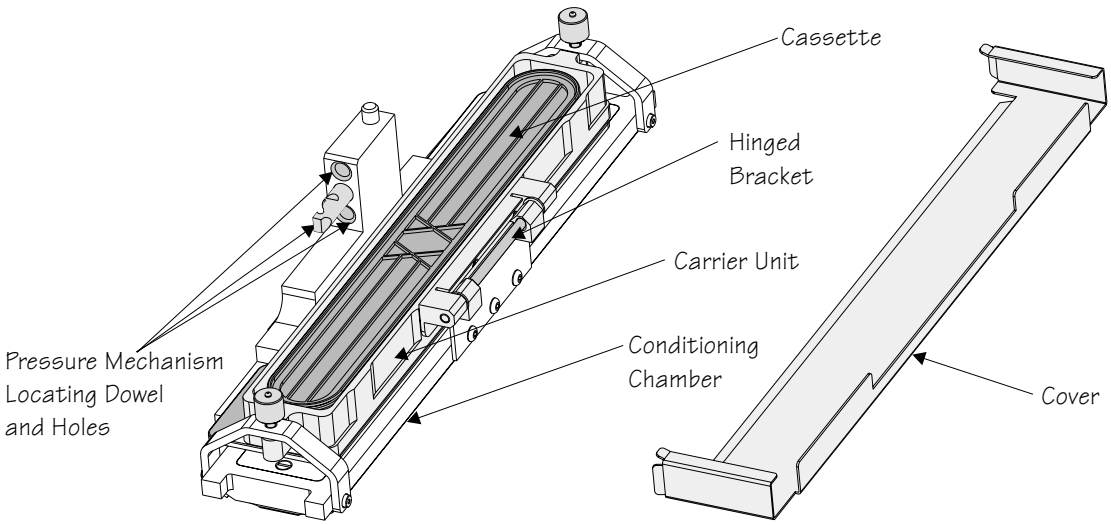
Figure 9-5 Pressure Mechanism Raised for Access

Cassette Transfer Head

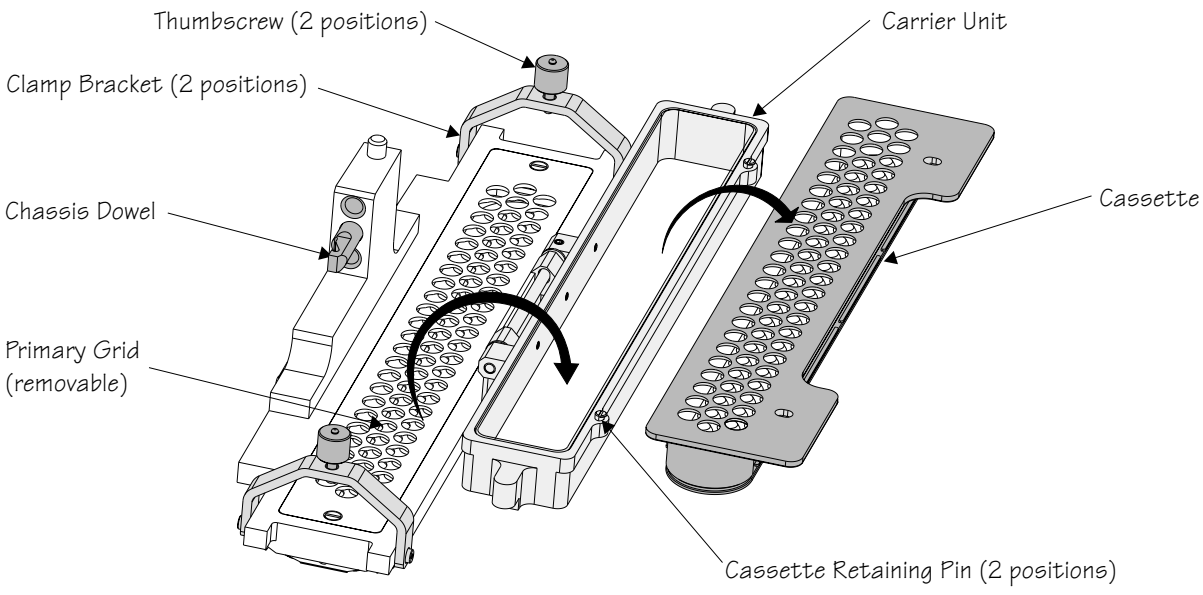
The function of the cassette transfer head option is to transfer print material from the cassette unit and onto a board as ProFlow moves across the stencil.

The cassette type transfer head comprises the following:

- Conditioning Chamber (single or dual chamber)
- Cassette Carrier Unit
- 300mm Cassette
- Retention System (see Retention System figure for detail)



ProFlow Transfer Head Assembly with Cover



Transfer Head Assembly Opened for Access

Figure 9-6 ProFlow Transfer Head

The transfer head is removable from the pressure mechanism unit. Two locating dowels are used to slide the unit onto the pressure mechanism. Once the unit is slid fully home, it is secured by closing the locking clip.

NOTE
When the transfer head is loaded with material, ensure that the cover is fitted when the ProFlow unit is not in use. The cover must be removed prior to print operation.

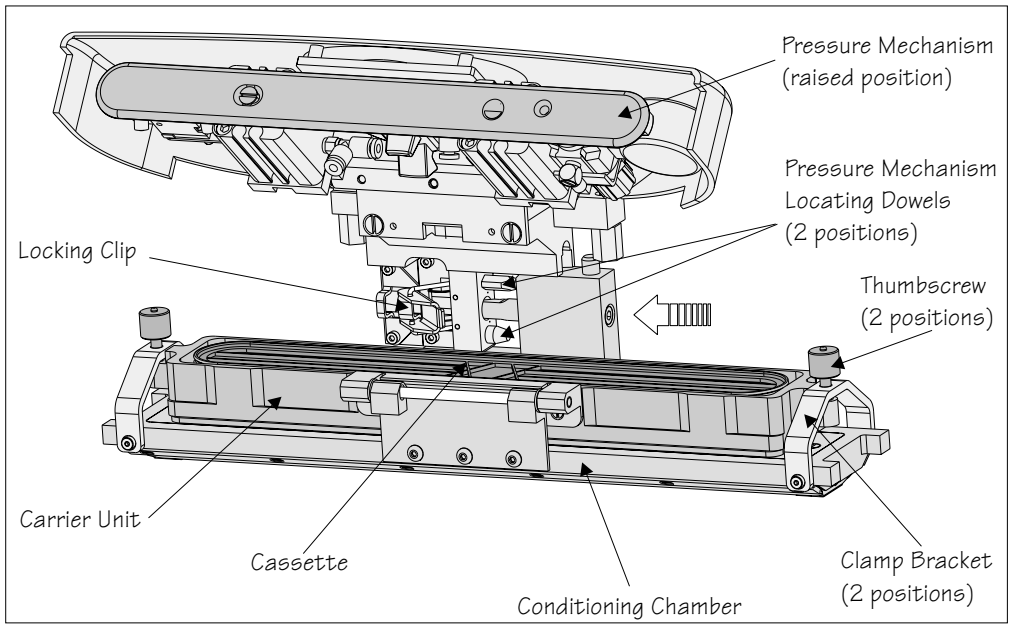


Figure 9-7 Transfer Head to Pressure Mechanism Interface

Transfer Head Size Option

To enable the ProFlow to effectively print on wider boards, the cassette style transfer head is supplied in three different size options of 300mm; 350mm and 400mm. The 300mm size cassette is used with all of these options, (Transfer Head Table in the Module Overview Section refers).

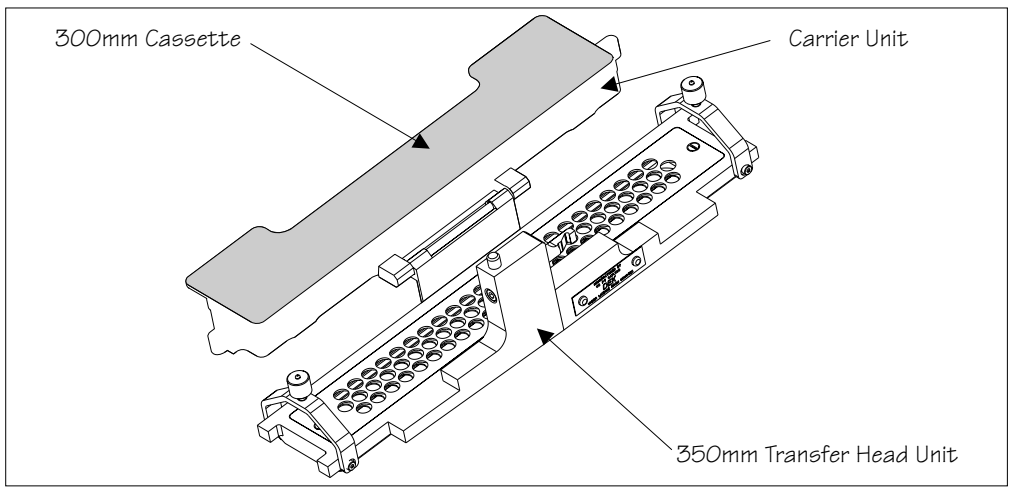


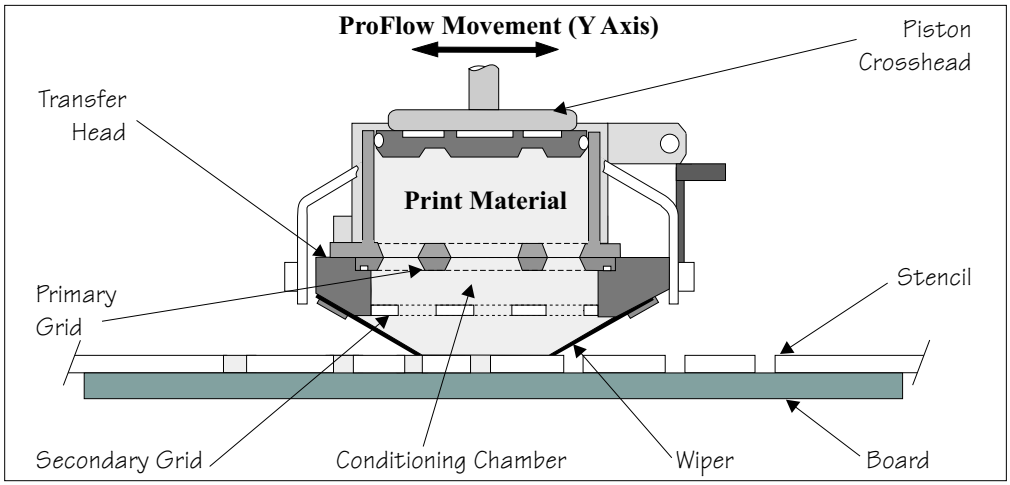
Figure 9-8 Transfer head (350mm)

Conditioning Chamber

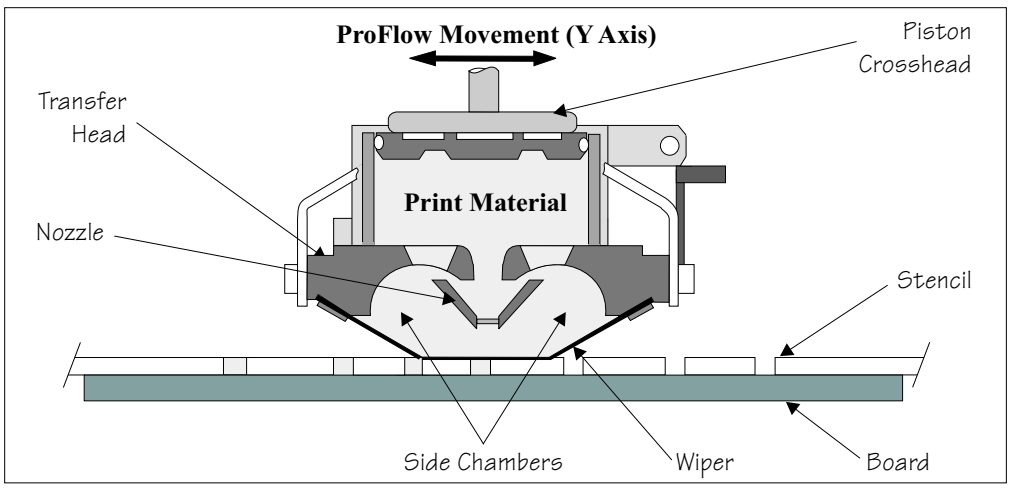
The ProFlow transfer head contains a conditioning chamber for maintaining the condition of the print material. This chamber can be accessed by removing the primary grid, which is accessible whilst the carrier unit is in the open position. The grid is sealed onto the conditioning chamber by means of two M4 countersunk screws and 'O' ring which fits into the transfer head (ProFlow Transfer Head Figure refers). There are two types of conditioning chamber for both the cassette carrier unit and rechargeable unit, as follows:

- Single Conditioning Chamber
- Dual Conditioning Chamber

The single conditioning chamber, ensures maximum print material optimization on conventional SMT PCBs printing, the printing material is driven around the conditioning chamber and bottom chamber by the action of the adhesive nature of the printing material to the stencil, while the transfer head traverses the image.



The dual conditioning chamber, was partly developed from knowledge gained with the single conditioning chamber. This to ensures maximum print material transfer and optimization on more demanding process platforms, the print material is driven around the two individual side chambers, in the same manner as above.



NOTE
For ease of identification, all transfer heads with single conditioning chambers are coloured black and all transfer heads with dual conditioning chambers are coloured blue.

Cassette Carrier

The cassette carrier unit is attached to the conditioning chamber by a hinged bracket, this is swung open when fitting the cassette into place (ProFlow Transfer Head Figure refers).

The cassette is located within the carrier by means of two integral ribs and two retaining pins.

NOTE
When loading a cassette, before the carrier is swung back onto the conditioning chamber, the cassette sealing strip must be removed.

Two clamp brackets at each end of the transfer head are latched over the carrier and cassette, these are secured by tightening the thumbscrews into the carrier dimples.

The cover is fitted to the underside of the ProFlow transfer head during periods when the ProFlow unit is not in use. This seals any exposed printing material from the atmosphere and also prevents inadvertent seepage or spills onto the stencil.

Cassette

The 300mm ProFlow cassette capacity is between 800g and 850g of solder paste.

WARNING
SOLDER PASTE AND SOLVENTS. WHEN USING OR HANDLING ANY SOLDER PASTE OR SOLVENT FORMULATION THE MANUFACTURERS' RECOMMEND SAFETY PRECAUTIONS MUST BE STRICTLY ADHERED TO.

WARNING
PROTECTIVE CLOTHING. APPROVED PROTECTIVE CLOTHING SHOULD BE WORN BY SOLDER PASTE AND SOLVENT HANDLERS AT ALL TIMES TO ELIMINATE FUME INHALATION, EYE CONTACT, SKIN CONTACT AND INGESTION.

Figure 9-9 Cassette Overview

The specially designed ProFlow cassette makes loading of the print material rapid and user friendly. The cassette system reduces waste to an absolute minimum and is also environmentally friendly (the operator does not have to touch or manually work print material at any stage during print operations).

The routine for changing cassettes is detailed in the Consumable Replenishments Chapter of the User manual.

ProFlow cassettes are supplied hermetically sealed with a tear off foil, this is removed after the cassette has been fitted to the ProFlow transfer head. If the cassette is being fitted to a new or cleaned transfer head, ie where the transfer head conditioning chamber is free from print material. The ProFlow unit should be primed as detailed in the Consumable Replenishments Chapter of the User manual before print operations are carried out.

When the cassette is fitted to the ProFlow unit the system is totally enclosed, maintaining the print material in optimum condition. If the system has not been used for some time a knead operation is available, as detailed in the Sequences - Knead Paste Section of this chapter.

A cover can be fitted to the underside of the transfer head during periods when the ProFlow unit is in the raised position or if the transfer head is removed.

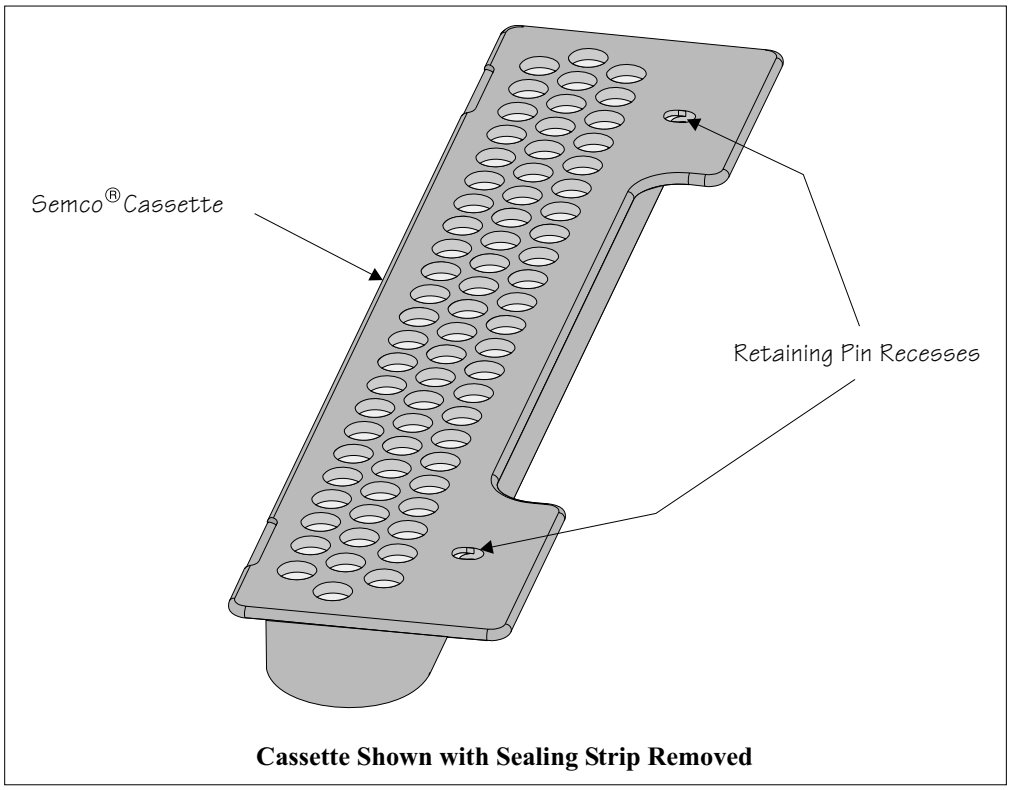


Figure 9-10 ProFlow Cassette

Retention System

The retention system, is sited on the underside of the transfer head and consists of:

- Secondary Grid (stainless steel)
- Wipers - 200/300 titanium coated step edged (2 positions)
- Skis - vulcanised rubber (2 positions)
- Wiper Retaining Strips (2 positions)

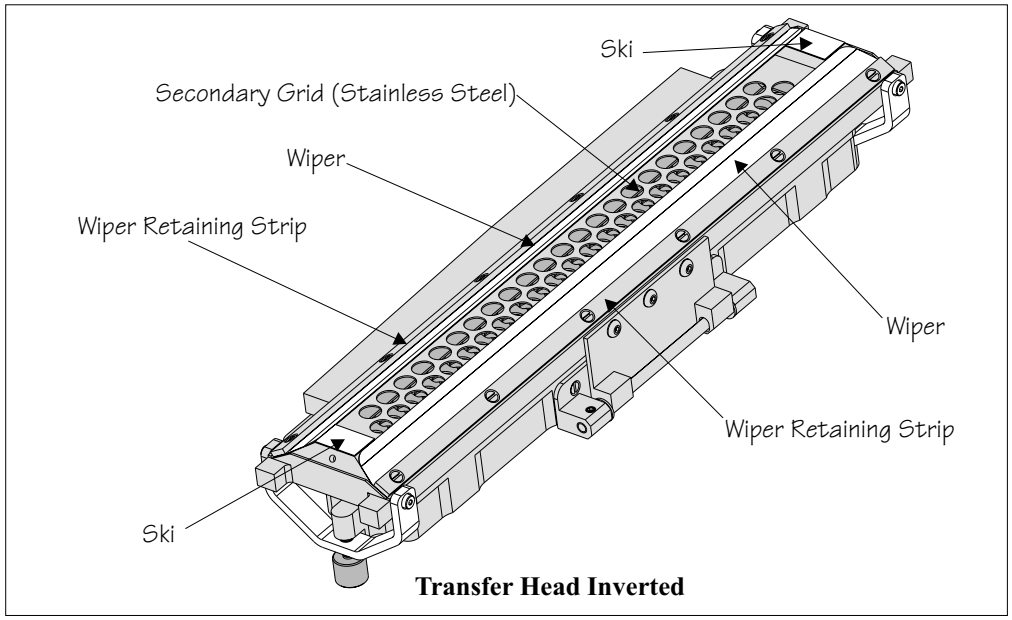


Figure 9-11 Retention System

Maintenance

In order to maintain and clean the unit, all items of the retention system can be easily dismantled. Wipers and skis are inevitably prone to wear over prolonged use.

300 micron titanium wipers are available where additional ProFlow system pressure transfer is required. These are available for all transfer head sizes.

For ink/adhesive printing, mylar wipers are available for all transfer head sizes.

A specially designed transfer head maintenance stand is supplied with ProFlow to be used during cleaning and maintenance operations of the retention system.

Information on the removal and replacement of these items is detailed in the Consumable Replenishments Chapter of the User manual.

Rechargeable Transfer Head

The rechargeable transfer head option is fully compatible with the ProFlow hardware and offers the alternative of using ProFlow without changing the format new material is supplied in, ie material not in ProFlow cassettes can still be used with ProFlow.

Elements of the rechargeable transfer head comprise:

- Conditioning Chamber (single or dual chamber)
- Diaphragm Retainer
- Diaphragm
- Filling Ports (3 in number, 1 for 150mm transfer head)
- Retention System
- Cover
- Recharging Nozzles (2 in number)

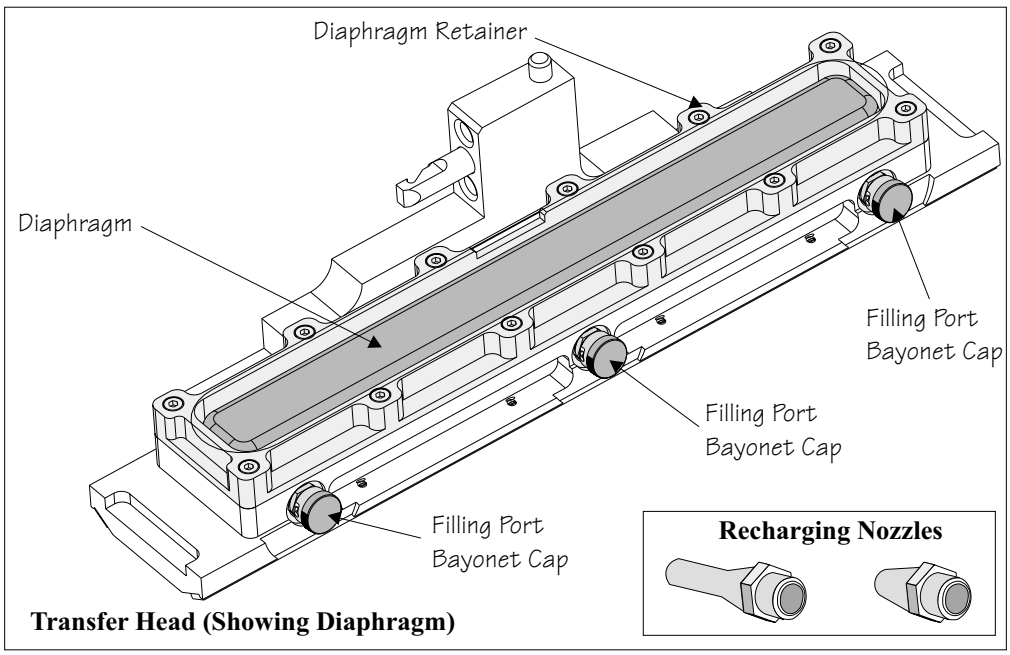


Figure 9-12 Rechargeable Transfer Head

The rechargeable transfer head is constructed in much the same way as the cassette transfer head. The main difference being that a diaphragm, held in position by a diaphragm retainer, replaces the cassette. The transfer head is also fitted to the pressure mechanism unit in the same way as the cassette transfer head unit, (Cassette Transfer Head Section of this chapter refers).

Print material is initially filled into the paste chamber through the stainless steel grid of the retention system. General recharging is performed by using the 3 filling ports sited on the front side of the transfer head. The filling ports are sealed using bayonet connector caps.

NOTE
For detailed procedures of print material filling refer to the Consumable Replenishments Chapter of the User manual.

Recharging

Recharging the rechargeable transfer head is carried out using the following standard cartridge:

- ‘Semco’ type - 500g or 1kg sizes

NOTE
Maximum cartridge diameter should not exceed 43.6mm.

These cartridges are utilized by using either of the following:

- Manual ‘Mastic’ Gun
- Pneumatic Gun (optional)

NOTE
When using a 500g cartridge, an adaptor (supplied) is fitted between the cartridge and rear of the gun.

WARNING
SOLDER PASTE AND SOLVENTS. WHEN USING OR HANDLING ANY SOLDER PASTE OR SOLVENT FORMULATION THE MANUFACTURERS’ RECOMMEND SAFETY PRECAUTIONS MUST BE STRICTLY ADHERED TO.

Manual Mastic Gun

The standard cartridge, as listed above, can be fitted to a general purpose mastic gun as shown in the Mastic Gun and Cartridge figure.

Figure 9-13 Mastic Gun and Cartridge

NOTE
For detailed procedures of print material filling refer to the Consumable Replenishments Chapter of the User manual.

Pneumatic Gun

The pneumatic gun is an optional accessory for the rechargeable transfer head. The gun, supplied with a holster, is fitted to the machine and is pneumatically connected to the factory air supply. The gun enables ready access and use for regular charging of the ProFlow unit.

Figure 9-14 Pneumatic Gun (optional)

NOTE
For detailed procedures of print material filling refer to the Consumable Replenishments Chapter of the User manual.

Pneumatic Supply

The pneumatic air supply offers a positive force to the ProFlow system during the print cycle providing a continuous supply of print material to the stencil.

NOTE
This force should not be confused with ProFlow system pressure which is the force applied to the ProFlow unit by the printhead mechanism stepper motor.

Manual Control

For ProFlow pressure mechanisms with the manual pressure regulator option - system air pressure is applied to the piston crosshead enabling the pressure actuators. ProFlow pressure is factory set at 2.5 Bar, however this can be adjusted by means of the regulator sited on the ProFlow pressure mechanism (Pneumatic Supply Main Components figure refers).

NOTE
Under normal conditions this setting may vary slightly between a typical range of 1.5 Bar to 3 Bar dependent upon material types, print speeds and temperature changes.

Air supply is provided from the manifold assembly at the rear of the machine. A regulator and gauge within the ProFlow pressure mechanism unit enables the manual adjustment and monitoring of air pressure to the piston actuators.

ProFlow utilizes two air lines. The first air line is a continuous air supply from the mains air providing motive force. Air supply from the manifold paste dispenser solenoid acts as a switching control to the ProFlow pilot air valve, this enables two way actuator movement.

Standard software has control only of the switching air line, therefore the crosshead piston may be either in the fully up or fully down position.

The speed at which the pressure actuators force the piston crosshead onto the cassette is factory set, this can be adjusted if the material supply is inadequate or too fast. Adjustments are made at the exhaust flow restrictors control on the pilot valve, (see Adjustments and Settings - Exhaust Flow Restrictors Section of this chapter for further information).

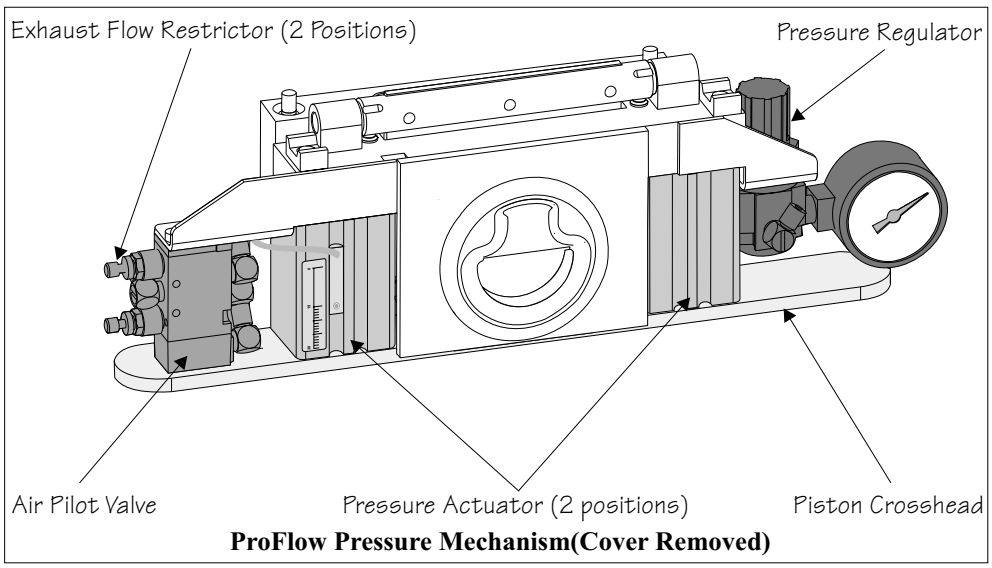
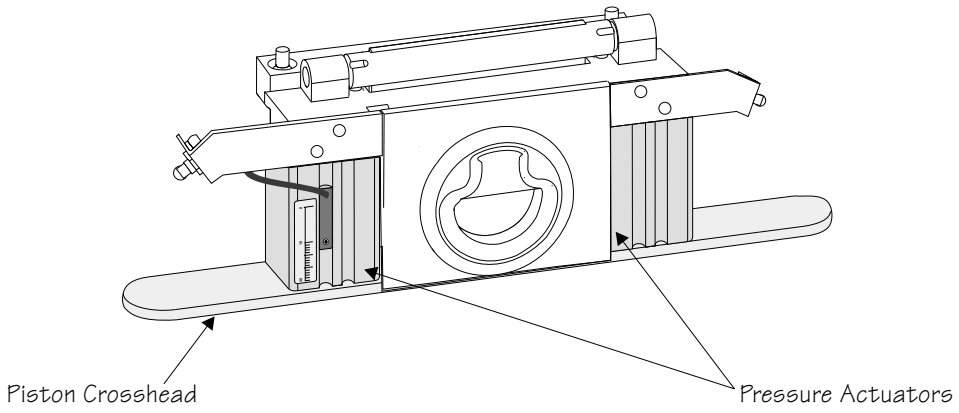


Figure 9-15 Pneumatic Supply Main Components

Software Control

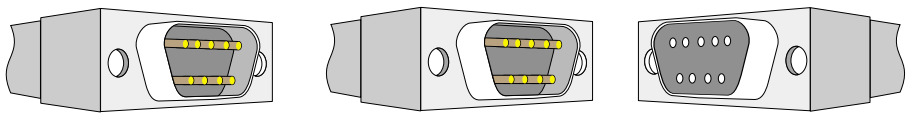
For ProFlow pressure mechanisms with the software controlled air regulator option, system air pressure is applied to the piston crosshead enabling the pressure actuators. ProFlow pressure is factory set at 2.0 bar, however this can be adjusted by means of the ProFlow paste pressure parameter under edit data

With this software option a further parameter (Idle Pressure) is available. This parameter applies a light pressure onto the piston crosshead and print material system whilst the ProFlow unit is idle but remaining on the stencil surface. (Refer to Adjustments and Settings - Software Pressure Adjustment Section of this chapter for further details.)



ProFlow Pressure Mechanism (Cover Removed)

View on Rear of Machine (Cover Removed)



M25PL01
3. TOTEM 5
5. 0V

M25PL02
1. 12V
5. IN A (0V)

M25SK03
1. Supply
4. 100Hz O/P
6. 0V

Figure 9-16 Software Controlled Pressure Mechanism

DRIVES AND SENSORS

Motor

The system utilizes the ProFlow printhead mechanism motor and sensor for all vertical movement configurations.

Name	Type	Functional Description
ProFlow Mechanism	Stepper Motor	Raises and lowers the ProFlow to the required height

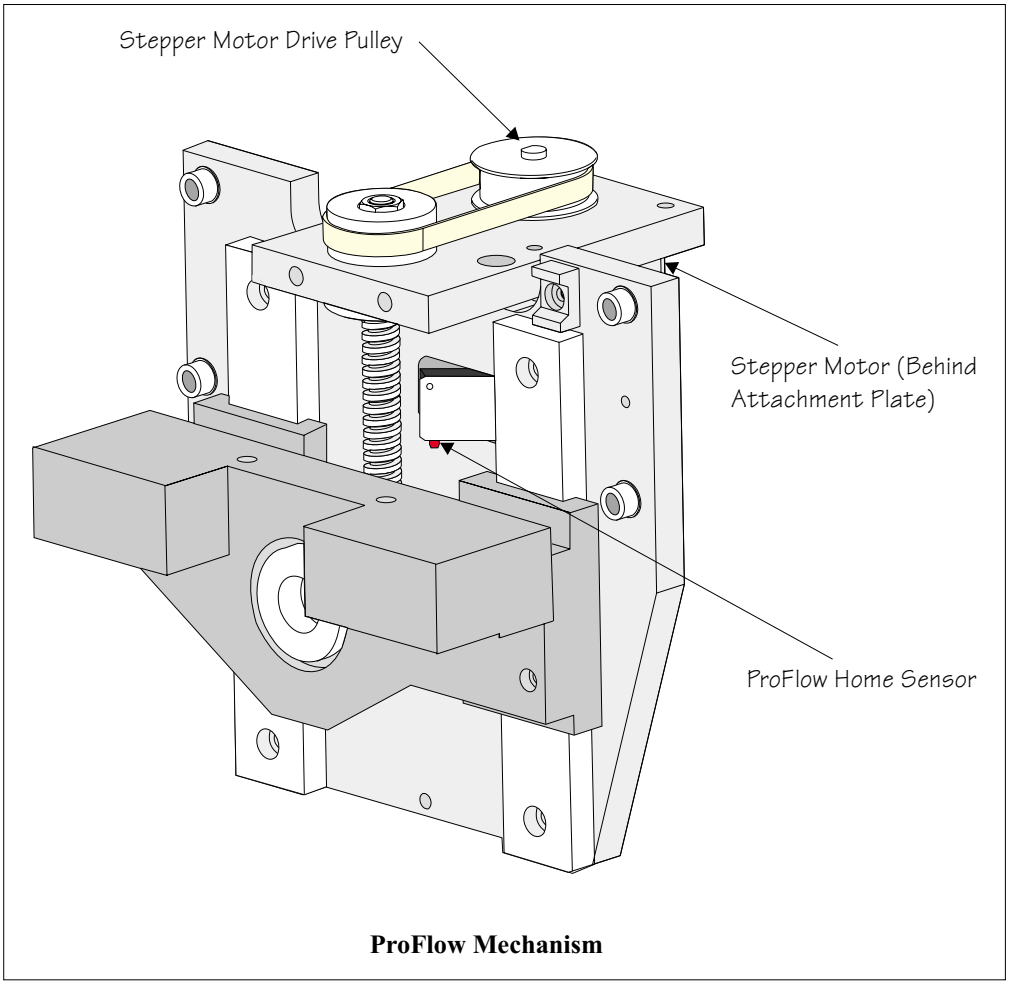


Figure 9-17 ProFlow Mechanism Motor and Sensor Location

Sensors

Name	Type	Test Point	Functional Description
Cassette Low	Reed Switch	MultiMove X12 IN6	Detects when the transfer head is low on paste/empty
ProFlow Home	Microswitch	Stepper Multiplexer	Detects when the ProFlow unit has moved into the home position

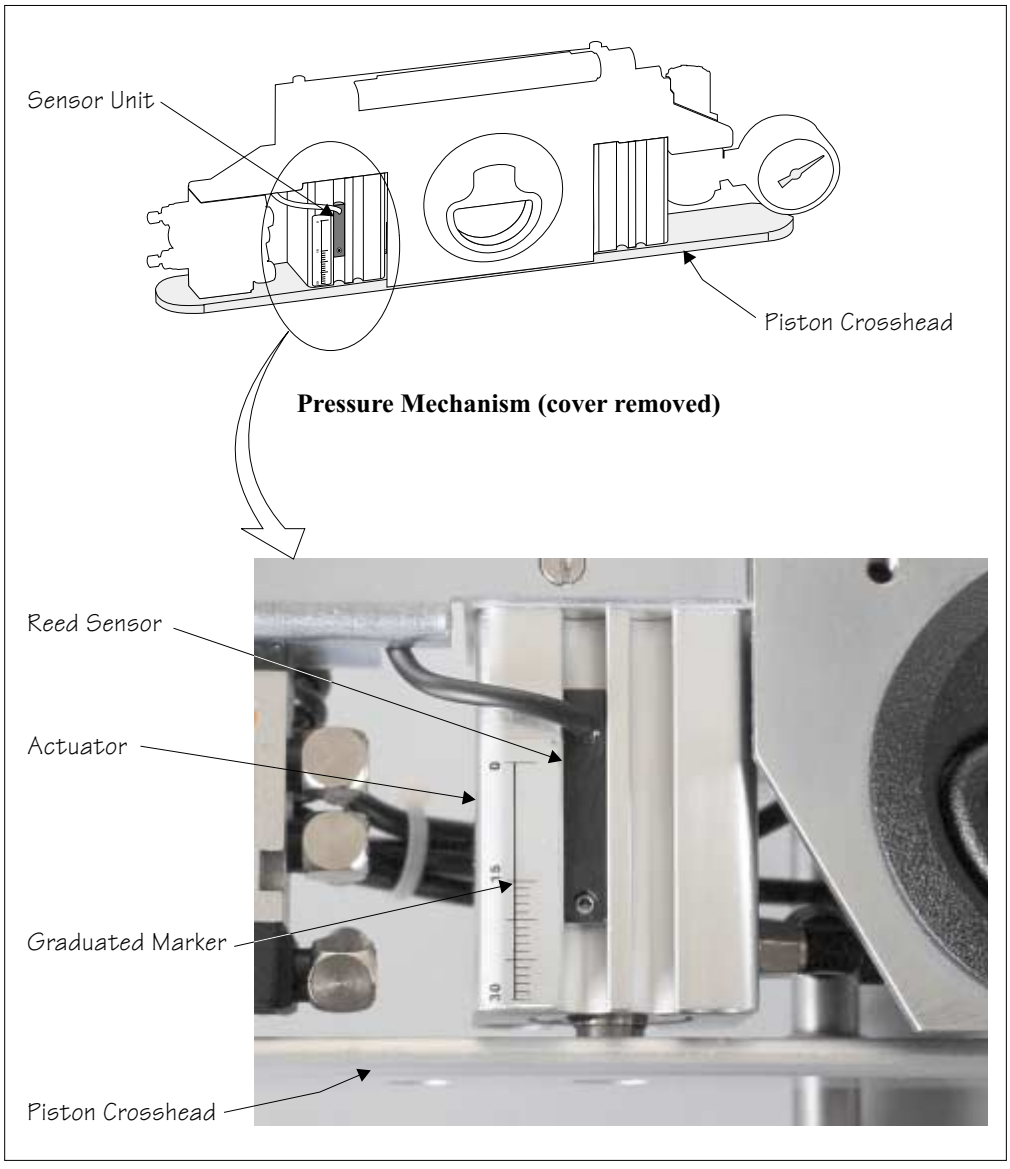


Figure 9-18 Cassette Low Sensor Location

Cassette Low Sensor

When the paste reservoir becomes low or empty of print material, the sensor operates giving a warning window on the machine monitor and the indication of the tricoloured beacon is changed.

NOTE
Selecting Warn, Pause or Suspend in Set Preferences (Consumable Action) affects the machine reaction to a Cassette Low indication. Refer to the Set Preferences and Consumable Replenishments chapters of the User manual for more details.

The cassette low sensor reed switch is secured to the left pneumatic actuator on the ProFlow pressure mechanism, (ProFlow Cassette Low Sensor refers). The pneumatic actuator pistons move slowly down as the print medium inside the transfer head is used up. The sensor reed switch is enabled when the magnetized piston diaphragm comes into close proximity with it, (Reed Switch and Circuit Schematic figure below refers).

The input for the cassette low sensor floats high until the reed switch is enabled, once made the input is pulled down to 0v. This information is fed to the MultiMove X12 card (IN6) of the machine controller.

NOTE
The cassette low sensor is height adjustable so that print material wastage can be reduced to a minimum. For further information refer to the Adjustments and Settings section of this chapter.

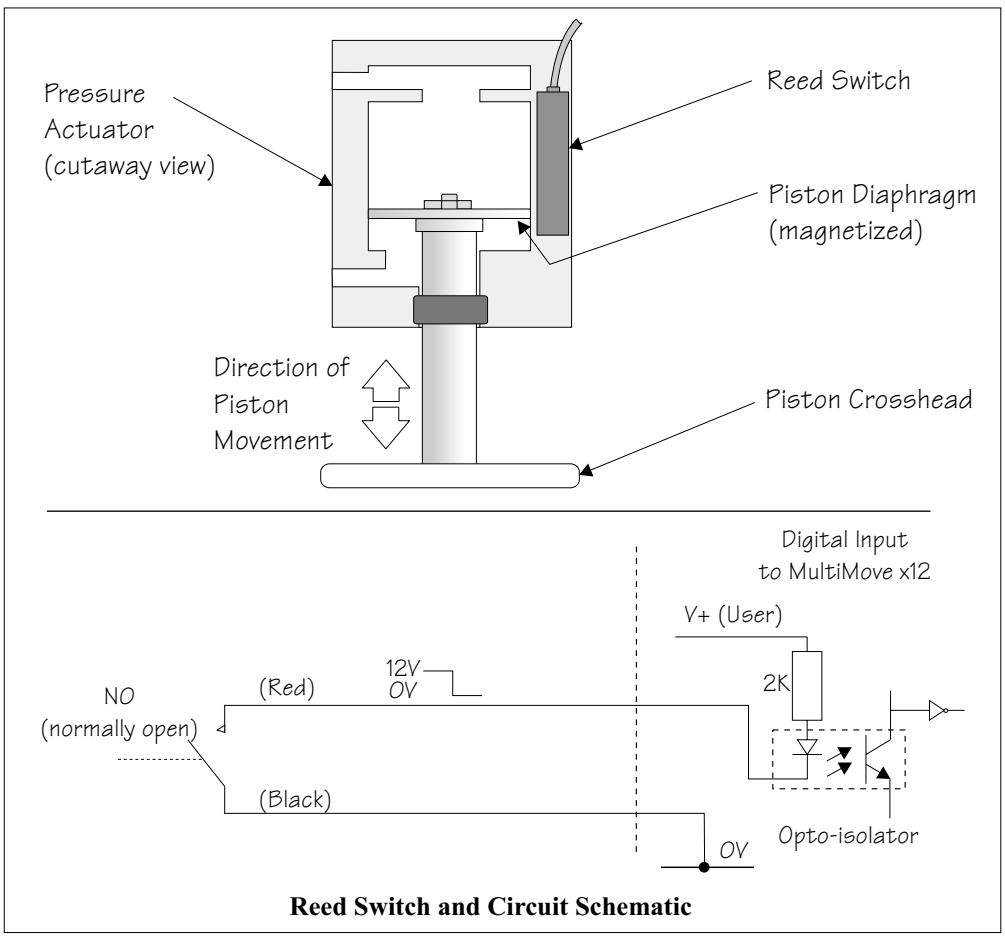


Figure 9-19 Reed Switch and Circuit Schematic

SEQUENCES

Print Cycle

ProFlow is a single bi-directional printing device, there is no requirement (with the exception of knead paste), to carry out any vertical movements at the end of each print stroke.

Contact Height

1. At the start of the print cycle the ProFlow unit is lowered to contact height (zero pressure) onto the screen, Step 1 of ProFlow Print Cycle figure refers.

   NOTE
   When the unit is on the screen, the paste pressure is either at:
   a. Off (manually adjusted pressure mechanism option).
   b. Idle Pressure (software adjusted pressure mechanism option).

   The print carriage is positioned to ensure that when the rising table is lifted the ProFlow wipers are positioned directly over the front or rear rail board clamps.

System Pressure

2. System pressure is applied to the ProFlow unit prior to the print carriage commencing the print stroke (ProFlow print height), Step 2 of ProFlow Print Cycle Figure refers.

   NOTE
   System pressure is the force exerted by ProFlow (utilizing the ProFlow printhead stepper motor) onto the stencil during the print cycle.
   A downward force of approximately 3 kilograms is found to be suitable for a 300mm size ProFlow unit.

Paste Pressure

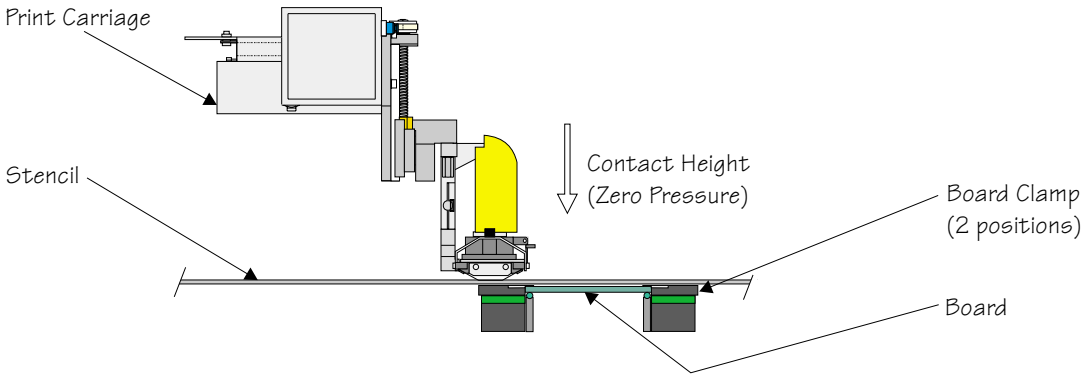
3. Paste pressure is applied to the ProFlow transfer head during the print stroke, Step 3 of ProFlow Print Cycle Figure refers. A downward pneumatic pressure of approximately 2 bar is exerted onto the transfer head unit by the ProFlow pressure mechanism.
4. The print carriage performs a print stroke at a speed of between 2 - 150mm/ sec, Step 3 of ProFlow Print Cycle Figure refers. Paste pressure is removed from the transfer head on completion of the print stroke (and before system pressure is removed).

   NOTE
   If software controlled pressure mechanism is fitted the paste pressure changes to idle pressure.

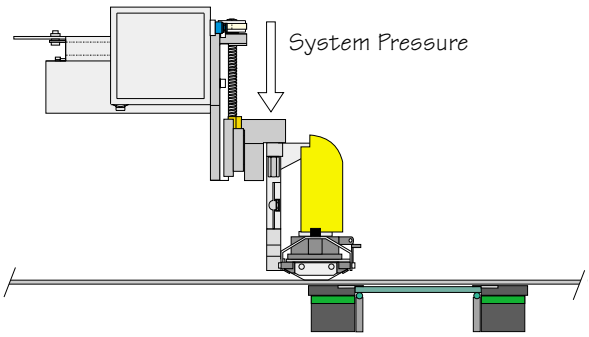
5. The print carriage stops at a position centrally on a rail, ensuring that ProFlow is well supported whilst still under system pressure.
6. The system pressure is removed returning the ProFlow unit to contact height (zero pressure). Step 4 of ProFlow Print Cycle Figure refers.

ProFlow is now ready to print the next board by repeating the above sequence whilst travelling in the alternate direction.

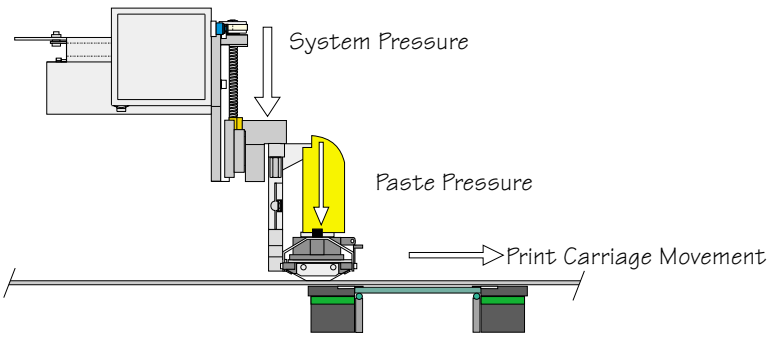
NOTE
When printing has finished, the unit can be left on the screen in its contact position and the print material remains sealed to the atmosphere. If the ProFlow unit is not to be utilized for a prolonged period of time, it should be separated from the screen and the cover fitted.



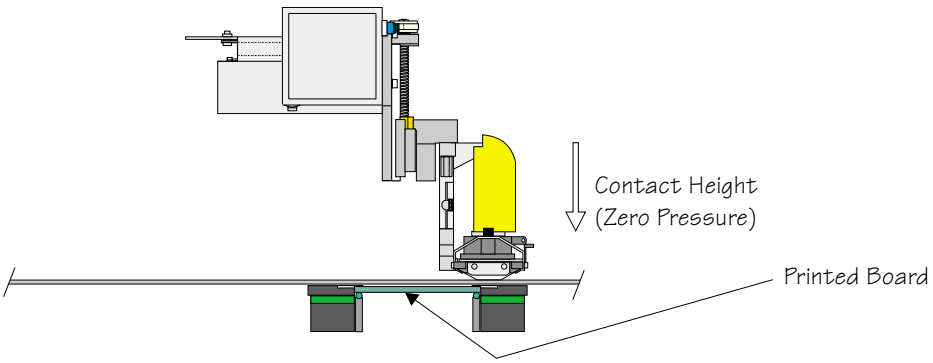
Step 1 - ProFlow Moved to Contact Height with Stencil



Step 2 - System Pressure Applied Prior to Printing (Print Height)



Step 3 - Paste Pressure Applied During Print Stroke



Step 4 - Paste Pressure Followed by System Pressure Removed at End of Print Stroke

Figure 9-20 Side View of ProFlow During Print Cycle

ProFlow Placement This sequence is designed to move the ProFlow unit from the home position onto the stencil, at contact height, when one of the following occurs:

- When **Run** is selected.
- When **Knead Paste** is selected.
- When **Prime ProFlow** is selected.
- When **Load Cassette** is selected.

The following sequence occurs when ProFlow placement is initiated:

1. The message **'Has the ProFlow unit's base cover been removed?'** is displayed.
2. Selecting **Remove Cover**, the message **'Open the printer cover and remove the ProFlow unit's base cover'** is displayed, enabling the base cover to be removed.
3. Selecting **Yes**, the message **'The ProFlow unit will be placed in the REAR envelope'** is displayed.
4. Selecting **Select Another**, enables the preferred envelope to be changed from rear to front.
5. Selecting **Proceed**, the ProFlow unit is placed in contact with the screen.

Raise ProFlow Following print operations, ProFlow is raised from the stencil on initialization, selecting **Change ProFlow** or selecting **Change Screen** or **Change Tooling**. ProFlow is raised by one of the following methods:

- 'Shake-off' ProFlow
- 'Lift-off' ProFlow

Shake-off is the preferred method of raising the ProFlow unit. Lift-off is only carried out if the ProFlow unit is not in a shake-off envelope or the stencil protection parameter in the board file is set to **ON**.

The shake-off envelope is the portion of stencil required by the ProFlow transfer head when performing the shake-off or knead over rail function. Depending on the stencil, it's justification and the board width, a particular product may have none, one or two shake-off envelopes. If the unit is not in a shake-off envelope a lift-off is carried out.

Shake-off ProFlow This sequence is designed to raise the ProFlow unit clear of the stencil without leaving a print medium deposit on the stencil. Pre-conditions exist prior to any shake-off procedure, these are:

- ProFlow is on the stencil inside the shake-off envelope for the current product, or a board is in place.
- No pressure is being applied to the Paste system.
- The stencil protection parameter in the board file is set to **OFF**.

The following sequence occurs when shake-off is initiated:

1. The print carriage moves away from the stencil image at set print speed. It moves in the reverse direction and back again, (when it is not possible for the initial movement to be away from the image, it moves towards it).

   This cycle is repeated twice more while at the same time the unit is raised 2mm/sec.

2. ProFlow is raised to the zero height position.

Lift-off

This sequence is designed to raise the ProFlow unit straight up off the stencil, without any movement in the horizontal plane. A print medium deposit may be left on the stencil.

The preconditions for a 'Lift-off' to be initiated are:

- The ProFlow unit is in a turnaround envelope, not a shake-off envelope or the stencil protection parameter in the board file is set to **ON**.
- No pressure is being applied to the paste system.

The turnaround envelope is where the printer has evaluated the position in which the ProFlow unit has come to rest and calculated that there is only enough room for the ProFlow unit to print back across the image or do a lift off.

The following sequence occurs when lift-off is initiated:

1. The message **'Has the ProFlow unit's base cover been fitted?'** is displayed.
2. Selecting **Fit Cover**, the message **'Open the printer cover and fit the ProFlow unit's base cover'** is displayed, enabling the base cover to be fitted, while the ProFlow unit is at contact height.
3. Selecting **Yes**, The ProFlow unit is raised to the zero height position.

Knead Paste

Print material changes it's characteristics (viscosity) through lack of use, causing poor print quality. To overcome this a knead paste sequence is available and is initiated by one of the following:

- The elapsed time since a board was printed has exceeded the value of the paste knead period parameter.
- When **Knead Paste** is selected.
- A print stroke is about to be applied and there is a deferred request for a paste knead.
- The amount of boards printed, since the last paste knead equals the value of the knead before printing parameter, (only valid if the knead off-image parameter is set to enabled).

When a paste knead sequence is initiated the message **'Automatic paste knead activated'** is displayed.

Two types of knead operation may be carried out:

a. Knead off image

b. Knead over a board

Knead Off Image

This operation is carried out off the stencil image, when the knead off-image parameter is set to enabled and the ProFlow unit is in a shake-off envelope. If the ProFlow unit is not in a shake-off envelope the paste knead is deferred until it is.

NOTE
*A knead off-image can not be carried out if stencil protection is selected to **ON** in the board file.*

1. If a board is not already in place, the board clamps close and the board rails are raised to print height (for a board thickness of 0mm).
2. ProFlow is lowered to print height, as set by ProFlow knead pressure and ProFlow paste pressure is applied to the system.
3. The print carriage moves away from the stencil image at either the front or rear knead speed. The message **'Performing knead off-image'** is displayed.
4. The unit is moved in the reverse direction and back again.
5. This sequence is repeated for the number of times set by the current value of the knead deposits parameter.
6. Upon completion ProFlow paste pressure (piston pressure) is changed to ProFlow idle pressure and ProFlow raises to the contact height position.

Knead Over a Board

The knead over board function only occurs when the knead off-image parameter is set to disabled. Knead occurs over the next print board from either direction:

1. Load a board if a board is not already in place.
2. ProFlow is lowered to print height, as set by ProFlow knead pressure and ProFlow paste pressure is applied to the system.
3. The ProFlow unit is driven backwards and forwards over the loaded board the number of times set by the current value of the knead deposits parameter. The message **'Performing knead over board'** is displayed.
4. Upon completion ProFlow paste pressure (piston pressure) is changed to ProFlow idle pressure and ProFlow raises to the contact height position.

POSITIONING

ProFlow has four vertically positioned configurations:

- Home Position
- Zero Height
- Contact Height
- Print Height

Home Position

The home position is when the ProFlow unit is fully raised. The ProFlow unit is homed on the following occasions:

- Initialization
- Power Up
- Exiting Diagnostics
- When power is restored following system power down.

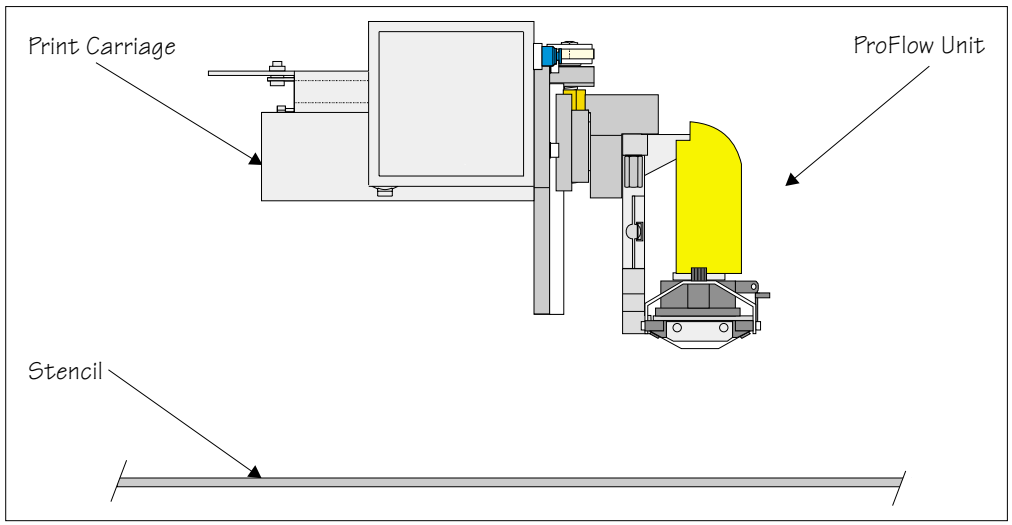


Figure 9-21 ProFlow in the Home Position

Zero Height

The zero height position is when the ProFlow unit is raised to the number of steps on it's internal counting system to move to the home position. The ProFlow unit is moved to zero on the following occasions:

- Selecting **Change ProFlow**
- Selecting **Change Screen**
- Selecting **Change Tooling**

Contact Height

Contact height is when the ProFlow wipers are just in contact with the stencil, but with no force exerted (zero pressure).

NOTE
For setting up information refer to Contact Height Position Set Up in Adjustments and Settings Section of this chapter.

ProFlow should normally be left in this position when the unit is not in use, this prevents material leakage, contact with the air/drying out and also prevents material contamination.

NOTE
With software controlled pressure mechanism fitted, idle pressure is applied to the piston, (not shown).

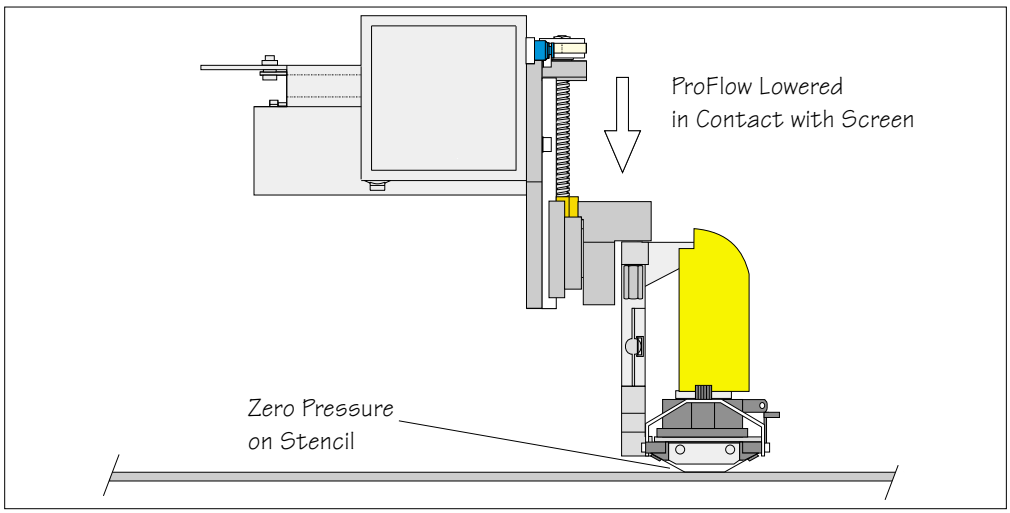


Figure 9-22 ProFlow in the Contact Height Position

Print Height

Print height is when the system pressure is being applied to ProFlow whilst positioned on the stencil, (system pressure is dependent upon the board file programmed). Piston pressure is also applied (during the print stroke) at this position.

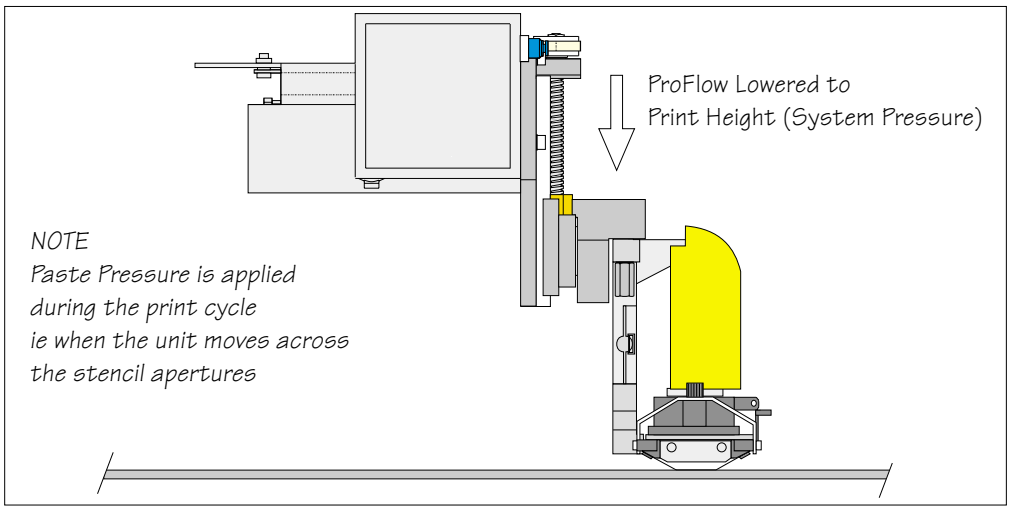


Figure 9-23 ProFlow in the Print Height Position

ADJUSTMENTS AND SETTINGS

Cassette Low Sensor

The cassette low sensor position can be changed in order to minimize print material wastage. A graduated scale (millimetre) on the actuator cylinder body provides a reference point for accurate sensor positioning, (Cassette Low Sensor figure refers). The sensor is moved up or down by loosening the securing screw, (1.5mm Allen key).

The factory setting for the sensor is set to 20mm on the graduated scale. Each millimetre movement is equivalent to approximately 43gms of print material usage.

WARNING
SOLDER PASTE AND SOLVENTS. WHEN USING OR HANDLING ANY SOLDER PASTE OR SOLVENT FORMULATION THE MANUFACTURERS' RECOMMEND SAFETY PRECAUTIONS MUST BE STRICTLY ADHERED TO.

WARNING
PROTECTIVE CLOTHING. APPROVED PROTECTIVE CLOTHING SHOULD BE WORN BY SOLDER PASTE AND SOLVENT HANDLERS AT ALL TIMES TO ELIMINATE FUME INHALATION, EYE CONTACT, SKIN CONTACT AND INGESTION.

The following procedure should be carried out when print material wastage is excessive.

1. Gain access to the ProFlow unit by opening the machine cover.
2. Lift off the ProFlow pressure mechanism cover.

Cassette Option

3. Noting the present position of the sensor against the graduated marker, loosen the sensor using a 1.5mm Allen key.
4. With each graduation on the graduation scale being equivalent to approximately 43gms of print material, move the sensor down by single graduations until the optimum print material usage position is obtained, (Cassette Low Sensor Figure refers).
5. Carefully re-tighten the sensor securing screw.

   NOTE
   To prevent damage to the sensor, do not overtighten grub screw.

6. Replace the pressure mechanism cover.
7. Close the machine cover.

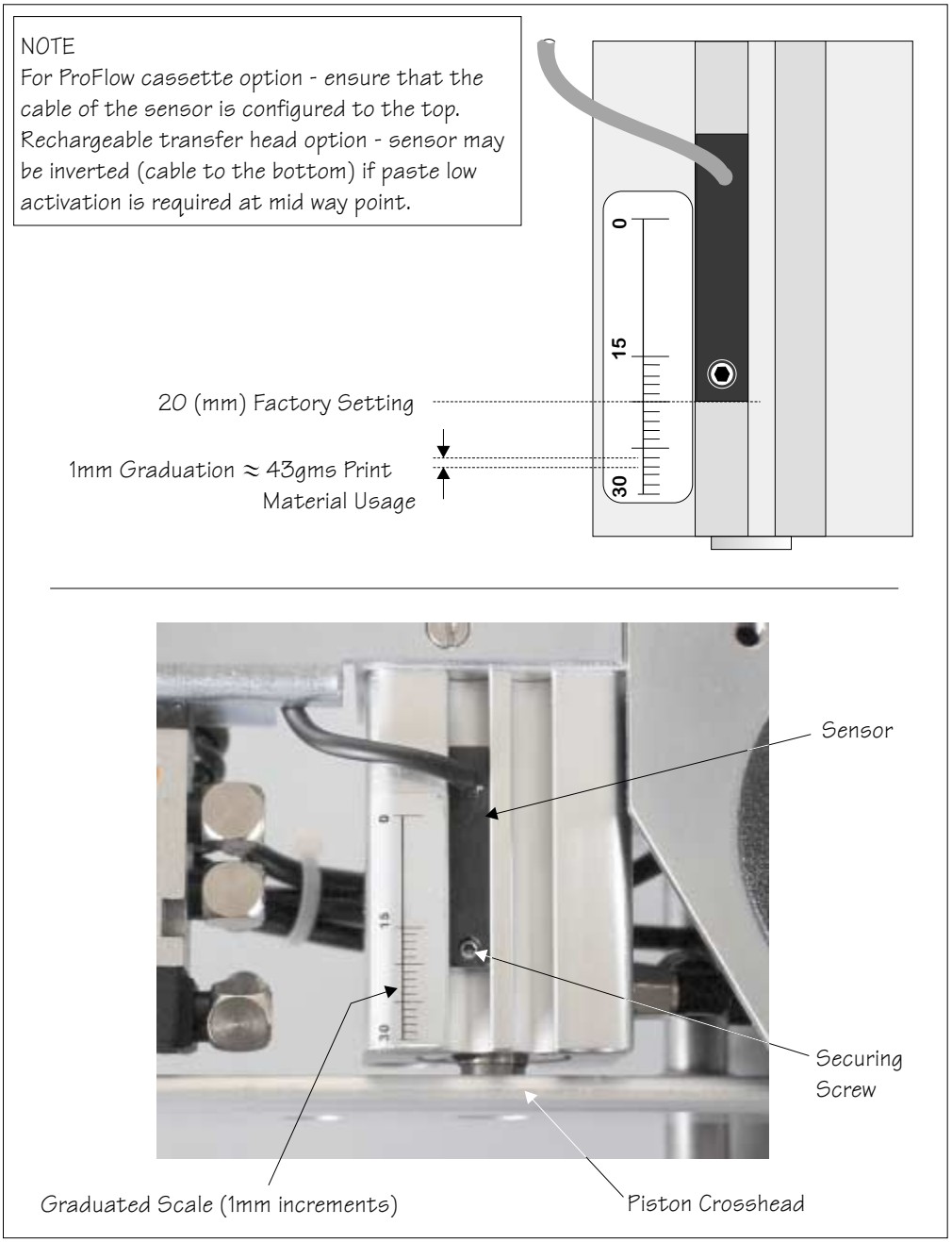


Figure 9-24 Cassette Low Sensor

Rechargeable Transfer Head Option

8. When using a rechargeable transfer head and paste low sensor activation is required at the mid diaphragm point the reed sensor can be inverted so that a higher sensor initiation can be achieved. (In this position the sensor cable is at the bottom of the sensor.)

ProFlow Contact Position Setup

To set up the ProFlow contact height position carry out the following procedures:

1. In Module Diagnostics Page select **Rising Table**.
2. Select **Home Rising Table**.
3. Select **Run Diagnost**.
4. Select **Exit** to return to Module Diagnostics Page.
5. In Module Diagnostics Page select **Camera Axes**.
6. Select **Home Camera X Axis**.
7. Select **Run Diagnost**.
8. Select **Home Camera Y Axis**.
9. Select **Run Diagnost**.
10. Select **Exit** to return to Module Diagnostics Page.
11. In the Module Diagnostics Page select **ProFlow**.
12. Select **Home ProFlow**.
13. Select **Run Diagnost**.
14. Select **Exit** to return to Module Diagnostics Page.
15. In the Module Diagnostics Page select **Print Carriage**.
16. Select **Home Print Carriage**.
17. Select **Run Diagnost**.
18. Select **Drive Carriage Using Jog Buttons**.
19. Using the jog buttons drive the Print Carriage to the mid position of the stencil.
20. Load a stencil with an off centre image.
21. At the MMI select **Exit** to return to Module Diagnostics Page.
22. In the Module Diagnostics Page select **ProFlow**.
23. Select **Adjust** on the Menu Bar.
24. In the ProFlow Adjust Parameters select **PFLOW CONTACT POS**.
25. At the Menu Bar select **Incr.** or **Decr**. to set the Contact Position to **5.5mm**.
26. Fit an empty transfer head to the ProFlow pressure mechanism. Remove the cover.

    NOTE
    Ensure wipers and skis are fitted to the transfer head.

27. Position a **0.1mm** shim on the stencil under the transfer head.
28. In the Module Diagnostics Page select **Drive System to Contact Height**.
29. Select **Run Diagnost**.

    NOTE
    Correct contact height is when the shim is just held between the transfer head wipers and stencil. At this position it is not possible to slide the shim sideways past the transfer head skis. If correct contact height is not yet achieved, carry out the following steps:

30. Select **Adjust** on the Menu Bar.
31. In the ProFlow Adjust Parameters select **PFLOW CONTACT POS**.
32. At the Menu Bar select **Incr.** or **Decr.** to increase or decrease the Contact Position set height by **0.5mm** (eg 5.0mm or 6.0mm).

    NOTE
    *Normally the contact position is between the range of **4mm - 8mm** (nominally **6mm**).*

33. Select **Exit** to return to Module Diagnostics Page.
34. In the Module Diagnostics Page select **Drive System to Contact Height**.
35. Select **Run Diagnost**.
36. Check if contact height is correct, (as detailed in NOTE above). If adjustment is still required repeat Steps 30 to 35 varying the set position until correct height is achieved.
37. On completion of contact height set up select **Home ProFlow** on Module Diagnostics Page.
38. Select **Run Diagnost**.
39. Remove shim. Remove empty transfer head, if necessary.

Exhaust Flow Restrictors

Exhaust flow restrictors are fitted to ProFlow pressure mechanisms with the manual pressure regulator option.

NOTE
Exhaust flow restrictors are not fitted to ProFlow units with software controlled regulator option fitted (Figure - Software Controlled Pressure Mechanism of the Mechanical Details section refers).

The speed at which the pressure actuators force the piston crosshead onto the transfer head system is factory set to fully open. This can be adjusted if the supply is too fast. ProFlow pressure adjustment is either carried out manually on the unit or by optional software control.

Two needle valve adjusters on the exhaust flow restrictors are used to limit the force of movement (and hence the speed) of the piston crosshead in each direction.

Adjustment of the bottom valve (R2) affects the downward motion of the piston (fully open - fastest movement). If print material flow is found to be inadequate during a print cycle adjust valve R2 anti-clockwise until the correct flow is achieved. If print material flow remains low with the valve fully open adjust the pressure regulator. (Pneumatic Supply Section of this chapter refers).

NOTE
Print material seepage may occur if the material supply is too fast.

Adjustment of the top valve (R1) affects the upward motion of the piston (fully open - fastest movement).

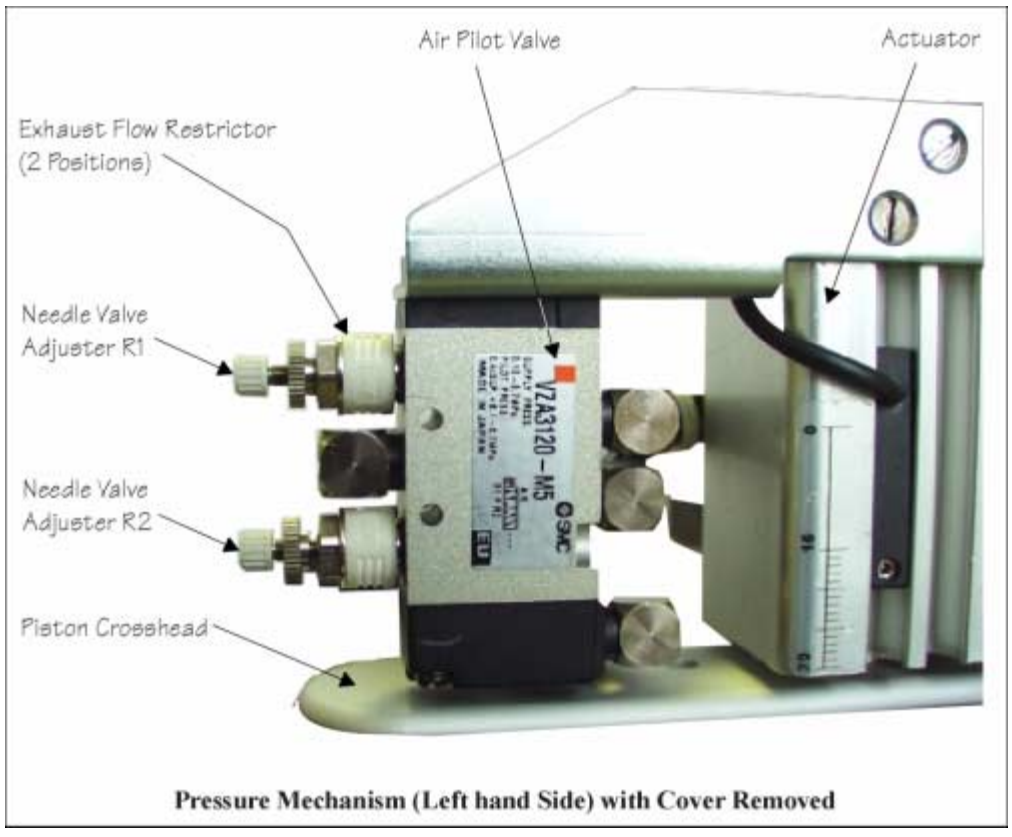


Figure 9-25 Exhaust Flow Restrictors

Software Pressure Adjustment

The software controlled regulator option can be instructed to supply and maintain pneumatic pressure to the piston crosshead within the range of 0.2 bar to 4 bar, or no pressure at all.

Software controlled piston pressure has three settings:

- Paste Pressure
- Idle Pressure
- No Pressure

NOTE
If the machine does not detect a software controlled regulator (manual adjustable pressure mechanism option fitted), pressure on the system is either on or off rather than being set to paste pressure and idle pressure.

Paste Pressure

This is the set operating pressure whilst the ProFlow unit is either in the knead or printing mode (and is the same in both cases). On removal of the ProFlow paste pressure (piston pressure), ie on completion of print stroke or knead function, the ProFlow paste pressure is reduced to ProFlow idle pressure.

NOTE
Paste pressure parameters can be adjusted in the product file under edit data or by selecting the Adjust button during machine running.

Idle Pressure

A light pressure is applied whilst the ProFlow unit is idle but remaining in contact with the stencil surface. This pressure is sufficient to prevent air pockets forming in the ProFlow system but not enough to cause print material seepage.

NOTE
Idle pressure does not affect movement of the screen chase.
Idle pressure parameters can be adjusted in the product file under edit data or by selecting the Adjust button during machine running.

No Pressure

No pressure is exerted whilst the printer is in the following configurations:

- When refilling or changing a cassette.
- Whilst the ProFlow unit is off the stencil.
- Whilst the ProFlow unit is being placed on, or lifted off the screen.

In the event of an E Stop action, pressure on the transfer head is released altogether.

Upon restoration of system power any pressure that was previously applied to the unit is restored, provided that the system is not re-initialized.

ProFlow Manual Regulator

For information on the regulator setting refer to the Pneumatic Module Chapter.

ProFlow Stencil Support

The ProFlow stencil support option provides stencil support when printing boards that are narrower than the ProFlow transfer head thus avoiding potential paste smearing onto the top of the stencil.

The standard height when the adjustable tooling top is in the closed position is 81mm. The support comprises the following items:

- Changeable Gauge Plate
- Tooling Bottom
- Adjustable Tooling Top

(Refer to Board Support Tooling Chapter of this manual for further information.)

Height Adjustment

To set the ProFlow stencil support to the correct height carry out the following:

1. Loosen the 7mm hexagonal nut securing the tooling top and tooling bottom.
2. Slide the adjustable tooling top upwards to open up the tooling top and bottom faces.
3. Position the two printed circuit boards to be printed between the tooling top and bottom opening faces, (Setting Up Stencil Support Height Figure refers).
4. Tighten the bolt locking the adjustable tooling top to the tooling bottom.
5. Remove both printed circuit boards.

   The support is now set to the correct screen height, ie 81mm + thickness of board.

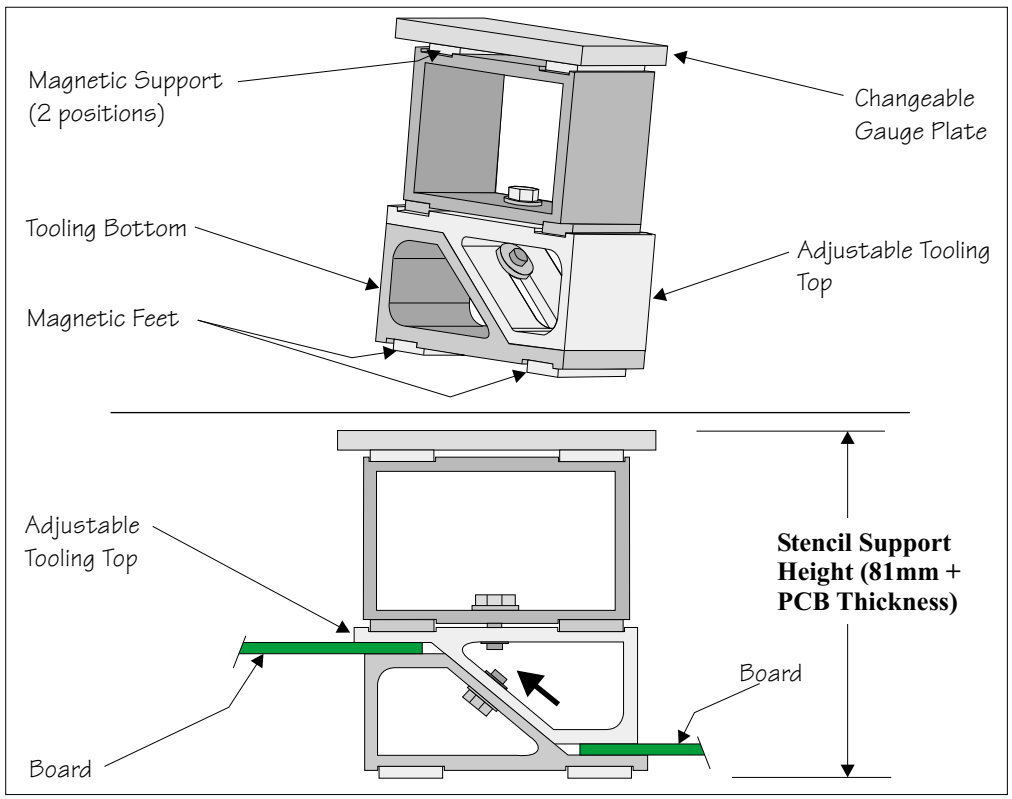


Figure 9-26 Setting Up Stencil Support Height

REPLACEMENT PROCEDURES

Squeegees to ProFlow

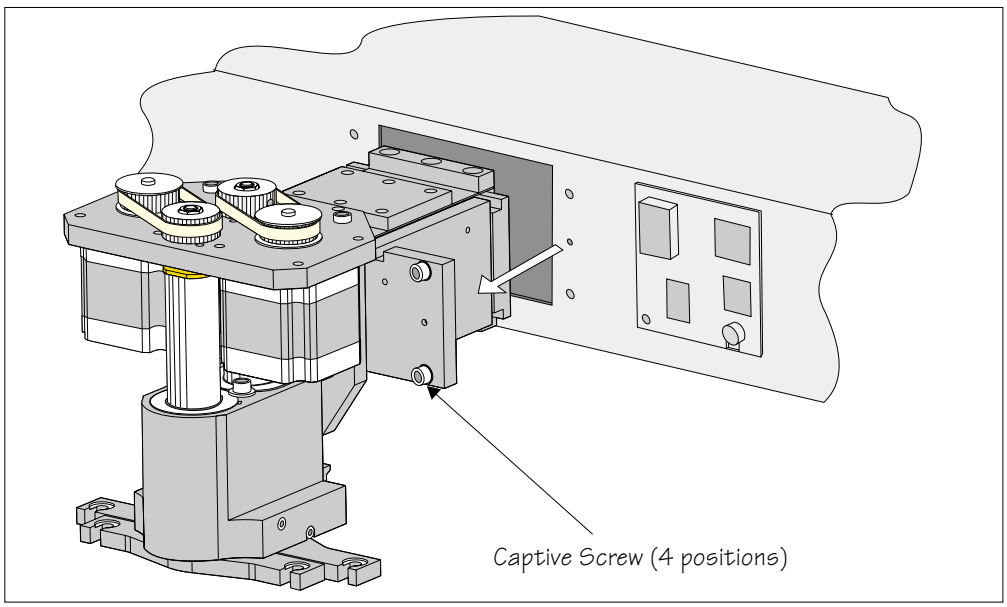
Instances may occur when the machine is required to print using the ProFlow module configuration. The following procedure details how to revert the machine from squeegee use to the ProFlow configuration:

ProFlow Printhead Mechanism

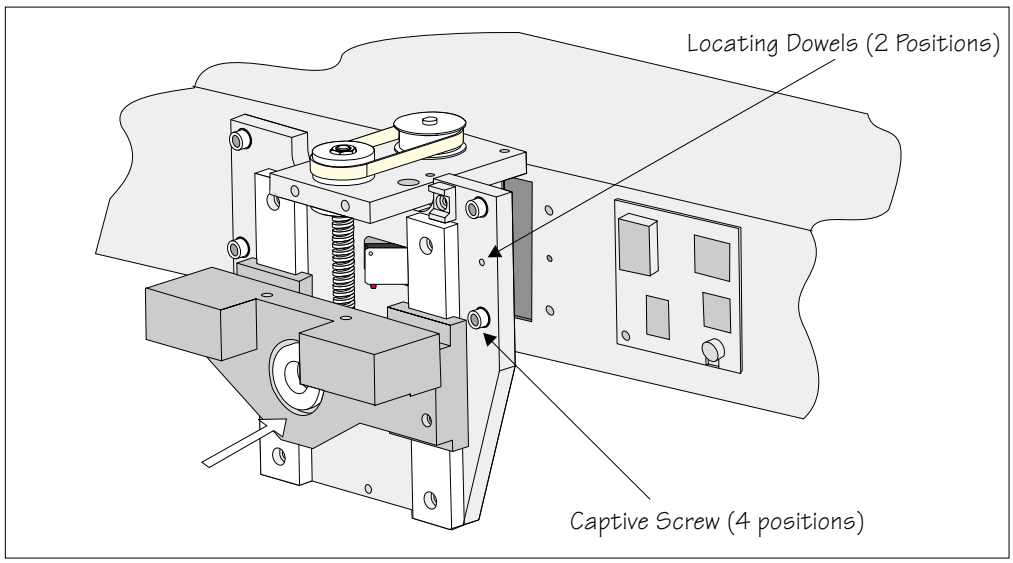
1. In Diagnostics ensure that the squeegees are homed. Position the print carriage so that removal and fit is carried out within easy reach.
2. Switch the machine **OFF** and disconnect pneumatics.
3. If squeegees are fitted, remove to a safe stowage.
4. Remove the following squeegee mechanism connectors from the print carriage, right hand side:

- 9PL16 - Front squeegee motor
- 9PL17 - Rear squeegee motor
- 9PL08 - Front and rear home sensors
- 9PL19 - Pressure amplifier (if fitted)

5. Loosen the four captive screws securing the squeegee printhead mechanism to the print carriage, using a **4mm** Allen key (see figure below). Carefully remove the mechanism out of the print carriage. Remove to safe stowage.

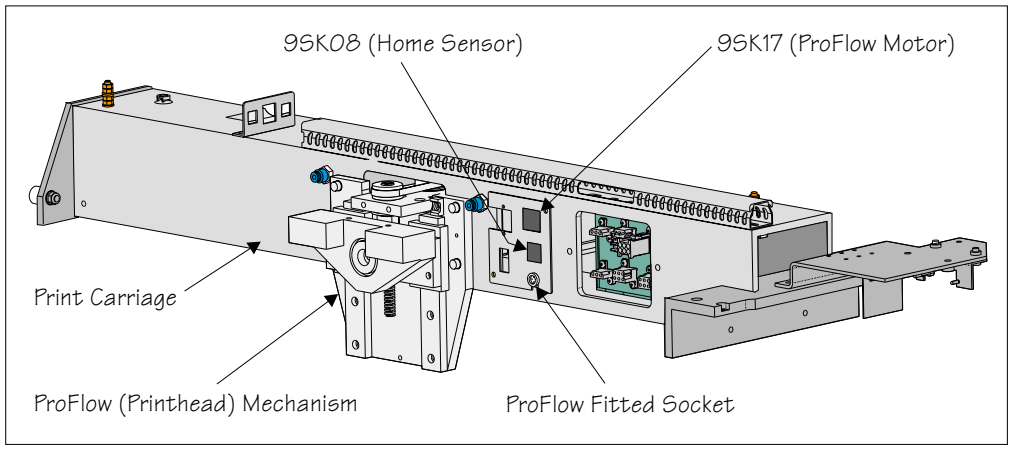


6. Position the ProFlow printhead mechanism locating dowels into the print carriage and secure the unit by means of the four captive screws, using a **4mm** Allen key (see figure below).



7. Fit the following ProFlow mechanism connectors (figure below refers):

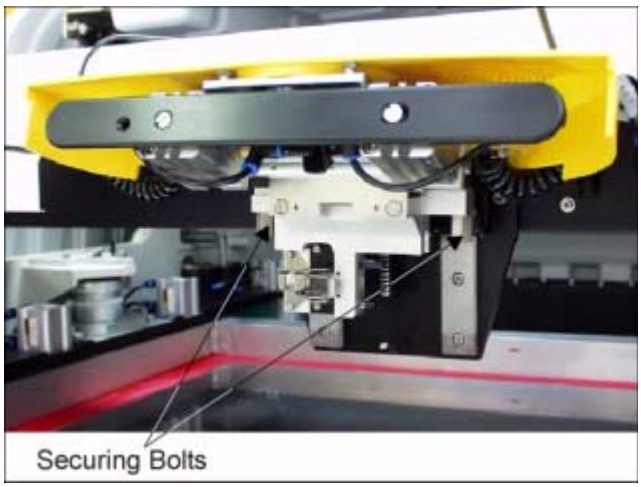
- ProFlow motor connector 9PL17 into 9 way socket 9SK17
- ProFlow home sensor connector 9PL08 into 6 way socket 9SK08



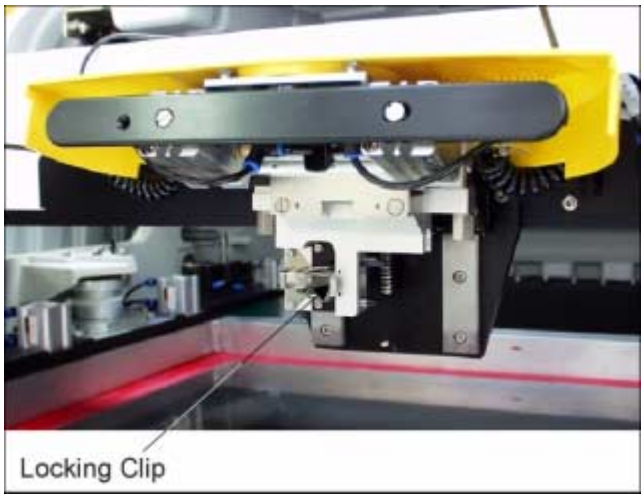
ProFlow Unit

1. Fit the pressure mechanism part of the ProFlow unit to the ProFlow printhead mechanism bearing block by means of the two securing bolts. Tighten using a **5mm** Allen key.

   NOTE
   Unit shown in unlatched position to identify bolts.



2. Ensure that the locking clip on the pressure mechanism is pressed over to the right and clicks into place, as shown in the figure below. This ensures that the locking clip is in the correct position to secure the transfer head.



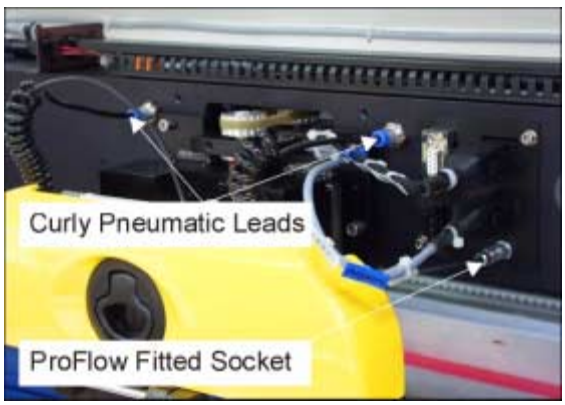
3. Locate and fit the ProFlow transfer head unit to the pressure mechanism by means of the two locating dowels. Slide the unit onto the pressure mechanism. Once the unit is slid fully home, it is secured by closing the locking clip.

4. Lift the light shroud for access and plug the electrical connection ProFlow Fitted from the ProFlow unit into the socket sited on the right hand side of the ProFlow on the print carriage, (figure below refers).

CAUTION
ELECTRICAL CONNECTION. This electrical connection informs the machine of ProFlow fitment and must always be connected whilst the ProFlow unit is fitted otherwise damage may occur if machine is run.

Connect the curly pneumatic leads from the pressure mechanism to each respective left and right pneumatic connector sited either side of the ProFlow printhead mechanism (figure below refers).

NOTE
If the squeegee paste dispenser option is fitted to the print carriage, before using ProFlow, ensure that the paste dispenser regulator gauge reads '0' pressure .



5. Connect the pneumatics and switch the machine to **ON**. To ensure that the machine recognizes the ProFlow module, the following indications on the machine MMI are evident:
   a. During the boot up sequence the operator is prompted to fit the **'ProFlow cover'**.
   b. The soft key that previously indicated **'Paste Load'** now indicates **'Knead Paste'**.
   c. In Diagnostics the ProFlow menu page can be accessed.

Parameters

6. Select **Set Preference** on the MMI and modify the settings to that indicated in the table below.

	Nominal Setting	Range Parameter
ProFlow Contact Position	5.5mm	Min -10mm Max +10mm (Incr 0.1mm)
Paste Pressure	2.2bar	Min 0.2 bar Max 4 bar (Incr 0.2 bar)

7. By selecting **Adjust** on the MMI, ensure that the following print process parameters in the table below are adjusted for use with ProFlow.

	Nominal Setting	Range Parameter
Front & Rear Print Speed	70mm/sec	Min 2mm/sec Max 150mm/sec
ProFlow System Pressure	3kg	Min 0kg Max 20kg
Separation Speed	10mm/sec	Min 0.1mm/sec Max 20mm/sec
ProFlow Knead Pressure	4kg	Min 0kg Max 20kg

8. Set the Proflow pressure mechanism pressure settings to read the following:

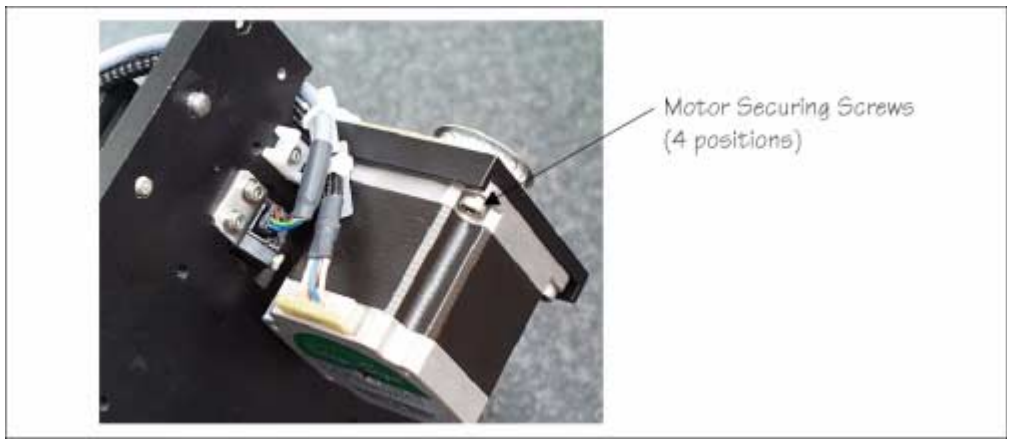
	Nominal Setting	Range Parameter
Manually Controlled Option	2.2bar Paste Pressure	
Software Controlled Option	2.2bar Paste Pressure	Min 0.2bar Max 4bar (Incr 0.2bar)
	0.2bar Idle Pressure	Min 0bar Max 4bar (Incr 0.2bar)

NOTE
The settings detailed represent the starting point for subsequent refinement and optimization.
Information on the machine set up procedures are detailed in the Machine Programming chapter of the User manual.

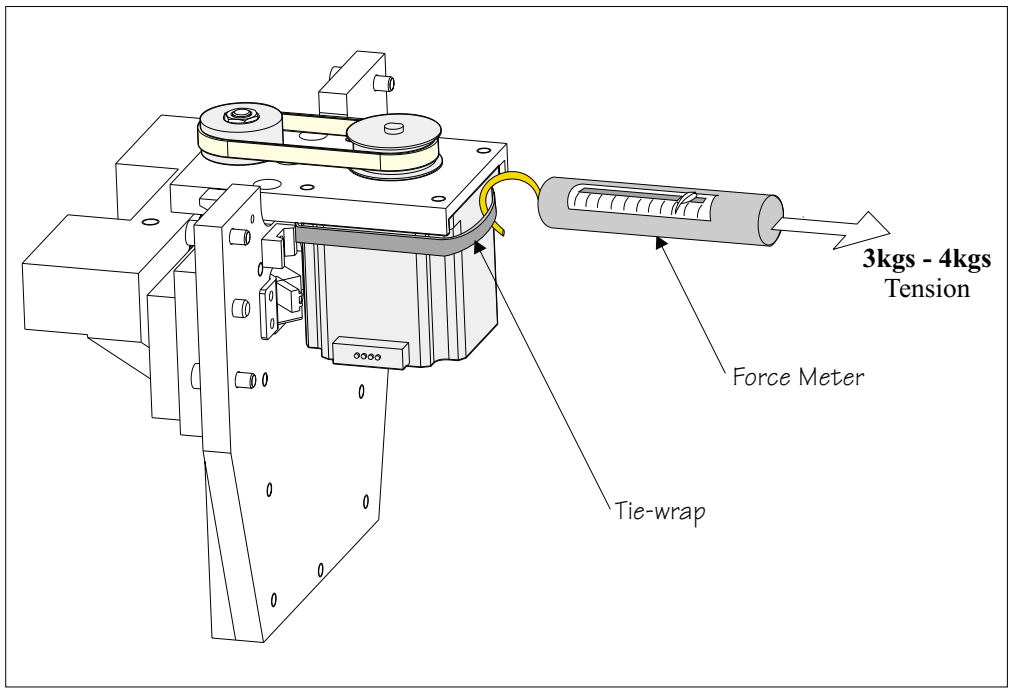
Drive Belt Replacement

To replace the ProFlow drive belt the printhead mechanism must first be removed from the print carriage, carry out the following procedure:

1. In Print Carriage Diagnostics, select **Drive Carriage to Front Position**. Power down the machine, raise the machine covers.
2. Remove the ProFlow pressure mechanism and transfer head.
3. Disconnect all plugs from the printhead mechanism to the connector panel on the print carriage.
4. Remove the printhead mechanism by unscrewing the four captive screws securing the unit to the print carriage.
5. Placing the unit on a secure surface, slacken off the four screws securing the stepper motor to the support plate, (figure below refers).



6. Remove the old drive belt. Fit new belt in position.
7. Using a cable tie wrap or similar, provide a loop around the top of the motor body enabling the motor to be pulled using a force meter. Ensure that the force meter is pulled in the direction which the drive belt is fitted, (figure below refers).



8. Pull the force meter until a tension of **3-4kgs** is monitored on the meter. Tighten the four screws whilst the motor is under tension.
9. On completion re-fit the printhead mechanism to the print carriage and re-connect all leads to the print carriage connector plate.
10. Re-fit ProFlow pressure mechanism and transfer head to printhead mechanism.

FAULT FINDING

Symptom	Possible Causes	Possible Solutions
Leakage between the skis and wipers	Pneumatic paste pressure set too high.	reduce paste pressure or increase speed. Check settings, mechanical security.
	Incorrect contact position.	Try alternative set up method.
	Old issue wipers or skis fitted.	Ensure that the latest hardware is fitted.
Stencil or wiper damage	Foreign matter between the board and stencil.	Ensure boards are clean and flat when entering the machine.
	First side components not seating in the tool nest correctly.	Check tooling nest/ first side placement.
	Metal edge wipers not being used.	Ensure the latest ProFlow hardware is fitted.
	Stencil design not suitable for use with ProFlow.	Large apertures need support bars, top side of laser cut stencils must be smooth.
	Imaging speed too high.	Reduce print carriage speed.
	Bowed boards entering the machine not being flattened by clamping pressure.	Ensure the quality of raw materials conforms to specification. Bowing less than 1% of diagonal dimension of board.
	Unsupported stencil.	Support the stencil to keep the top surface of the as flat as possible.
	Cassette empty.	Replace cassette and check adjustment of paste low sensor.
Bridging	Variation in stencil height due to foreign matter between board and stencil.	Ensure the boards are clean and flat, the underside of the stencil is clean and free from damage.
	Bad board support causing the board to bow upwards.	Modify the board support tooling strategy and check that the rail to table height is set correctly.
	Pneumatic pressure too high.	Reduce paste pressure or increase print carriage speed.
	Print carriage speed too low.	Increase print carriage speed or reduce pneumatic pressure
	Solder paste slump.	Control the temperature in the preplacement.
Bridging at the end of the print stroke	Rail to table height incorrectly set.	Check and reset rail to table height dimension.
	Pads too close to the edge of the board.	Board design for DEK machines requires a 5mm distance from the board edge to the apertures.
	Board clamps not level or parallel.	ECB 638
Print wedging	Excess system pressure.	Reduce system pressure.
	Print speed too fast for the paste being used.	Change the print speed.

Symptom	Possible Causes	Possible Solutions
Top side of stencil not cleaning	Wipers damaged.	Replace wipers.
	Insufficient board support.	Add/modify tooling.
	Insufficient stencil support.	Add stencil support.
	Transfer head too large for product.	Use 300mm head for all products up to 300mm long and shortest possible for larger products.
	Skis damaged or dirty.	Replace with latest issue skis, Mylar vulcanized into PTFE (black).
	Too much paste pressure.	Reduce paste pressure.
	Insufficient paste pressure.	Increase system pressure.
	Contact position set incorrectly.	Reset contact height to just deflect the stencil when viewed from the underside.
Insufficient paste on fine pitch devices	Cassette empty.	Replace cassette and check adjustment of cassette low sensor.
	Paste pressure too low.	Reset pneumatic pressure.
	Insufficient board support.	Investigate/modify tooling set up.
	Incorrect stencil design.	Ensure that stencil conforms to aperture height.
Insufficient paste through large apertures	Paste pressure too high.	Reset pneumatic pressure.
	Print speed too high.	Adjust print carriage speed
	System pressure too high.	Adjust system pressure setting.
	Cassette empty.	Replace cassette and check cassette low sensor setting.
Insufficient paste in apertures at the end of print stroke	Board bowed upwards by tooling too close to the rails.	Move the tooling towards the centre of the board.
	Rail to table height setting incorrect causing bowing over the tooling pins.	Check and reset the rail to table height setting.
	Paste pressure too low.	Reset pneumatic pressure.