User Guide

ProJet®

x60*Pro* Series
3D Printers

ProJet 660*Pro,* ProJet 860*Pro*

Part Number 95052
Rev. A

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Symbols

The following symbols are used on the ProJet x60*Pro* system and in this manual.

	General Caution: User should use care to avoid possible damage to equipment.
	Hot Surface: User should use care when working near or on the labelled item.
	High Voltage: User should use appropriate electrical safety precautions.

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1 ProJet x60Pro® Series Overview

Welcome to the exciting world of 3D Printing with our largest and most capable 3D Printers, the ProJet 660*Pro* and 860*Pro*. In addition to their outstanding build volume, the x60*Pro* Printers incorporate many new features that automate and streamline the 3D printing process. The full-color capability, an easy-to-use design, combined with high-performance composite materials, makes the x60*Pro* Printers the fastest, most cost-effective 3D printer available today for rapid prototyping.

This manual will instruct you on how to take care of your printer and give you an introduction to 3D Printing. In addition, you can find information about 3D printing and its many applications and techniques on our 3DS Central User Web site at *3dscentral.3dsystems.com*.

This Web site is tailored to both beginner and advanced customers. We recommend that you register immediately to receive free, unlimited access to this excellent resource.

1.1 New Features

The x60*Pro* Printers are our fastest, most capable printers. We've built in the features customers most asked for:

- Larger build volume
- Higher resolution
- Automated Core Removal/Recycling
- Quick-Load Binder and Cleaning Solution Cartridges

1.2 Specifications

Printer Dimensions and Type	ProJet 660*Pro* • With top cover closed: Length 76" (193 cm) x Width 30" (76 cm) x Height 57" (145 cm) • With top cover open: Length 76" (193 cm) x Width 36" (91 cm) x Height 74" (188 cm) • Crated: 87" wide x 48" deep x 64" high (221 cm wide x 122 cm deep x 163 cm high • Floor standing model on six casters. Two front casters are lockable. ProJet 860*Pro* • With top cover closed: Length 47" (119 cm) x Width 46" (117 cm) x Height 69" (175 cm) • With top cover open: Length 47" (119 cm) x Width 46" (117 cm) x Height 74" (188 cm) • Crated: Length 64" (163 cm) x Width 58" (147 cm) x Height 70" (173 cm) • Floor standing model on four casters. Two front casters are lockable. Both models • Full color capability; color shell thickness =.025" (.635 mm) • Integrated Core removal and vacuum units.
Printer Weight	ProJet 660*Pro* • Uncrated: 837 lbs (380 kg) • Crated: 1116 lbs (507 kg) ProJet 860*Pro* • Uncrated: 800 lbs (360 kg) • Crated: 1060 lbs (482 kg)
Network Connectivity	TCP/IP 100/10 Base T

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Operating Environment	
Ambient Temperatures	• Maximum Temp. Range: 50-80° F (10 - 26.6° C) • Recommended Temp. Range: 55-75° F (12.7 - 23.9°C)
Ambient Relative Humidity	• Maximum RH Range: 15 - 60%, non-condensing • Recommended RH Range: 20 - 55%, non-condensing (May experience sub-optimal performance at extremes.)
Build Volume	ProJet 660*Pro* • 10" x 15" x 8" (254 mm x 381 mm x 203 mm) • 1200 cubic inches build capacity ProJet 860*Pro* • 15" x 20" x 9" (381 mm x 508 mm x 229 mm) • 2700 cubic inches build capacity
Build Speed	2-4 layers per minute
Layer Thickness	.0035" - .004" (.089 - .102 mm)
Resolution	600 x 540 dpi print resolution
Noise Levels	Both models • During Printing = 57dB • Emptying Overflow = 66dB • Vacuuming - Cover Open = 72dB ProJet 660*Pro* • Fine Cleaning - onboard Post-Processing Unit = 72dB
CSA, CE Approval	Pending: CE certification and UL listing.
Power Requirements	Both models • 100V, ~50-60 Hz, 15 Amp. • 115V, ~50-60 Hz, 15 Amp. • 230V, ~50-60 Hz, 8 Amp. **Note:** At 100-115V, a 20A circuit is required and the system ships with the appropriate 20 A plug. Due to high amperage, a dedicated circuit is strongly recommended. Approximately 78 watts are required when the printer is in Sleep mode.

Materials - High Performance Composite	VisiJet® PXL™ Core™
	VisiJet® PXL™ Binder
	3D Systems is always evaluating new materials for use with your printer. For the latest information check the Materials section of our Web site: 3dscentral.3dsystems.com.
Print Heads	5 each HP11 (clear, black, cyan, magenta, yellow) 1520 jets total
Liquid Waste System	Pull-out tray

1.3 Computer/System Requirements

Computer operating systems and hardware change frequently. Please check out the latest recommendations on our 3DS Central Web site, in the Support section, under 3D Printing Software: 3dscentral.3dsystems.com.

1.4 How the 3D Printing System Works

The ProJet® x60*Pro*/VisiJet® PXL™ Core™ Printing System is based on the Massachusetts Institute of Technology's patented 3DP® Technology (3D Printing). This 3D Printing process involves:

- Importing a solid 3D modeling file into the 3DPrint Software
- Setting up your files to print in the 3DPrint Software
- Printing the part
- Drying the part, emptying the build bed, and removal of excess PXL Core material
- Cleaning and servicing the printer
- (Optional) Applying post-processing materials to the printed part
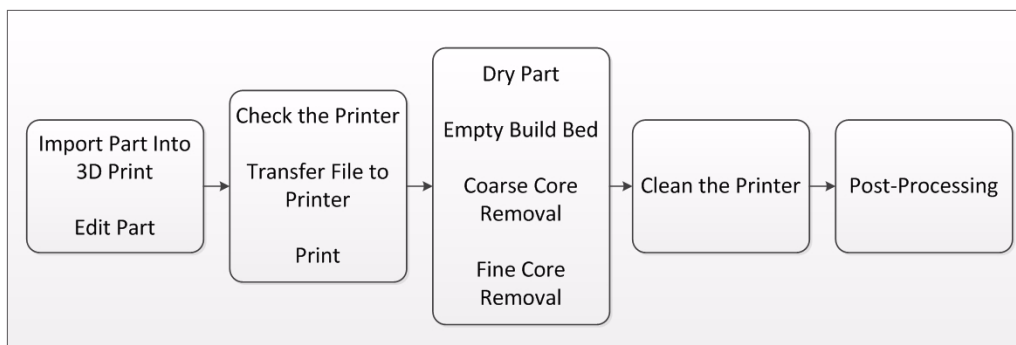
To start, the 3DPrint Software takes a three-dimensional design file, (3DPrint is compatible with most 3D modeling software files) and converts it into cross-sections, or layers, that are between 0.0035" - 0.004" (0.089 - 0.102 mm) thick. Before printing, 3DPrint evaluates the part geometry and checks if there are enough materials in the printer to print the number of layers required to build the part. If there are, the printer then prints each layer, one after the other, from the bottom of the part to the top. If not, 3DPrint will prompt you to add Core, to add binder, or to change a print head before it will start the print job.

During printing, binder is first applied with a higher saturation to the edges of the part, creating a strong "shell" for the part exterior. In a color printer, this shell will contain the colors. Next, an infrastructure that works like strong scaffolding is created for the part walls, which are also built with a higher saturation of binder for added strength. The remaining interior areas are printed with a lower binder saturation, which gives the part its stability. See the illustration below.
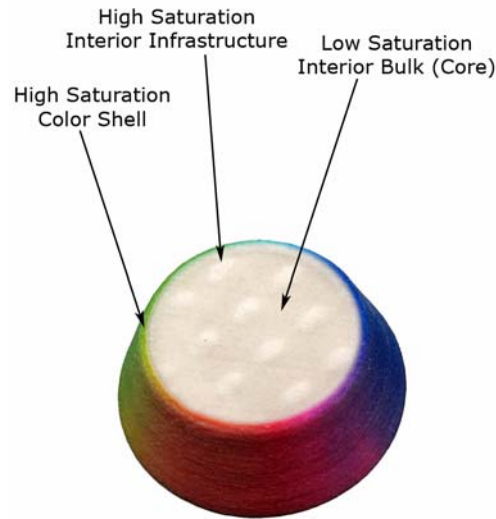
When the part is finished printing, the user empties the Build Bed of most of the excess Core material around and on the part by vacuuming with the integrated vacuum system. This "coarse cleaning" returns the Core to the Feeder for reuse. After coarse cleaning, the part is ready to be removed from the printer and undergo "fine cleaning". Fine cleaning consists of blowing off the remaining Core material using compressed air and brushing the part to loosen any Core that adheres. Fine cleaning is easily accomplished in the onboard Post Processing Unit (ProJet 660*Pro*) or the separate Core Recycling Station (ProJet 860*Pro*).

You can evaluate the part as it is, or you can choose to post-process the part with infiltration products to give it additional strength and durability. With the finished part in your hands, you can start improving or modifying your design within the same day, and usually within hours.

1.5 Important Terms

Binder - VisiJet PXL liquid that is dispensed through the HP11 print head and applied to the VisiJet PXL Core material. The binder saturation value will vary depending on the part geometry. The 3DPrint software uses a default core and shell saturation value that is suitable for most part geometries.

Build Bed - The area in front of the Feeder where the part is printed. The platform of the Build Bed can be raised or lowered using the appropriate command on the printer LCD menu. Before each build, the printer fills the Build Bed with VisiJet PXL Core and then spreads a final layer of Core to ensure the surface of the Build Bed is completely smooth.

Build Chamber - The interior of the printer that houses the Build Bed, Service Station, the Debris Separator, the Carriage, the Fast Axis assembly, the Vacuum Hose, and the Feeder.

Carriage - Assembly that houses the Print Head and its Pogo Pin Connectors.

Consumables - VisiJet PXL Core, VisiJet PXL binder, and the infiltrants that are used (wax, salt water, Color Bond, StrengthMax). All consumables have been developed for the fastest printing speeds and lowest materials costs.

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Debris Separator - Located in the Build Chamber. Its function is to prevent chunks or particles from going back into the printer Feeder during any vacuuming operation.

Deck - Area surrounding the Build Bed.

Feeder - Printer component that stores PXL Core. Core that is vacuumed up after a build, or Core that is manually emptied from the Build Bed, is recycled and returned to the Feeder for reuse.

Fast Axis - Printer component that houses the Carriage and the Fast Axis rails on which the Carriage moves. The Fast Axis moves on the Slow Axis rails which are housed beneath the Build Chamber Deck.

Infiltration - Process of applying various post-processing products (resins, wax, epoxy, etc.) to fully cleaned parts to give them specific properties such as strength and durability.

LCD - Liquid Crystal Display.

Platform - The metal plate in the Build Bed. The platform (or Build Platform) can be raised or lowered by selecting the appropriate command on the printer LCD menu.

Pogo Pins - Gold contact pins for the print head contacts. Clean the Pogo Pins with an alcohol swab whenever a print head is removed, cleaned, or replaced.

Print Head - There are five HP11 Print Heads for the ProJet 660*Pro* and 860*Pro*. These print heads print the pattern of the part by squirting tiny drops of PXL binder onto the PXL Core material. When a new HP11 print head is installed, the printer runs an automatic purge cycle to clean the print head of its ink and to prepare it for dispensing binder. **Note:** Only HP11 model C4810A Black cartridges can be used.

Print Head Contacts - The contact points on a print head cartridge that match up with the Pogo Pins.

Purge - Process of removing ink from the HP11 print head to prepare it for dispensing PXL binder.

Service Station - Cleans the print head jets to remove residue that accumulates during printing. It is extremely important to clean the Service Station after **every build** to remove residue buildup. If the Service Station is not clean, your print head will not get properly cleaned and this will result in shortened print head life.

Waste Tray - Absorbs the binder waste and will require changing only when you are prompted to in 3D Print. Located at the bottom rear of the printer after removing the rear panel.

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1.6 ProJet x60*Pro* Components

The main components of the ProJet x60*Pro* system are highlighted below.

1.6.1 System Exterior

ProJet 660*Pro*

ProJet 860*Pro*

Number	ProJet 660*Pro*	ProJet 860*Pro*
1	Printer Cover	Printer Cover
2	Control Panel	Control Panel
3	Printer Storage Compartment	Printer Storage Compartment
4	Post-Processing Unit (PPU) Cover	
5	PPU Storage Compartment	
6	Arm Holes	

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1.6.2 Printer Interior
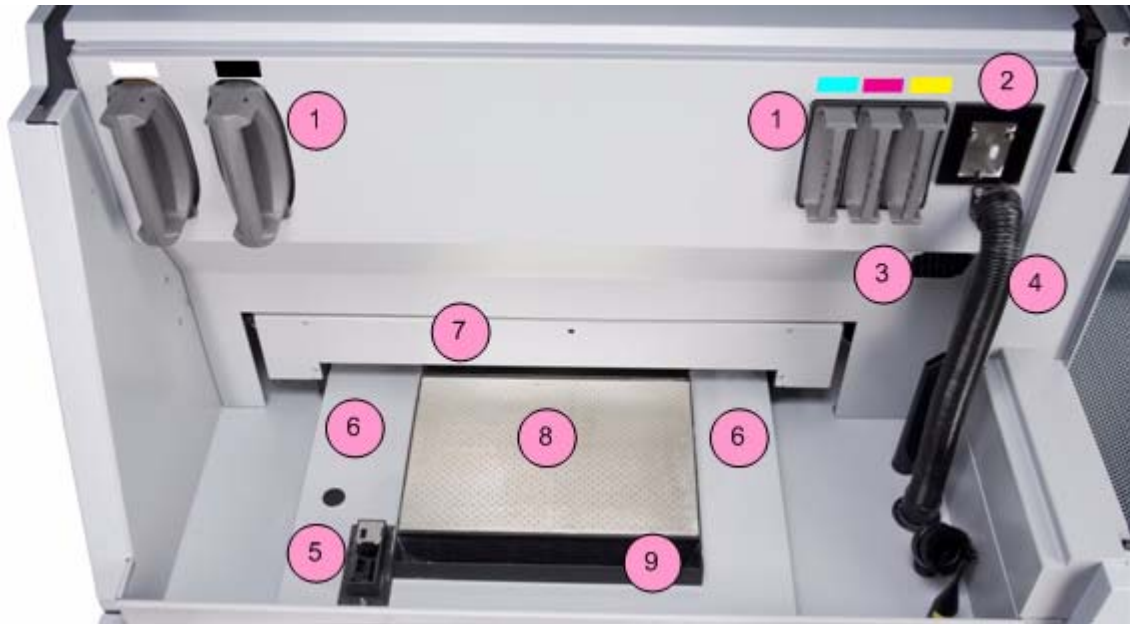
Number	Component
1	Binder Cartridges
2	Debris Separator
3	Heater Vent
4	Vacuum Hose
5	Service Station
6	Deck
7	Fast Axis Assembly
8	Build Bed
9	Front Overflow

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1.6.3 Storage
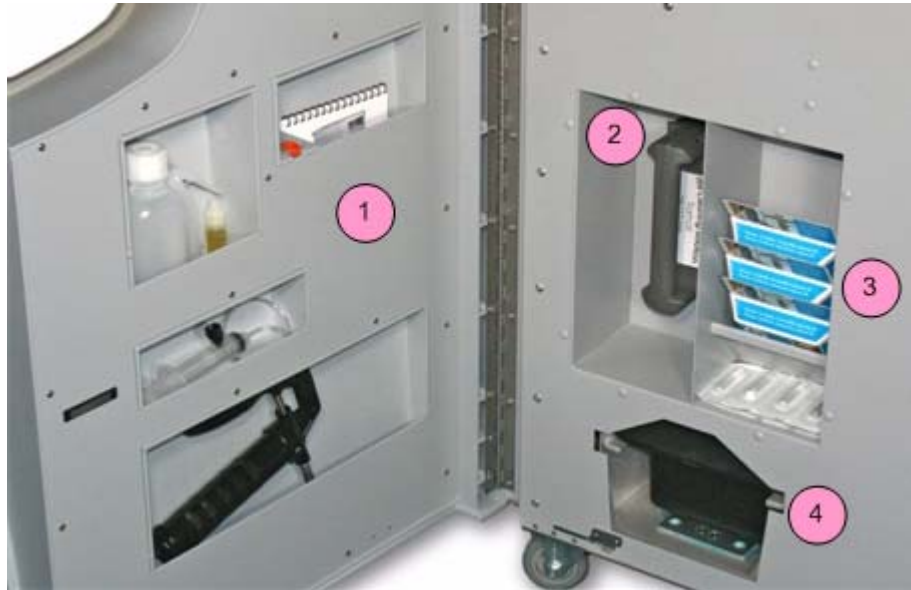
Number	Component
1	Tools and Acessories Storage
2	Cleaning Solution Cartridge
3	Print Head Storage
4	Waste Tray

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1.6.4 Post-Processing Unit (PPU) Interior (ProJet 660*Pro* Only)
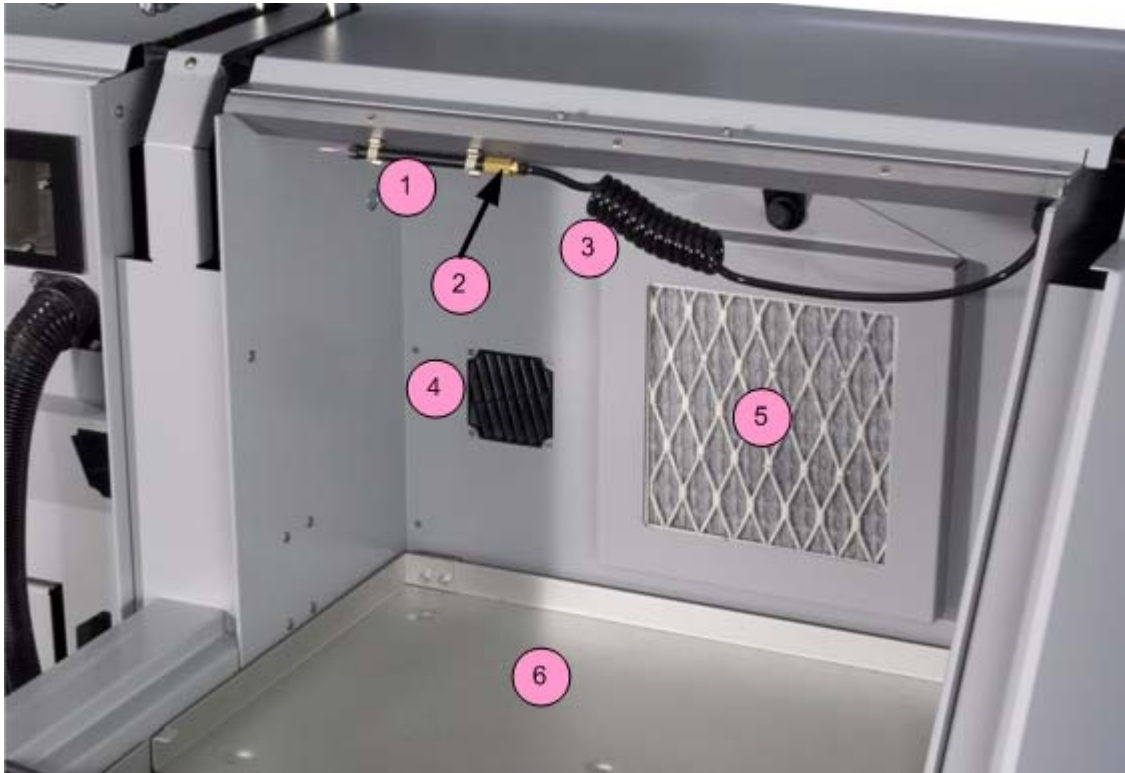
Number	Component
1	Air Wand
2	Air Pressure Control Nut
3	Air Hose
4	Heater Vent
5	Carbon Filter
6	Post-Processing Tray
7	Accessory Tray

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1.6.5 Post-Processing Unit (PPU) Storage (ProJet 660*Pro* Only)

Number	Component
1	Tool Basket
2	Parts Trays (shown under Dipping Kit)
3	Accessory Tray

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1.7 ProJet x60*Pro* Rear View
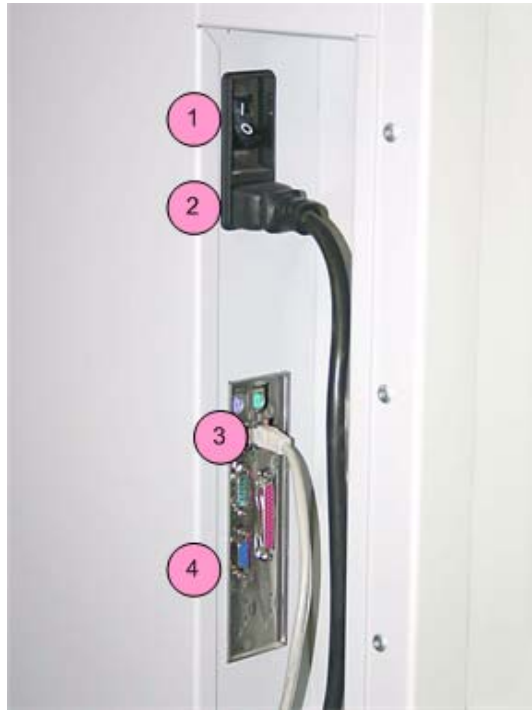
Number	Component
1	Power Switch
2	Power Cord
3	Network Cable
4	Electronics Box (E-Box) Connections

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1.8 Service Station
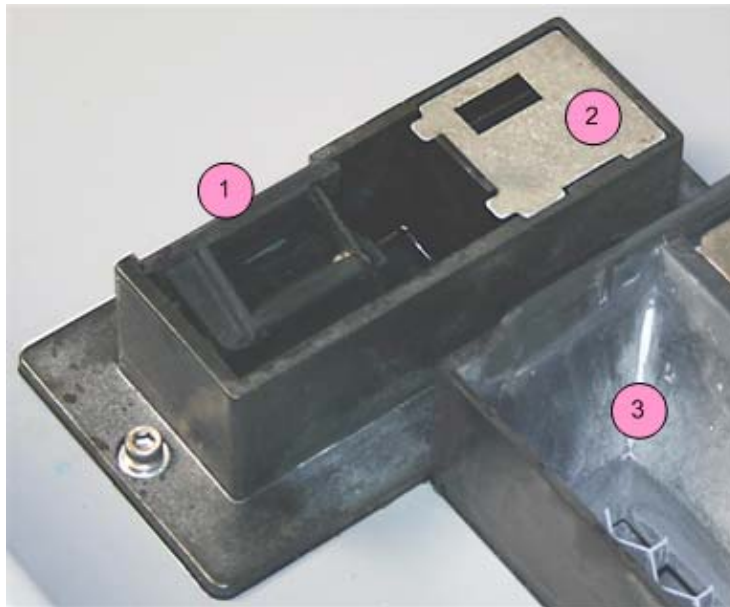
Number	Component
1	Squeegee
2	Spit Plate
3	Front Overflow

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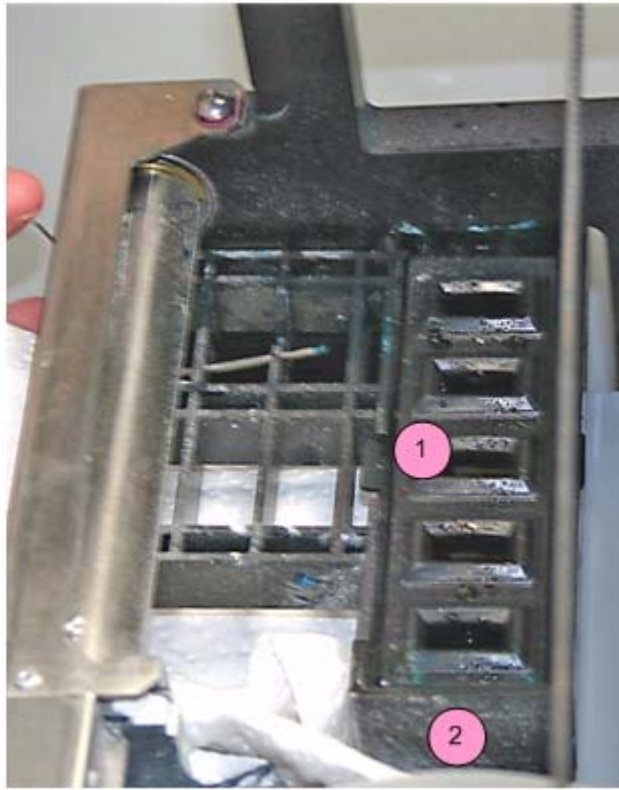
1.9 Parking Caps

Number	Component
1	Parking Caps (5 total)
2	Parking Spittoon (under Parking Caps)

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1.10 Carriage, Print Heads, and Pogo Pins

1.10.1 Front View
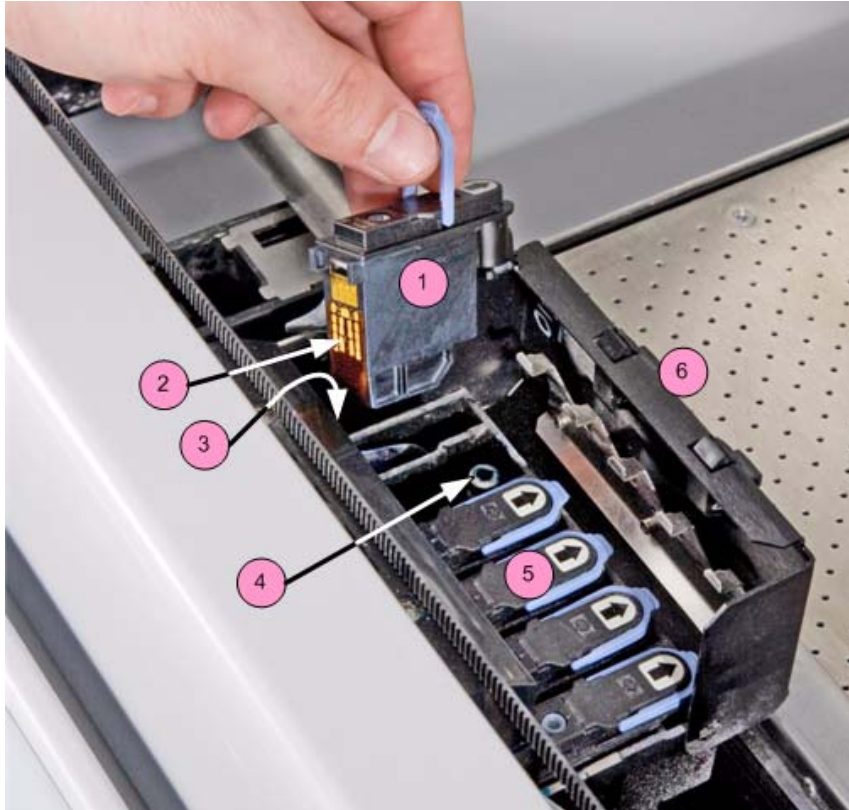
Number	Component
1	Print Head (removed)
2	Print Head Contacts
3	Pogo Pins (inside)
4	Septum
5	Print Head (installed)
6	Carriage Cover

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1.10.2 Top Inside View
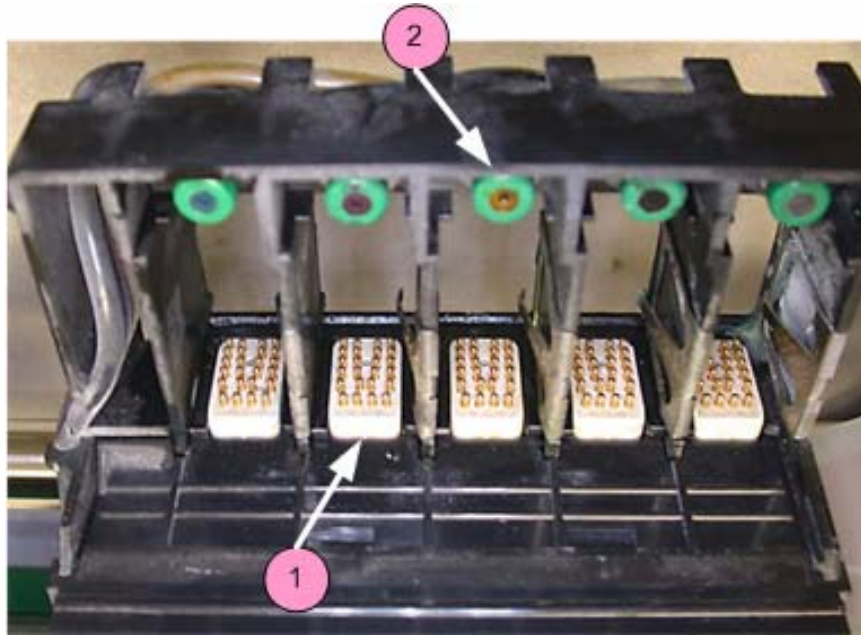
Number	Component
1	Pogo Pins (5 sets total)
2	Septum (5 total)

Note: Carriage cover shown removed.

1.11 Control Knob Operations

Push the Control Knob once to:
- Bring up the LCD menu.
- Select a menu item.
- Open a submenu.
- Start/Cancel/Stop a menu function.

Turn the Control Knob left or right to:
- Highlight a menu item.

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1.12 LCD Menu Overview - ProJet 660*Pro*

Main Menu	Printheads Submenu	Build Chamber Submenu	Post Process Submenu
Vacuum	Main Menu >	Main Menu >	Main Menu
Core Removal	Change Printheads	Raise Platform	Post Process Heater
Prep Build Chamber	Align Printheads	Lower Platform	Post Process Filter
Status Report>	Purge Printheads	Spread Layer	
Printheads >		Fill Bed	
Build Chamber >		Empty Build Chamber	
Post Process Menu>			
Go Online			

1.13 LCD Menu Overview - ProJet 860*Pro*

Main Menu	Printheads Submenu	Build Chamber Submenu
Vacuum	Main Menu >	Main Menu >
Prep Build Chamber	Change Printheads	Raise Platform
Access Build Plate	Align Printheads	Lower Platform
Status Report>	Purge Printheads	Spread Layer
Printheads >		Fill Bed
Build Chamber >		Empty Build Chamber
Go Online		

1.14 Where To Go For More Information

Quick Start Guide A *Quick Start Guide* is included on the 3DPrint Installation media (typically a USB thumb drive). Or, visit our 3DS Central Web site at *3dscentral.3dsystems.com*.

Software User Manuals User Manuals for the 3DPrint Software is supplied on the Installation media (typically a USB thumb drive) with the software. Additional copies are available on our 3DS Central Web site at
 3dscentral.3dsystems.com.

Post-Processing Learn more about the different post-processing products that are available to use with your printer, on the Best Practices section of our 3DS Central Web site at *3dscentral.3dsystems.com*.

Consumables To order consumables/materials, contact your local Service Provider or Reseller.

1.15 Contact 3D Systems

If you have any questions about your 3D Printer or the 3D Print/3D Edit Pro Software, please contact your local Reseller/Service Provider. If they are unable to help, contact us directly.

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2   Setup And Print The Build

This section will briefly introduce you to using 3DPrint to get your part ready to build. Then it will show you how to get your ProJet x60 ready and actually print your part. For all the details on using 3D Print, refer to the **3DPrint User Manual.**

2.1 Install 3D Print

If 3DPrint has not been installed, you will first need to install it. Installation instructions are available in the **3DPrint User Manual**. Be sure to install the software on the same computer that is connected to your 3D Printer. Also be sure you use the version of 3DPrint that came with your ProJet x60 system.

If you encounter any problems during installation, please contact your local Service Provider or Reseller, or visit the Support section of our Web site at *3dscentral.3dsystems.com*.

2.2 Open A Part In 3D Print

1.   Launch the 3DPrint Software.
2.   In the **Open** dialog, select a file to print, or browse to a file on your computer. Click the **Open** button, or double click on a file to open it in 3D Print.

2.2.1   3DPrint Main Window

After the file is opened, the part will be displayed on the 3DPrint Main Window. Here it will be shown in a 3D View on the right, and 2-D views on the left showing a top view and a side view. See the **3DPrint User Manual** for a complete description of the Main Window and its features and toolbars.
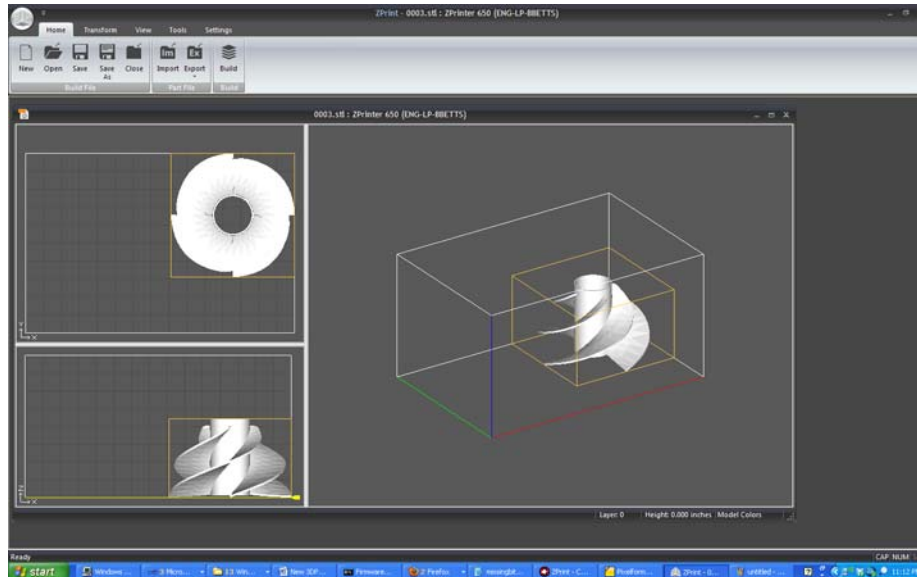
2.2.2   Part Orientation, Strength, and Printing Speed

How the part is oriented in the build volume will have an effect on the strength of the part before infiltration. Orientation - and placement (location) on the build platform - will also impact the speed at which the build completes.

For details on placing and orienting your part using 3D Print, refer to the **3DPrint User Manual.**

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2.3 Check The Default Settings

Before you start your build, check the settings for the printer.

2.3.1 Printer Settings

1. Select **Settings > Printer Settings** to display the **Printer Settings** dialog.

2. In the **Printer Settings** dialog, check that the default printer is the printer that is connected to your computer.

3. If you need to make a change, click on **Select Printer**.

4. In the **Select 3D Printer** dialog, choose **Network** as the **Port Type**. Click the **Find** button to locate the printer on the network. If the printer is connected to the network, it will appear on the list. Select the printer and click **OK**.

5. The **Default Printer Settings** dialog reopens showing your new default settings. To save your settings, click the **Save As Default** button. You can change these settings at any time by repeating Steps 1 - 4.

2.4 Check The Build Settings

Before printing, ***always*** check your build settings.

1. Select **Settings > Materials**.

2. Check that the printer listed in the **Select Printer** field is the printer connected with the computer running 3D Print, and that the printer is Online.

3. **Print in Monochrome** instructs the printer to ignore any color information contained in your 3D model and print a completely white, monochrome part. *(ProJet 260C and 460Plus only)*

4. Click **OK**.

2.5 Prepare the Build Area

Go to your printer and check each item listed below to ensure the printer is ready to print. It is important to check each of these items before every build.

*   Check that the Deck, Fast Axis, and Build Bed are clean of any loose Core material. See ***Section 3.1, 'Vacuum Excess Core Material'*** for instructions on how to vacuum up excess Core from these areas.

*   Check that the Debris separator is empty. See ***Section 3.2, 'Empty The Debris Separator'*** for instructions on how to empty the Debris separator.

*   Check that Carriage and Rails are clean. See ***Section 3.3, 'Clean The Fast Axis Rails and Carriage'*** for instructions on how to clean the Carriage and Rails.

*   Check that Service Station is clean. See ***Section 3.4, 'Clean The Service Station'*** for instructions on how to clean the Service Station.

*   Check that the platform is raised to the top of the Build Bed. Select `PREP BUILD CHAMBER` > `CONTINUE` on the LCD menu to raise the platform to its proper position.

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A clean, properly prepared Build Bed

2.6 Print the Build

1. Select **Build >** on the Toolbar to display the Printing Options dialog.
    *   **Layer Print Range** allows you to print either the entire build or just a selected range of layers.
    *   **Delay Start Time** allows you to start the job at a specified later time.
    *   **Print Log** and **Detailed Report** generate log files that describe what happened during the print job. These are very useful in troubleshooting printing problems, and we recommend you leave them checked.
2. Select **OK** when you have selected your options.
3. The **Printer Status** dialog appears.

    3DPrint checks the printer readiness and calculates the materials needed to complete the build. The results are reported in the **Printer Status** dialog for you to check before starting the build.
    *   The dialog shows **OK** for each item and the **Print** button is enabled when the printer is ready.
    *   If you see a message and the **Print** button is not available for selection, see *Chapter 5 - Additional Operations* for instructions on how to clear a message.
4.   Choose your options for the build in the **Print Job Options** section of the **Printer Status** dialog.
    *   **Delay Start Time** - Delays starting the build for a time period you specify.
5. Check the **Printer Status** window to see what is currently displayed on the printer LCD menu. The printer must be **Online** before you can start the print job.
6. When all of the items in the **Print Head**, **Feeder**, and **General** sections show **OK**, the **Print** button is enabled. Click **Print** to start the build. Before starting the build, the printer will:
    *   Service the print head
    *   Fill the Build Bed with Core and then spread one layer to make the top surface smooth
7. The **Printing** dialog opens and tracks the following information for the duration of the build:
    *   Estimated Finish Time
    *   Estimated Time Remaining
    *   Layer% Completion status bar
    *   Starting Time
    *   Elapsed Time
    *   Pause Button - Click to pause the build. Click again to resume the build
    *   Cancel Button - Click to cancel the build

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- Cross-section view (2D) of the current build
- Part orientation of the current build as it is printing, in the X-Z Axis (side view)

2.7 Dry The Part

When your part is finished printing, the printer runs a drying cycle. A timer on the LCD menu will count down the time remaining to dry the part. Drying the part gives it added strength, so you should not handle parts before they have adequately dried.

You can leave the part in the Build Bed after the drying cycle ends and it will continue to increase in strength. The longer a part is dried the stronger it becomes, although until it is infiltrated, it will still be fragile and should be handled with care.

2.8 Clean the Part

Once your part has dried, you will need to clean it to remove any remaining loose Core material. Cleaning is done in two stages: coarse cleaning, which removes the Core material around the part in the Build Bed; and fine cleaning, which removes any Core still clinging to the part itself.

8.

2.9 Coarse Cleaning

There are three ways to remove unused Core material from the Build Bed after the drying cycle is finished:

- Unused Core is automatically removed from the Build Bed when the **Empty Build Piston After Printing** option is checked in the **Printer Status** dialog.
- If you unchecked the **Empty Build Piston After Printing** option but would still like to utilize this feature, you may do so at the printer. Select `BUILD CHAMBER > EMPTY BUILD CHAMBER` on the LCD menu to start the Automatic Core Removal cycle.
- If you unchecked the **Empty Build Piston After Printing** option, you can manually excavate the part by vacuuming Core away using the vacuum hose. Check the part orientation in 3DPrint before you begin vacuuming.

Important: For delicate parts, or parts with especially delicate features, it is recommended that you build the part with a Fixture when using the **Automatic Core Removal** feature.

If a part is too delicate to handle the low-level vibration during the Automatic Core Removal cycle, uncheck the **Empty Build Piston After Printing** option and manually excavate the part using the vacuum hose.

2.9.1 Manual Coarse Cleaning

1. Before you begin vacuuming, check the part orientation in 3DPrint to avoid damage to your part.
2. Close the printer top cover.
3. On the LCD Display, select `VACUUM`.
4. Open the printer top cover. The vacuum starts. Use the Control Knob to move the Build Platform up as you vacuum. Unused Core that is vacuumed from the Build Bed is recycled back into the printer Feeder so it can be used for future builds.

   Important: For delicate parts, or parts with especially delicate features, it is recommended that you build the part with a Fixture. Refer to the ***3DPrint User Manual*** for details on adding a Fixture.

> **NOTE:** Unused Core that is emptied or vacuumed from the Build Bed is recycled back into the printer Feeder so it can be used for future builds.

2.10 Fine Cleaning

After the bulk of the Core is removed from the Build Bed, gently pick up the part and place it in the built-in Post-Processing Unit (660*Pro*) or in the Core Recycling Station (CRS) where you can clean the part of any remaining Core with the Air Wand.

2.10.1 Fine Cleaning Using the Post-Processing Unit (660*Pro* Only)

1. Open the printer top cover.
2. Ensure that the Fast Axis is pushed all the way back into its parked position.
3. Select **BUILD CHAMBER > RAISE PLATFORM** on the LCD menu. Hold the Control Knob down to raise the platform closer to the top of the Build Bed.
4. Gently lift the part and place it in the Post-Processing Unit.

2.10.2 Fine Cleaning Using the Core Recycling Station

Transfer the part(s) to the Core Recycling Station following the steps below and perform the necessary fine cleaning operations. Refer to the ***Core Recycling Station User Guide*** for complete details.

2.10.3 Moving Parts By Hand

1. Open the glass cover of the CRS.
2. Open the printer top cover and gently remove the part from the Build Bed.
3. For easier part removal, select **BUILD CHAMBER** then **RAISE PLATFORM** on the LCD menu. Hold down the Control Knob to raise the platform to the top of the Build Bed.
4. Move the part to the CRS. Close the Station cover.
5. Close the printer top cover.

2.10.4 Moving Parts Using the Part Cart

1. Open the glass cover of the Core Recycling Station.

2. Open the printer top cover. From the main menu on the LCD select **ACCESS BUILD PLATE**.
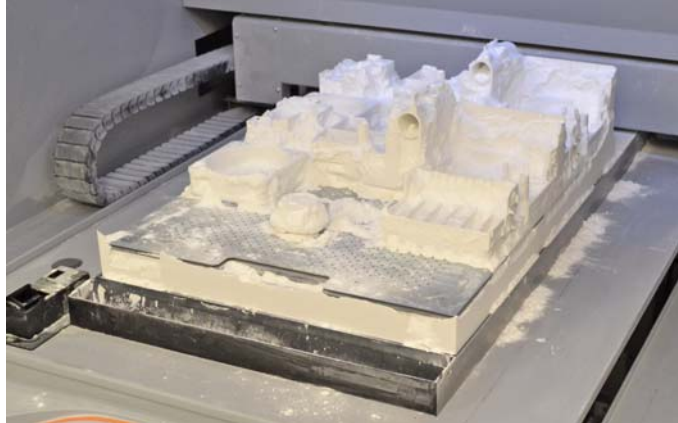
3. Raise the cart using the foot-operated jack so that the cart is level with the bottom of the build plate. Be careful the cart is not too low - it can damage the service station or the front of the printer.

4. Maneuver the part cart so that the front of the cart is adjacent to the build plate.

5. Using the handle, pull the build plate up and towards the cart until it slides onto the cart.

6. Move the cart to the Core Recycling Station. Adjust the height of the cart so it is level with the opening of the Station.

7. Slide the build plate carefully into the Core Recycling Station. Alternatively, for small parts, one can also carefully move the parts from the part cart into the Station by hand.

8. Close the Core Recycling Station glass cover.

9. Close the printer top cover.

2.10.5 Fine Cleaning in the CRS

The freshly-printed part will still have Core clinging to it, which must be removed before proceeding with the post-processing steps.

1. With your part in the Core Recycling Station and the top cover closed, turn the compressor and suction system on by turning the user switch to ON. It will take approximately 15 seconds for the suction system to fully turn on.

2. Choose either the Air Gun or the Air Wand to remove loose Core material. The Air Gun is ideal for pre-moving large amounts of Core. The Air Wand is ideal for clearing out tight spaces and bringing out details in a part.

3. Test the air flow against your hand and adjust as needed. Adjust the air pressure on the Air Gun with the trigger. Adjust the pressure on the Air Wand by turning the control nut located at the connection between the Air Wand and its air hose.

Important: For thin-walled or delicate parts, start with light air pressure.

4.   Using the Air Wand or Air Gun, remove all remaining Core on the part. The vacuum will collect the Core through the perforated floor of the Core Recycling Station and recycle it into the Core Tray underneath.

Important: When finished, use the Air Wand or Air Gun to clean the interior of the Core Recycling Station of any remaining Core.

5.   Turn the user switch to OFF. It will take approximately a minute for the filters to go through their cleaning cycle before the Station switches off fully.
6.   Allow the part to dry longer in the Core Recycling Station while you perform the Routine Cleaning described in Section 3. Then proceed with Post-Processing the part as described in Section 4.

2.11 Next Step: Cleaning the Printer

Right now - after cleaning the part and before post-processing - while the part continues to dry, take a few minutes and ***clean the printer***.

Regular cleaning and maintenance is the simplest, best way to ensure your parts look their best, and to keep your printer running trouble-free.

See ***Section 3, 'Routine Cleaning'*** for complete details on how to perform these routine cleaning tasks.

3   Routine Cleaning

This chapter describes the routine cleaning you should complete *after every build*. This will prepare the printer for the next build and keep the printer running smoothly and problem free. These tasks take only a few minutes to perform but make a huge difference in how well your printer runs.

3.1   Vacuum Excess Core

After every build, vacuum up all loose Core in the Build Chamber, including the Build Bed, Deck, and Fast Axis including the Rails and Carriage. To vacuum:

1.   Select **VACUUM** on the LCD panel.
2.   Open the printer top cover and remove the vacuum hose from its stand.
3.   Vacuum any excess Core in the Build Bed, around the Deck, and on top of the Fast Axis. Pull the Fast Axis forward and check for Core towards the back of the Build Chamber as well.

     •   You can leave Core in the Feeder (the area behind the Build Bed where Core is spread to the Build Bed), but the Core remaining in the Build Bed after a print job should be vacuumed.

4.   The vacuum will stop automatically after a couple of minutes, or you can push the Control Knob once to shut off the vacuum. When you are finished, return the hose to its holder.

3.2 Clean The Debris Separator

After vacuuming, clean the Debris Separator. The Debris Separator catches any large particles and keeps those pieces from being recycled into the feeder. To clean the Debris Separator follow the steps below.

Important: The Debris Separator must be cleaned <u>after every build</u>, in order to maintain the efficiency of the vacuum system.

1.   Pull the Debris Separator out of its holder on the printer.
2.   Empty the contents into a trash receptacle.
3.   Use the soft brush found in the Accessory Kit to brush any caked-on Core from the screen.
4.   Reach into the receptacle area with a stiff brush and remove any Core clinging to the screen.

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5. Return the empty Debris Separator to its holder. Be sure to push the Separator flat against the panel for a secure fit.

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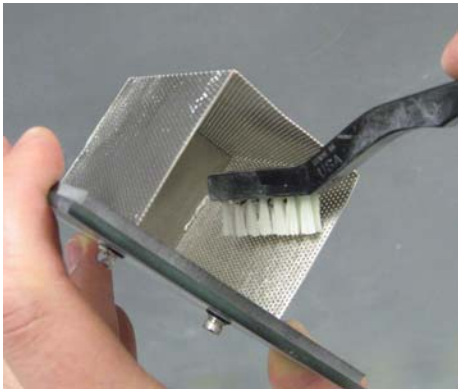
3.3 Clean The Parking Caps

The Parking Caps keep the print heads from drying out between print jobs. Cleaning the Parking Caps after every build results in longer lasting print heads and precise accuracy during printing.

The Parking Caps are located on the right end of the Fast Axis.

Before you begin:

- Get several dry paper towels.
- Get the squirt bottle included in your Accessories Kit.
- Fill the squirt bottle with distilled water.
- Wear disposable gloves.

1. Pull the Fast Axis toward you and slide the Printhead Carriage to the left to expose the Parking Caps.
2. Lay paper towels on the Build Bed under and around the Parking Caps.
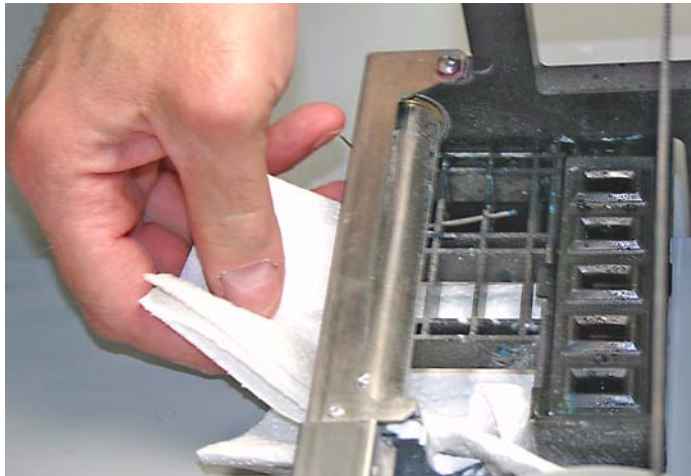
3. Cover the Front Overflow with paper towels.
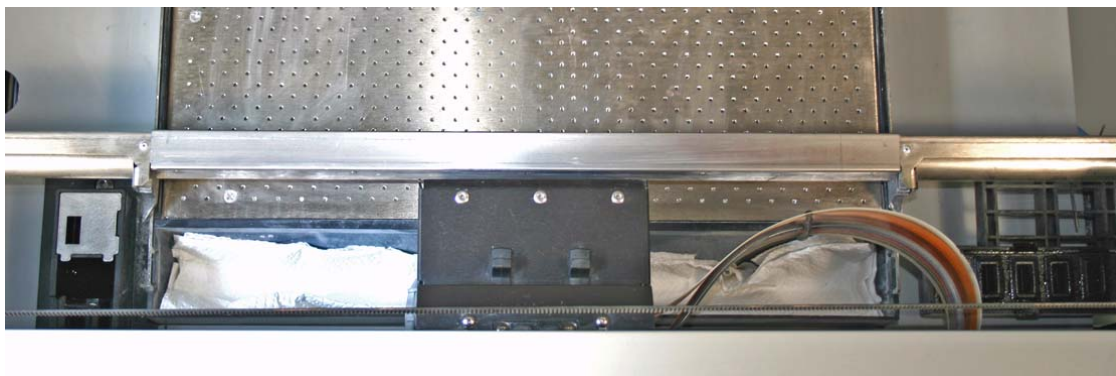
4. Squirt the distilled water onto the Caps. The water should drain out through the Spittoon under the Caps.

5. Use a dry paper towel to wipe the caps clean.

6. Remove the paper towels from the Build Bed and Deck. Wipe up any water on the Build Bed, Fast Axis or Deck.

7. Remove the paper towels from the front overflow and dry it thoroughly.

8. Vacuum the Build Bed and Deck remove any Core dislodged from the Rails or Carriage.

9. Be sure the Parking Caps are completely dry before starting your next build.

Note: If the Caps are very dirty, or if washing them as above is not sufficient, then remove the Caps from the printer and wash them under running water. Dry them thoroughly before reinstalling them in the Fast Axis.

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3.4 Clean The Fast Axis Rails and Carriage

Keeping the Fast Axis Rails and Carriage clean will keep the Carriage moving smoothly and thus optimize printing accuracy.

1.   Pull the Fast Axis toward you.

2.   Using a paper towel dampened with distilled water, wipe the top and bottom Rails to remove any Core. Move the Carriage back and forth as needed to clean the entire length of both rails.

3.   Dry the Rails thoroughly using a clean dry paper towel.
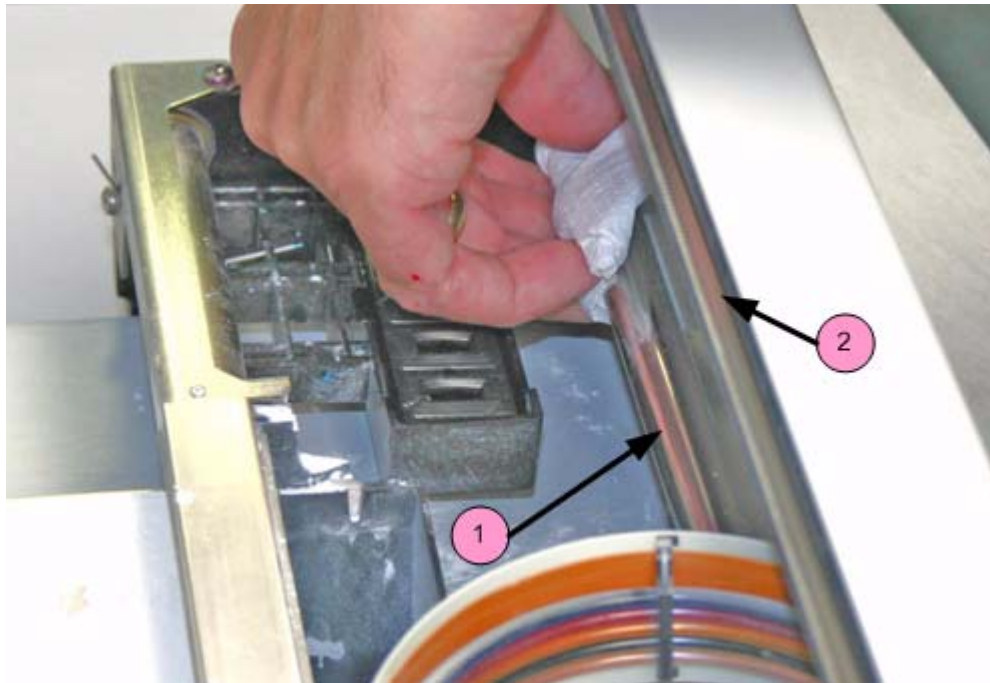
Number	Component
1	Bottom Rail
2	Top Rail

4.   Using a fresh paper towel, wipe the Carriage to remove any Core.

5.   Wipe or vacuum the Build Bed and Deck as needed to remove any Core dislodged from the Rails and Carriage.

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3.5 Clean The Service Station

The function of the Service Station is to clean the print heads during printing. Clean the Service Station after every build to remove residue buildup and to ensure the printer runs optimally for your next print job.

Before you begin:

- Get several dry paper towels and a cotton swab.
- Get the squirt bottle filled with distilled water.
- Wear disposable gloves.
- Get the Pick and Small Syringe from the Accessories Kit.

3.5.1 Example - Dirty Service Station
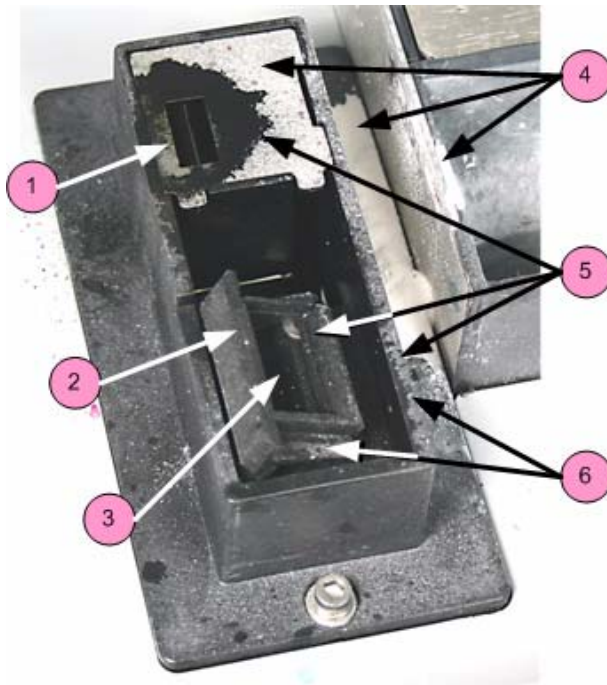
Number	Description
1	Spit Plate
2	Squeegee
3	Wash Holes
4	Core Residue
5	Ink, Binder Residue
6	Core Residue

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3.5.2 Example - Clean Service Station
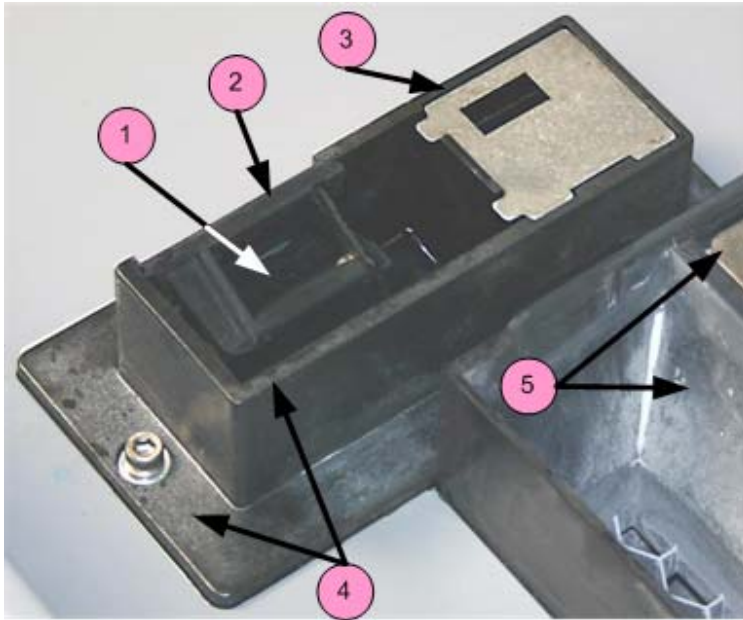
Number	Description
1	Wash Holes Clean and Open
2	Squeegee Clean and Dry
3	Spit Plate Clean
4	Housing Clean
5	Overflow and Build Bed Clean

3.5.3 Cleaning Procedure

1. Place paper towels around the Service Station, and between the Service Station and the Build Bed.
2. Cover the front overflow with paper towels.

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3. Position the squirt bottle close to the station and squirt water on and around the squeegee.

4. Use the cotton swabs or a paper towel and wipe the front and back of the squeegee. Use the Pick to scrape excess Core out of any corners.

5. Lift the spit plate up off the Service Station and clean it with a paper towel.

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6. Wipe off any water or cleaning solution on the Wash Holes. Thoroughly wipe the Service Station clean.

7. Install a needle onto the small syringe. Gently push the tip of the needle through each of the **six** Wash Holes to clear them.

8. Wipe up any water that may have spilled onto the Deck or Build Bed.

9. Replace the spit plate, using the edge tabs for correct alignment.

10. Close the printer top cover.

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4   Post-Processing

After your 3D model is dry and fine cleaned, it can be infiltrated. When high strength is not critical, Water Cure is a quick, easy way to finish parts. The best *concept* models are made using ColorBond™. Strength-Max™ Epoxy will confer superior strength for *functional* models.

4.1 Post-Processing Using Water Cure

Water cure with Epsom salt is the best way to finish concept models quickly and easily. No hazardous or restricted chemicals are involved: simply dissolve the Epsom salt into tap water and spray a fine mist over the surface of your parts to give them a smooth, hard surface and a bright white appearance.

The Water Cure with Epsom salt method applies to all parts printed using VisiJet PXL Core.

Water Cure with Epsom salt can be used on color parts but colors will remain slightly muted.

For complete details on water infiltration, see the ***VisiJet PXL User Guide***.

4.2 Post-Processing With ColorBond™

This section briefly describes post-processing a part using ColorBond Instant Infiltrant. The infiltrant soaks into the newly-printed part and bonds the printed Core together. This both strengthens the part and gives it more durability.

ColorBond is available in larger bottles for use in the **dipping** method. For parts with delicate features, smaller bottles of ColorBond are available for **drizzling** onto a part.

Safety Precautions

- Read and understand the *Material Safety Data Sheet* before using or handling this product.
- Wear a lab coat or smock, gloves, face shield, or goggles.
- Apply in a well-ventilated area.
- Specialized containers are recommended for applying ColorBond. Have a catch pan, waxed paper, or plastic drop cloth available for catching spills.
- Label disposal materials and dispose of according to the label instructions.
- Wear a dust mask when sanding finished parts.
- ColorBond reacts with water and ambient moisture. Once a bottle has been opened, it is recommended that the product be used within 30 days. Avoid all contact with water and avoid use under high humidity conditions. If ColorBond is exposed to excessive humidity, it will thicken up and become unusable for infiltration.
- Store ColorBond in a cool, dry area.

For complete details on post-processing your part using ColorBond, see the ***ColorBond User Guide***, available at *3dscentral.3dsystems.com*.

4.3 Post-Processing With StrengthMax™

This section briefly describes post-processing a part using StrengthMax Infiltrant. The infiltrant soaks into the newly-printed part and bonds the printed Core together. This both strengthens the part and gives it more durability.

Safety Precautions

- Read and understand the *Material Safety Data Sheet* before using or handling this product.

- Wear a lab coat or smock, gloves, face shield, or goggles.
- Apply in a well-ventilated area.
- Specialized containers are recommended for applying StrengthMax. Have a catch pan, waxed paper, or plastic drop cloth available for catching spills.
- Label disposal materials and dispose of according to the label instructions.
- Wear a dust mask when sanding finished parts.
- Store StrengthMax in a cool, dry area.

For complete details on post-processing your part using StrengthMax, see the **StrengthMax User Guide**, available at *3dscentral.3dsystems.com*.

5   Additional Operations

When you start a print job, 3DPrint checks the printer to ensure there are enough materials to complete the job and that the printer is properly prepared before starting the job. If the printer does not have enough Core, binder, or print head life to complete the job, a message appears in the **Printer Status** dialog telling you what you need to do to prepare the printer before printing.

Important: *Do not add Core or binder to the printer, or change a print head, unless you see a message telling you to in the **Printer Status** dialog.*

5.1 The Printer Status Dialog

The **Printer Status** dialog keeps you appraised of everything your ProJet x60*Pro* needs to start your print job. The two examples below show what appears when the printer is ready to print, and when it's not ready.

5.1.1   Ready to Print

In the example above, the **Printer Status** dialog shows the printer is ready for printing. Notice that each item shows **OK**, and the **Print** button is enabled. From here you would choose your printing options and click **Print** to start the job. Before the printer starts printing your file, it will first:

- fill the Build Bed with Core
- spread a layer to ensure the Build Bed surface is smooth
- service the print heads
- run an auto-alignment if a print head was replaced after the previous build

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5.1.2 Not Ready to Print

If there are not enough materials to complete the job, or the printer is not properly prepared, a message appears similar to the examples in red above. When any **one** of these messages appears, the **Print** button is disabled. The remainder of this chapter describes how to clear a message in the **Printer Status** dialog and start the build.

3DPrint allows you to continue and print if:

• The printer build temperature is still warming up.
• A Head Alignment will be performed. The Head Alignment runs before the part begins to print.

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5.2 Change Print Head(s)

If the **Printer Status** dialog indicates one or more print heads needs changing, follow the steps below.

1. On the Control Panel select **BUILD CHAMBER**, then **LOWER PLATFORM**. Continue holding in the Control Knob until the build bed is about 6" below the top.

2. On the printer's LCD menu, select **PRINT HEADS** then **CHANGE PRINT HEADS**. The fast axis moves to the service position.

3. Wet a paper towel with distilled water and wipe off the Alignment Sensor Window on the underside of the Carriage. The Alignment Window is located on the front left corner of the Carriage, under the bundle of print head tubes.

    Note: Don't wipe the bottoms of the print heads.

4. Dry with a clean paper towel.
5. Open the carriage cover by releasing the two latches.

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6. Lift the print heads to be replaced out of their slots and properly recycle or dispose of any empty cartridge(s).
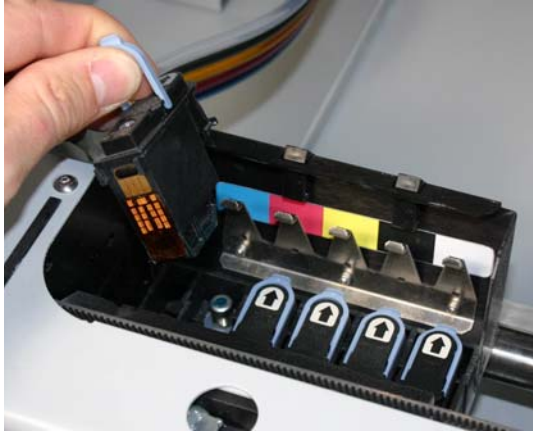
7. Get an alcohol swab (included with your Startup Kit). Snap it to break the glass inside, and squeeze the tube to saturate the swab

.

8. For each printhead being replaced, wipe off all the pogo pins (inside the carriage) with the alcohol swab. Use additional swabs if needed.
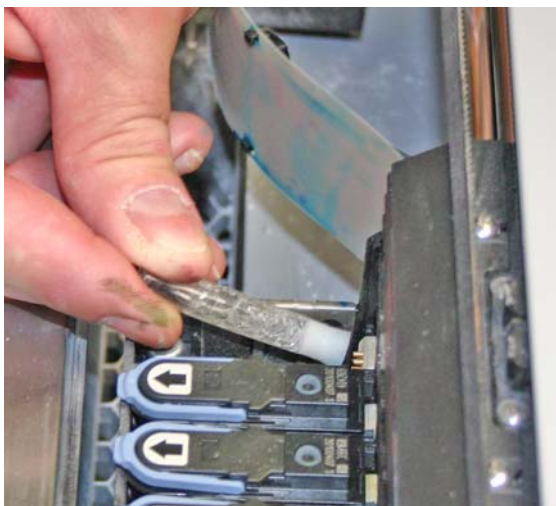
9. Remove the new printhead from its packaging. *Be sure to pull the tape tab off of the new printhead.*

10. Insert each new printhead. Press down firmly on the top of the printhead, at the same side as the pogo pins, to securely fit a printhead into its slot.

11. Close the carriage cover by pressing down until you hear it click shut. Be sure both latches are engaged.

12. Close the printer top cover. Select **CONTINUE** then **EXIT** on the LCD.

13. The fast axis reparks and the printer goes Online. The printer purges the new printheads and runs an auto-alignment pattern before the next print job to properly align the print heads.

5.3 Add Binder

If there is not enough binder in one or more of the cartridges, 3DPrint displays BINDER LOW in the **Printer Status** dialog.

>   **Important:** Do not add binder unless you are prompted to in the 3DPrint **Printer Status** dialog.

To add binder, follow the steps below.

1.   Pull the empty binder cartridge out of its housing on the printer.

2.   Get a new binder cartridge. Check the expiration date, and check the cartridge label for the correct color and orientation. Match the cartridge color to the color label on the printer.

3.   Insert the cartridge into its housing with the color marking on top. Ensure the cartridge is pushed all the way in. You should feel it gently snap into place.

>   **Important:** If a cartridge does not snap into place, *do not force it*. Check the orientation and that it is the correct color and try again.

5.4 Adding Core to the Feeder

3DPrint evaluates the geometry of the part to determine if there is enough Core material in the Feeder to complete the build. If there is not enough, 3DPrint displays ADD CORE in the **Printer Status** dialog.

>   **Important:** Do not add Core to the Feeder unless you are prompted to in the 3DPrint **Printer Status** dialog.

To add Core, follow the steps below.

1.   **Before** adding any Core, be sure you have

   •   Vacuumed all Core out of the Build Bed, and from the Deck, Fast Axis, etc.

   •   Finished cleaning any parts in the Post Processing Unit.

   •   Vacuumed up any other Core needing cleanup.

2.   Check the expiration date on the container.

3.   Open the printer top cover and place the container inside.

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4. Select **VACUUM** on the LCD menu. The vacuum starts. Direct the nozzle inside the container so it pulls up a continuous stream of Core material.

TIP: To check that Core is getting into the Feeder, look at the Debris Separator. You should see material moving through the window when the vacuum is running.

The vacuum automatically shuts off when the Feeder becomes full. See below.

NOTE - When the feeder is full, it has enough material to complete a build that uses the entire vertical capacity of the Build Bed. Adding further material provides no benefit, and risks overfilling the feeder. Do not continue running the vacuum after the Feeder is Full message appears. If you continue to vacuum material into the feeder, the LCD will display FEEDER LIMIT and the vacuum will be disabled.

```
THE FEEDER IS FULL

AUTO SHUTOFF IN 10 SEC


KEEP VACUUM ON
```

5. Remove the container and return the vacuum hose to its stand.

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5.5 Add Cleaning Solution

If there is not enough cleaning solution, 3DPrint displays ADD CLEANING SOLUTION in the **Printer Status** dialog.

> **Important:** Do not add cleaning solution unless you are prompted to in the 3DPrint **Printer Status** dialog.

To add cleaning solution, follow the steps below.

1. Open the lower door (under the Build Chamber).

2. Pull the empty cleaning solution cartridge out of its housing on the printer.

3. Get a new cleaning solution cartridge. Check the expiration date, and check the cartridge label for the correct orientation.

4. Insert the cartridge into its housing. Ensure the cartridge is pushed all the way in. You should feel it gently snap into place.

> **Important:** If a cartridge does not snap into place, *do not force it*. Check the orientation and that it is the correct type and try again.

5.6 Replace the Waste Tray

If the Waste Tray is Full, 3DPrint displays EMPTY WASTE TRAY in the **Printer Status** dialog.

To replace the Waste Tray, follow the steps below.

1. Open the lower door (under the Build Chamber).

2. Pull the full Waste Tray out of its compartment on the printer.

3. Insert a new Waste Tray into its compartment. Ensure the Tray is pushed all the way in.

5.7 Position Build Piston (Build Bed)

The Build Bed platform must be in its proper position at the top of the Build Bed in order for the printer to fill the bed and spread a layer of Core before starting a print job. If you see the message RAISE BUILD in the **Printer Status** dialog, go to the printer and select `PREP BUILD CHAMBER` to raise the platform to its proper position.

If you have taken out the Removable Build Plate, use the `ACCESS BUILD PLATE` menu item to raise up the platform so you can put the Build Plate back into position.

5.8 Cover

The printer cannot start a print job when the top cover is open. If the top cover is open, go to the printer and close it. Do not open the cover while the machine is printing.

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6   Printer Maintenance

This chapter details how to perform maintenance on your printer and how to prepare your printer for storage if you will not be running it for extended periods. Most of these procedures are only performed when you are prompted to in the 3DPrint **Maintenance** dialog. Others should be performed at the recommended frequency detailed in each procedure below.

The **Maintenance** dialog (found on the 3DPrint **Service** menu) keeps a record of when the Fast Axis bearing, the Slow Axis bearing, and the Piston Screw require lubrication. 3DPrint will prompt you when lubrication of any of these components is required. *Only lubricate these components when you are prompted to in 3D Print.*
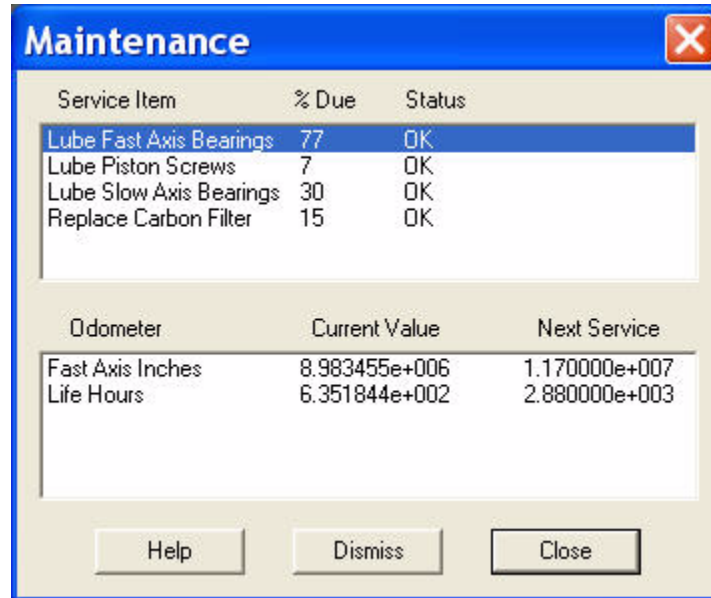

While lubrication of these items is important, it is equally important not to over-grease the bearings and piston screw when lubricating. Only a very small amount of grease or oil is required to keep these parts working optimally. Over-lubricating creates a situation where lubricant builds up in places where it should not be, and may cause the printer to report an error.

6.1 Fast Axis Bearing Lubrication

Frequency: *When prompted in 3D Print, or when you receive Error 2303-1.*

1. Open the printer top cover and pull the fast axis forward until it stops.

2. Lay clean paper towels under the left end of the Fast Axis.

3. Cover the Front Overflow with paper towels.

4. Using a paper towel dampened with distilled water, wipe the top and bottom Rails to remove any Core. Move the Carriage back and forth as needed to clean the entire length of both rails.

5. Dry both Rails thoroughly with a clean dry paper towel.

6. Using a fresh paper towel, wipe the Carriage to remove any Core.

7. Locate the Fast Axis oiling hole, located in the top of the Fast Axis near the left end.

8. Make sure there is no Core visible inside the hole or on top of the Fast Axis.

9. Lift up the hinged cap that covers the oiling hole.

10. Using the oil supplied in your Accessories Kit, place 5 drops of oil into the small reservoir. Do not overfill. Close the cap.

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11. Slide the Carriage back and forth to distribute the oil evenly over the Rails.

12. Reset the Maintenance Counter in 3D Print.
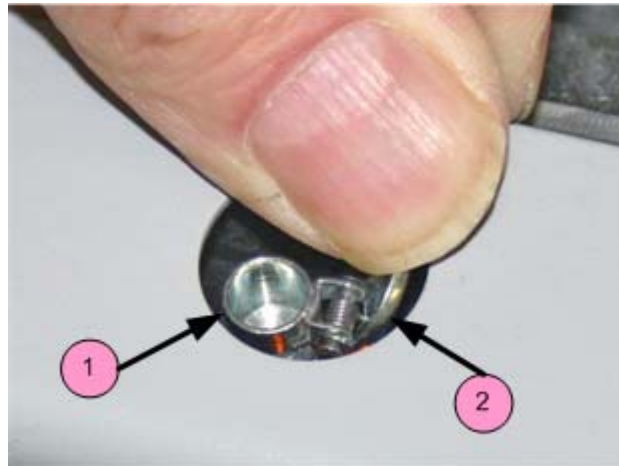
Number	Component
1	Oil Reservoir
2	Oil Reservoir Cap

6.2 Piston Screw Lubrication - ProJet 660*Pro*

1. Remove the back cover panel of the printer.

2. Remove the right side panel.

3. On the LCD display, select **BUILD CHAMBER > LOWER PLATFORM.** Hold the Control Knob down and lower the Build Bed platform as far as you can to expose the entire length of the piston screw.

4. Assemble the grease gun that is part of your Accessories Kit according to the instructions found in the document *09576 Grease Gun Loading Instructions*, which is supplied in the materials that were shipped with the printer. You can also find these instructions on our Web site at: *3dscentral.3dsystems.com*.

5. Look into the left end of the printer, in between the Waste Tray and the pocket for the Cleaning Solution Cartridge and locate the piston screw.
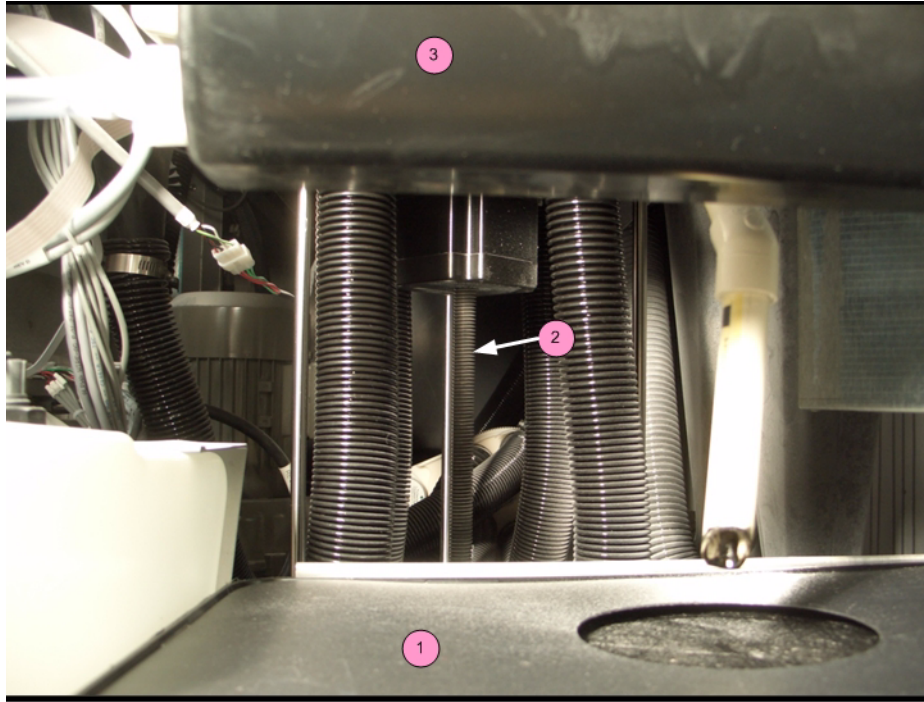
Number	Component
1	Waste Tray
2	Piston Screw
3	Pocket for Cleaning Solution Cartridge

6. Reach into the left end of the printer and wipe the Piston Screw clean of old grease, dust, etc.

7. Touch the grease gun to the Piston Screw and squeeze the trigger **twice** at the **top** of the Piston Screw (under the Build Bed), and then squeeze the trigger **once** at the **middle** of the Piston Screw.

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8. Spread the grease up and down the Piston Screw to evenly distribute it over the entire length of the screw.

9. Move the Build Bed up and down through its full range of travel a couple of times to finish lubricating the screw. Use the LCD menu items **`BUILD CHAMBER > RAISE PLATFORM`** and **`BUILD CHAMBER > LOWER PLATFORM`**. Don't forget to hold down the Control Knob to raise or lower the platform.

10. Wipe off any grease that may collect at the bottom of the screw with a paper towel.

Replace the side and back cover panels.

6.3 Piston Screw Lubrication - ProJet 860*Pro*

Frequency: *When prompted to in 3D Print.*

1. Remove the back cover panel of the printer.

2. Remove the right side panel.

3. On the LCD display, select **`BUILD CHAMBER > LOWER PLATFORM.`** Hold the Control Knob down and lower the Build Bed platform as far as you can to expose the entire length of the piston screw.

4. Assemble the grease gun that is part of your Accessories Kit according to the instructions found in the document *09576 Grease Gun Loading Instructions*, which is supplied in the materials that were shipped with the printer. You can also find these instructions on our Web site at: *3dscentral.3dsystems.com*.

5. Look into the right side of the printer, next to the Waste Tray and in front of the blower motor and locate the 3 piston screws.
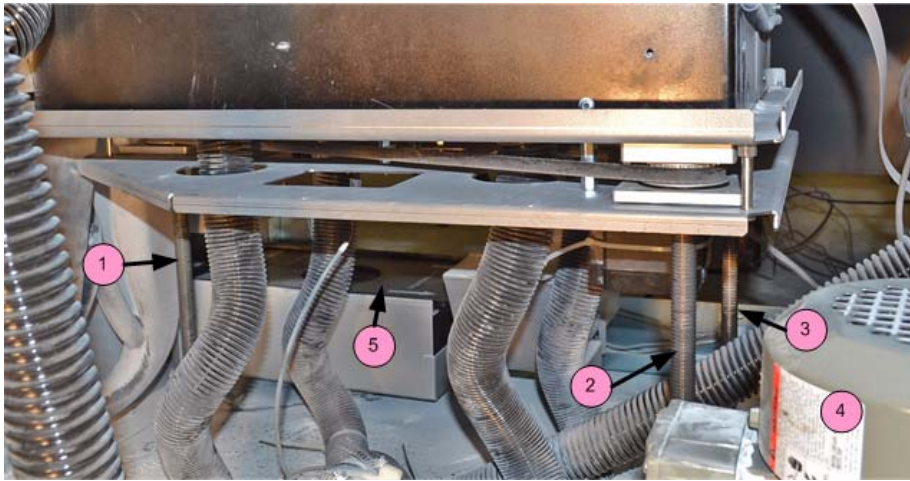
Number	Component
1	Front Piston Screw
2	Right Rear Piston Screw
3	Left Rear Piston Screw
4	Blower Motor
5	Waste Tray

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6. Reach into the right end of the printer and wipe the 3 Piston Screws clean of old grease, dust, etc. If reaching the left rear screw is too difficult, also remove the left side panel and reach in from there as shown below.

Number	Component
1	Electronics Box (E-Box)
2	Left Rear Piston Screw
3	Drive Pully
4	Drive Belt

7. Touch the grease gun to the Piston Screw and squeeze the trigger **twice** at the **top** of the Piston Screw (under the Build Bed), and then squeeze the trigger **once** at the **middle** of the Piston Screw.

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8. Spread the grease up and down the Piston Screw to evenly distribute it over the entire length of the screw.

9. Move the Build Bed up and down through its full range of travel a couple of times to finish lubricating the screw. Use the LCD menu items **BUILD CHAMBER > RAISE PLATFORM** and **BUILD CHAMBER > LOWER PLATFORM**. Don't forget to hold down the Control Knob to raise or lower the platform.

10. Wipe off any grease that may collect at the bottom of the screw with a paper towel.

11. Replace the side and back cover panels.

12. Reset the Maintenance Counter in 3D Print.

6.4 Slow Axis Bearing Lubrication

Frequency: When prompted in 3D Print, or when you receive an Error 2303-0.

1. Locate the round plastic cover on the Deck to the left of the Build Bed and close to the Service Station.

2. Take a flat head screwdriver or a Pick Tool and pop the round cover off to expose the grease fitting. Be careful not to scratch the deck surface. An alternative method is to reach your fingers under the left side of the deck and pop the cover off from underneath.

3. Pull the Fast Axis forward until you see the Slow Axis bearing in the center of the opening on the Fast Axis.

4. Assemble the grease gun that is part of your Accessories Kit according to the instructions.

5. Squeeze the handle until grease dispenses from the tip. Wipe clean with a clean paper towel.

6. Place the tip of the grease gun over the grease fitting. Push down to snap the gun into place on the fitting.

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7.   Squeeze the trigger 2 - 3 times or until you feel the tension change and then **STOP**. *Do not over-grease.*

8.   Unsnap the grease gun from the fitting. Replace the plastic cover.

9.   Slide the fast axis forward and backward several times to spread the grease on the slow axis surfaces.

10. Reset the Maintenance Counter in 3D Print.

6.5 Clean The Alignment Sensor Window

Frequency: *Clean the Alignment Sensor Window every time you change a print head, or remove a print head to clean the contacts and pogo pins.*

1.   On the Control Panel select **BUILD CHAMBER**, then **LOWER PLATFORM**. Continue holding in the Control Knob until the build bed is about 6" below the top.

2.   Pull the Fast Axis toward you and move it out over the build bed.

3.   Wet a paper towel with distilled water and wipe off the alignment sensor window on the underside of the Carriage. The alignment window is located on the front left corner of the Carriage, under the bundle of print head tubes.

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**Note:** Do not wipe the bottoms of the print heads.

4. Dry thoroughly with a clean paper towel.

6.6 Clean The Fast Axis Pulleys

Frequency: *On a regular schedule, depending on your usage. Or, whenever the printer has problems or errors related to the Fast Axis motion.*

1. Slide the fast axis out toward you.

2. Using the pick from the Accessories Kit, reach into the keyhole slot at the end of the fast axis and carefully remove any debris or Core from the teeth of the pulley. Slide the printhead carriage back and forth to rotate the pulley and expose all the teeth.

3. Repeat this for the pulley at the other end.

4. Vacuum or sweep up any debris that fell on the deck or build bed.
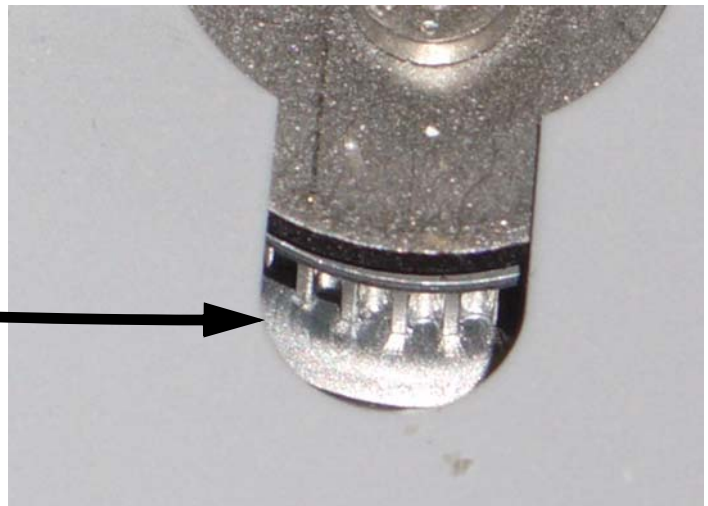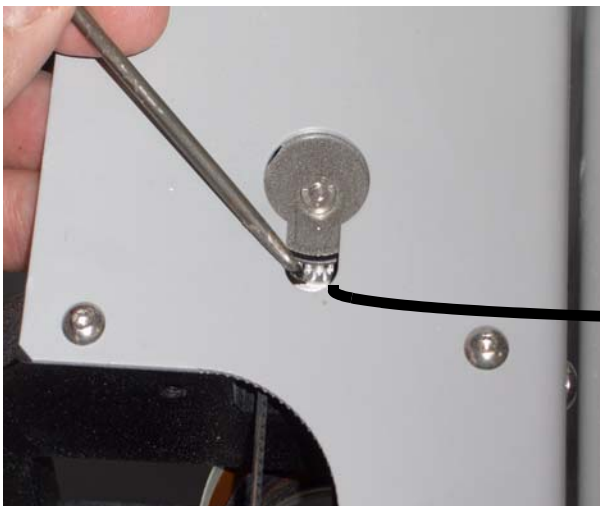
6.7 Clean The Slow Axis Rails and Pulleys

Frequency: *On a regular schedule, depending on your usage. Or, whenever the printer has problems or errors related to the Slow Axis motion.*
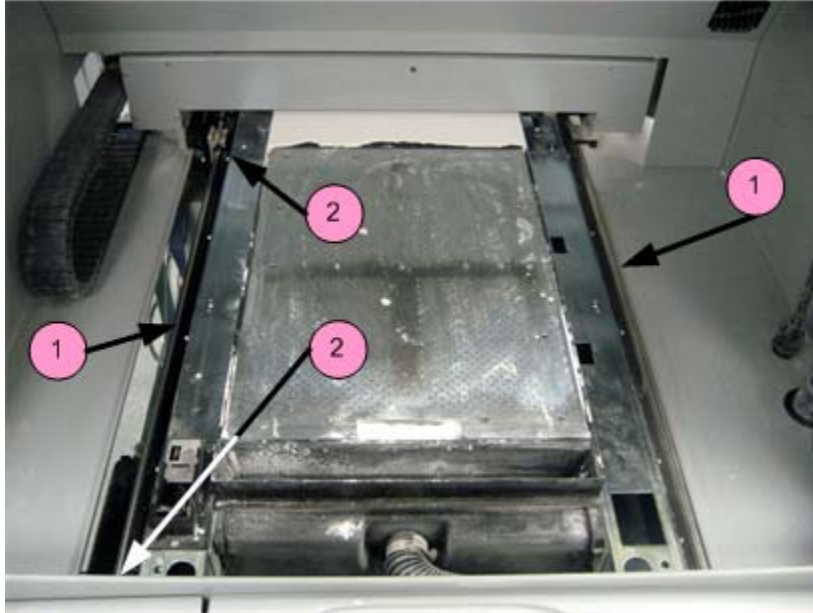
1. Unsnap the top deck from the chassis by pulling up at the front edge.

2. Lift up the front edge of the deck and slide the deck out toward you. Remove the deck from the printer.

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3. On the LCD select **VACUUM** to turn the vacuum on. Thoroughly vacuum the area around the slow axis rails.

Number	Component
1	Slow Axis Rails
2	Ends of Rail

4. Using a paper towel dampened with distilled water clean the slow axis rails on both sides. Carefully clean any debris from the ends of the left rail (see also next step). Dry both rails thoroughly with a clean dry paper towel.

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5. Using the pick from the Accessories Kit, reach below the slow axis rail and carefully remove any debris or Core from the teeth of the pulley. Slide the fast axis assembly forward and back to rotate the pulley and expose all the teeth. Also clean any buildup or debris from the end of the rail.
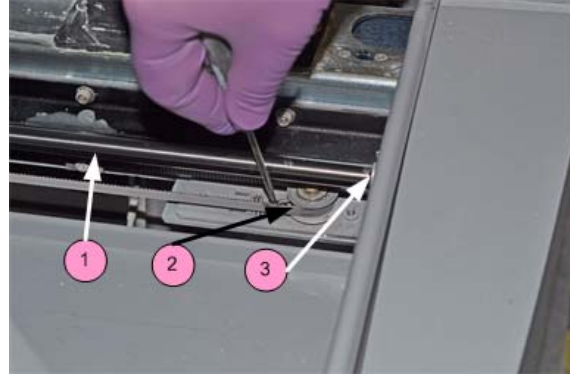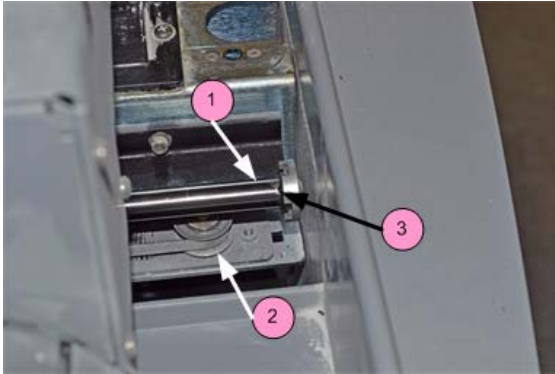
Number	Component
1	Slow Axis Rail
2	Pulley
3	End of Rail

6. Repeat this for the pulley at the other end.
7. Vacuum or sweep up any debris that fell.
8. Slide the deck back into position.

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9. Line up the cutout in the deck with the Service Station.


10. Press down on the front, middle and rear of the deck to snap all 6 retainers back into position.

6.8 Clean The Spreader Roller

Frequency: *On a regular schedule, depending on your usage. Or, whenever the printer has problems related to the surface finish of horizontal surfaces.*

1. On the LCD, select **BUILD CHAMBER** then **LOWER PLATFORM**. Lower the build bed by 4-5 inches.

2. Move the Fast Axis out over the build bed.

3. In 3DPrint select **Service** then **Toggle Roller On/Off** to turn the Spreader Roller on.

4. Using a paper towel dampened with distilled water, clean the Spreader Roller thoroughly by reaching up from underneath.
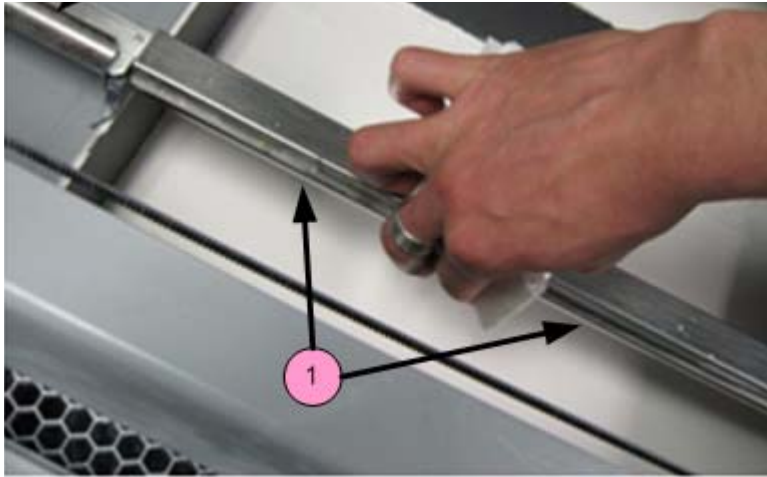
Number	Component
1	Spreader Roller

5. Dry the roller thoroughly with a clean dry paper towel.

6. In 3DPrint select **Service** then **Toggle Roller On/Off** to turn the Spreader Roller off.

7. Make sure the roller is completely dry before attempting to spread any Core.

6.9 Printer Storage Preparation

The ProJet x60*Pro* should never be turned off so it can automatically service the print heads and exercise the moving components during idle times.

If the printer will be unused for an extended period (several weeks or even months), some extra care is required to be sure your printer is ready to go when it is reactivated. Contact your dealer and request a copy of the Summer Storage Procedure. You can also download it from our Web site at *3dscentral.3dsystems.com*.

7   Troubleshooting the ProJet x60*Pro*

If you should encounter any problems with your ProJet x60*Pro*, the steps below will help you troubleshoot the problem and, in most cases, correct it yourself. If you need to call service, we've provided a list of the information to have ready for your Service Provider.

Start Here

Start with *Section 7.1, 'Try This First'*. In many cases this will solve the problem.

Troubleshoot

If the problem persists, use these troubleshooting flowcharts and tables to isolate the problem.

Power Up Problems

- *Section 7.2, 'Problems Powering Up'*

Motion Errors

- *Section 7.3, 'Print Head Errors/ Weak Parts'*
- *Section 7.4, 'Alignment Errors'*
- *Section 7.5, 'Motion Errors - Fast Axis'*
- *Section 7.6, 'Motion Errors - Slow Axis'*

Network Errors

- *Section 7.7, 'Network Errors - Cannot Connect to Printer'*
- *Section 7.8, 'Network Errors - Packet Timeout'*

Part Quality Problems

- *Section 7.9, 'Part Quality Issues - General'*
- *Section 7.10, 'Part Quality Issues - Streaky or Striped Parts, Delamination'*
- *Section 7.11, 'Part Quality Issues - Bad Surface Finish'*

Other problems

- *Section 7.12, 'Miscellaneous Problems'*

Additional information

- *Section 7.13, 'Error Codes and Messages - Background Details'*
- *Section 7.14, 'Additional Information'*

Call for Service

If you do need to call service, use the checklist provided here to gather the information your Service Provider will need.

- *Section 7.15, 'Calling for Service'*

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7.1 Try This First

Before calling for service, follow these steps:

1. **Clean the machine thoroughly!**
   This includes all parts of the deck, service station, axis rails, pulley teeth, and pogo pins. Remove any debris build up at the ends of travel, on the axis rail and even on the axis rail supports.

   * *Section 3.1, 'Vacuum Excess Core'*
   * *Section 3.2, 'Clean The Debris Separator'*
   * *Section 3.3, 'Clean The Parking Caps'*
   * *Section 3.4, 'Clean The Fast Axis Rails and Carriage'*
   * *Section 3.5, 'Clean The Service Station'*
   * *Section 6.5, 'Clean The Alignment Sensor Window'*
   * *Section 6.6, 'Clean The Fast Axis Pulleys'*

   Finally, you should remove all 5 printheads and clean the pogo pins. If the printhead is old, dirty, or has reported an error through 3D Print, replace the printhead with a new one.

   * *Section 5.2, 'Change Print Head(s)'*

2. **Perform any needed maintenance.**
   Check the Printer Status Dialog window in 3DPrint for any maintenance that is due.

   * *Section 5.1, 'The Printer Status Dialog'*

3. **Inspect the printer.**
   Perform a quick inspection of the machine. During the inspection you should be looking for any signs of leaks, loose screws or loose nuts. Loose screws or nuts should be tightened and leaks should be reported to your local Service Provider immediately.
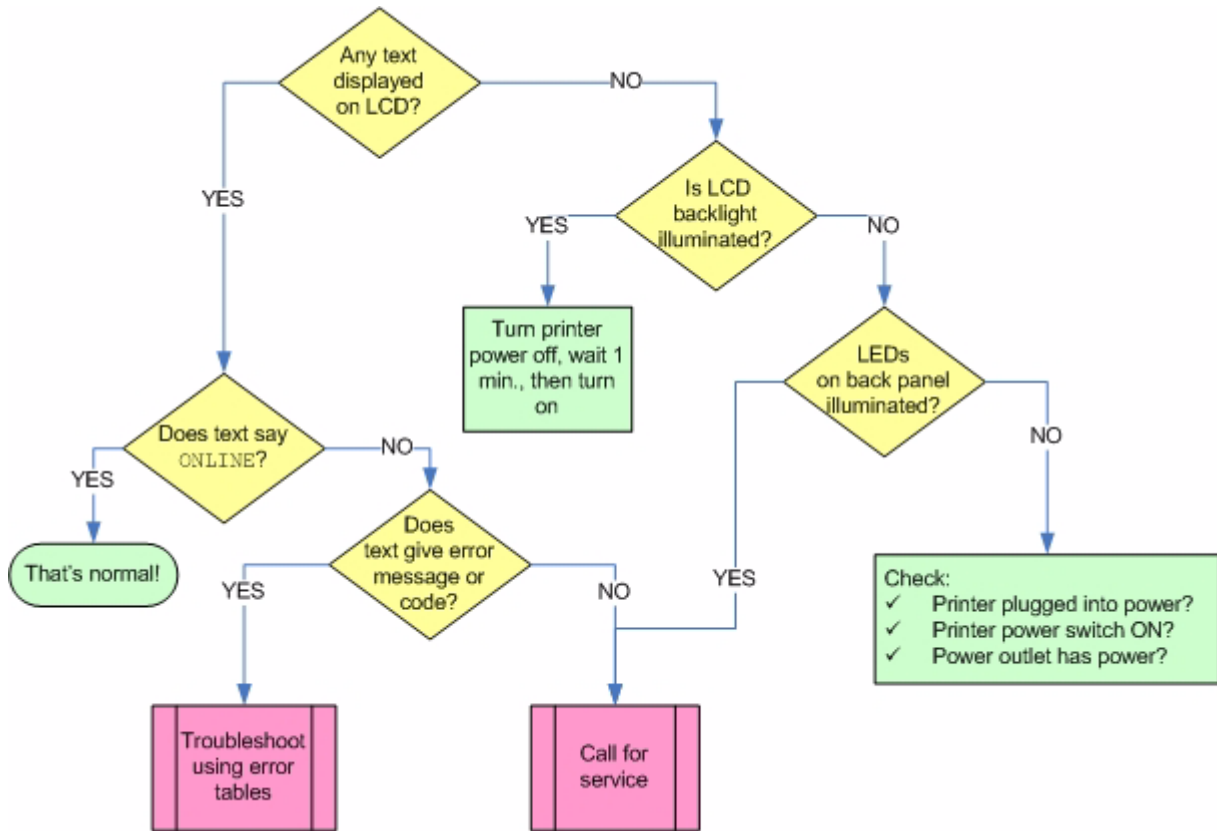
4. **Check for motion problems**
   Turn the machine off and move the carriage and fast axis to the middle of the build bed, then re-boot the machine. Watch for any obstructions or jumpy movements. If the movements are jumpy in any axis, clean the rail as described in step 1 above and lubricate that axis.

   * *Section 6.1, 'Fast Axis Bearing Lubrication'*
   * *Section 6.4, 'Slow Axis Bearing Lubrication'*

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7.2 Problems Powering Up

If your printer does not power up normally, use the flowchart below.

```
                              ┌─────────────┐
                              │  Any text   │
                              │  displayed  │────── NO ──────┐
                              │  on LCD?    │                │
                              └─────────────┘                ▼
                                     │                ┌─────────────┐
      YES                            │                │  Is LCD     │
                                     │        YES ────│ backlight   │── NO ──┐
                                     │                │ illuminated?│        │
                                     │                └─────────────┘        ▼
                                     ▼           ▼                   ┌─────────────┐
                              ┌─────────────┐  ┌──────────────┐      │   LEDs      │
                              │ Does text   │  │ Turn printer │      │ on back panel│── NO ──┐
          YES ────────────────│ say         │  │ power off,   │      │ illuminated?│        │
                              │ ONLINE?     │── NO ──┐ wait 1  │      └─────────────┘        │
                              └─────────────┘  │ min., then   │            │                 │
                                     │         │ turn on      │           YES                NO
                                     ▼         └──────────────┘            │                 │
                              ┌──────────────┐    │                        │                 ▼
                              │ That's normal!│   ▼                        │          ┌──────────────────────┐
                              └──────────────┘ ┌─────────────┐             │          │ Check:               │
                                               │   Does      │             │          │ ✓ Printer plugged    │
                                          YES  │ text give   │  NO         │          │   into power?        │
                                               │ error       │             │          │ ✓ Printer power      │
                                               │ message or  │             │          │   switch ON?         │
                                               │ code?       │             │          │ ✓ Power outlet has   │
                                               └─────────────┘             │          │   power?             │
                                                │            │             │          └──────────────────────┘
                                                ▼            ▼─────────────┘
                                        ┌───────────┐  ┌───────────┐
                                        │Troubleshoot│ │ Call for  │
                                        │ using error│ │ service   │
                                        │ tables     │ └───────────┘
                                        └───────────┘
```

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7.3 Print Head Errors/ Weak Parts

There are a number of Error Codes the printer may report that all relate to the print heads, and that all share a common set of solutions. The same solutions also apply to parts that are weak and break too easily.

 Error Codes covered in this section:

*   Error 1000 Unknown head error
*   Error 1001 Head Power Fail
*   Error 1003 x Head Error
*   Error 1004 x Head Error
*   Error 1005 x Head Error
*   Error 1006 x Head Too Hot
*   Error 1007 x Head Error
*   Error 1009 x Head Error
*   Error 1010 x Head Error
*   Error 40800 x Head Error
*   Error 40801 Headcard Power Fail
*   Error 40802 x Use Only HP11
*   Error 60700 Head X temperature calibration failed
*   Error 60701 Head X invalid serial number
*   Error 60702 Head X temperature too high
*   Error 10040 Pogo Comm Error

For more detailed information on what these errors mean, see *Section 7.13, 'Error Codes and Messages - Background Details'*.

7.3.1 Try This First

Most often, these errors (and weak parts) are caused by accumulation of Core, binder, and debris on the print heads. Dirty print heads, in turn, are very often caused by a service station that is dirty and not cleaning the heads properly.

The first solution to try is to clean the service station thoroughly. See *Section 3.5, 'Clean The Service Station'*.

If this fails to solve the problem, use the troubleshooting flowchart below.

How to do it

To remove the printheads and clean the pogo pins, follow the steps in *Section 5.2, 'Change Print Head(s)'*.

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Head	80% Life
0 Clear	800 mL
1 Black	400 mL
2 Yellow	400 mL
3 Magenta	400 mL
4 Cyan	400 mL

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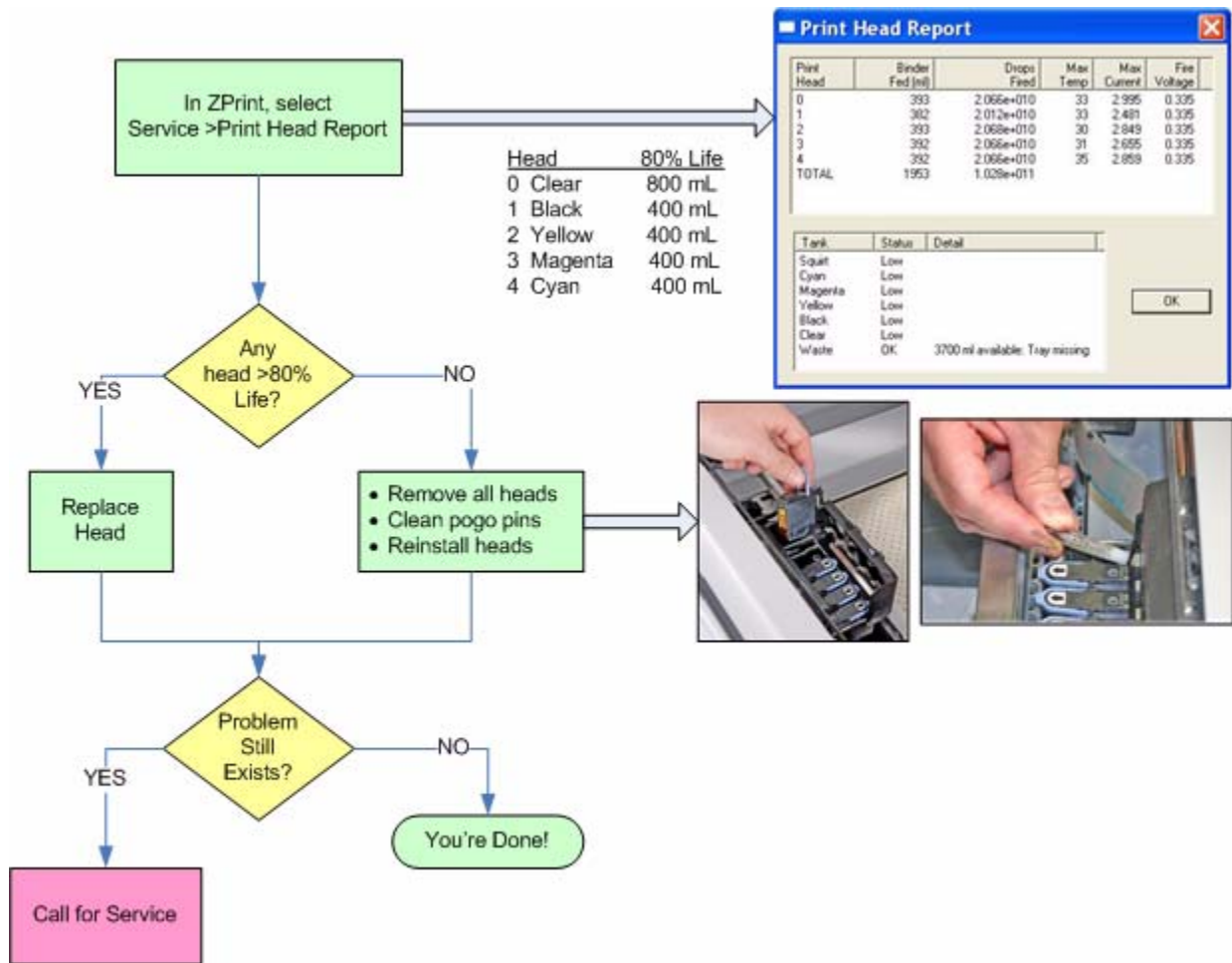
7.4 Alignment Errors

If you have run an alignment pattern and the printer reports that the alignment has failed, follow the troubleshooting flowchart below.

How to do it

If it passes alignment but the print quality is not OK, see *Section 7.3, 'Print Head Errors/ Weak Parts'*.
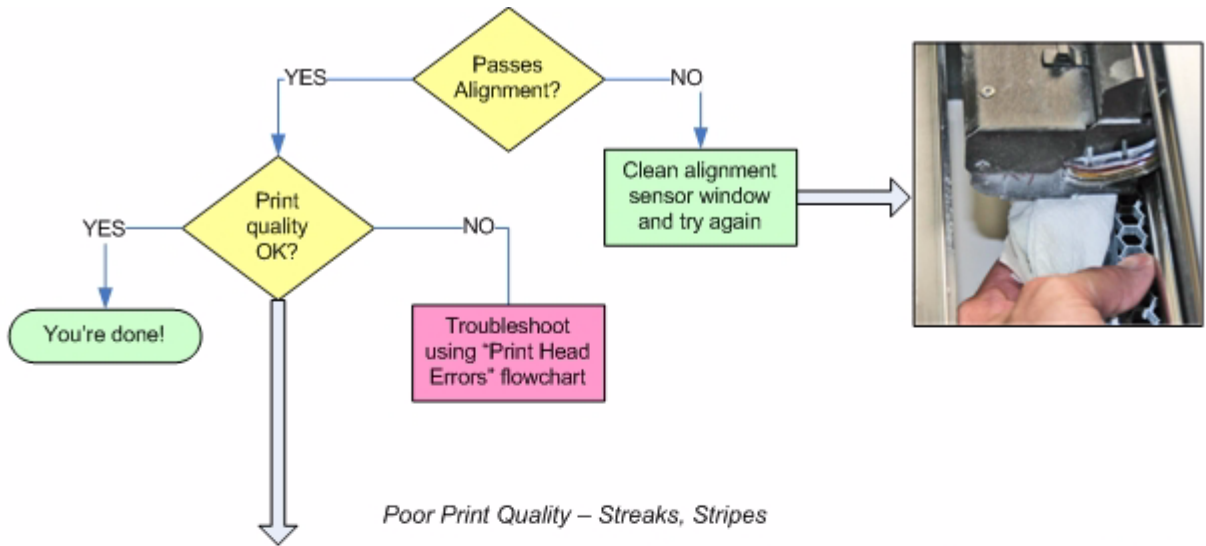
Poor Print Quality – Streaks, Stripes

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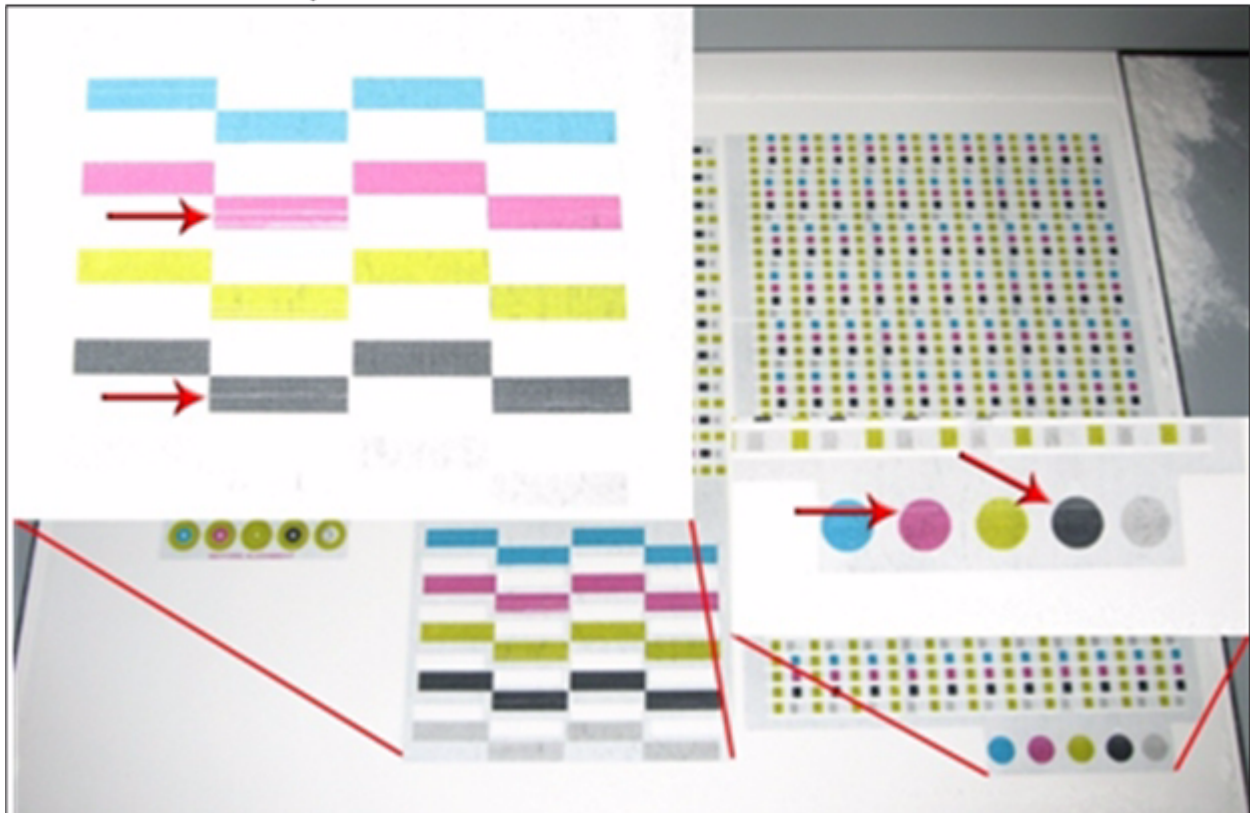
7.5 Motion Errors - Fast Axis

There are a number of Error Codes the printer may report that all relate to the **Fast Axis**, and that all share a common set of solutions.

Error Codes covered in this section:

- Error 2301:1 Motors Not Rezeroed
- Error 2303:1x Axis Pos Error
- Error 2305:1x Axis Settle
- Error 2400:1x Axis Seek Error
- Error 3011 System Error
- Error 3013 Sequencer Timeout
- Error 43000 Sequencer Timeout

For more detailed information on what these errors mean, see *Section 7.13, 'Error Codes and Messages - Background Details'*.

How to do it

To perform the cleaning and lubrication called for in the flowchart, see:

- *Section 3.4, 'Clean The Fast Axis Rails and Carriage'*
- *Section 6.6, 'Clean The Fast Axis Pulleys'*
- *Section 6.1, 'Fast Axis Bearing Lubrication'*

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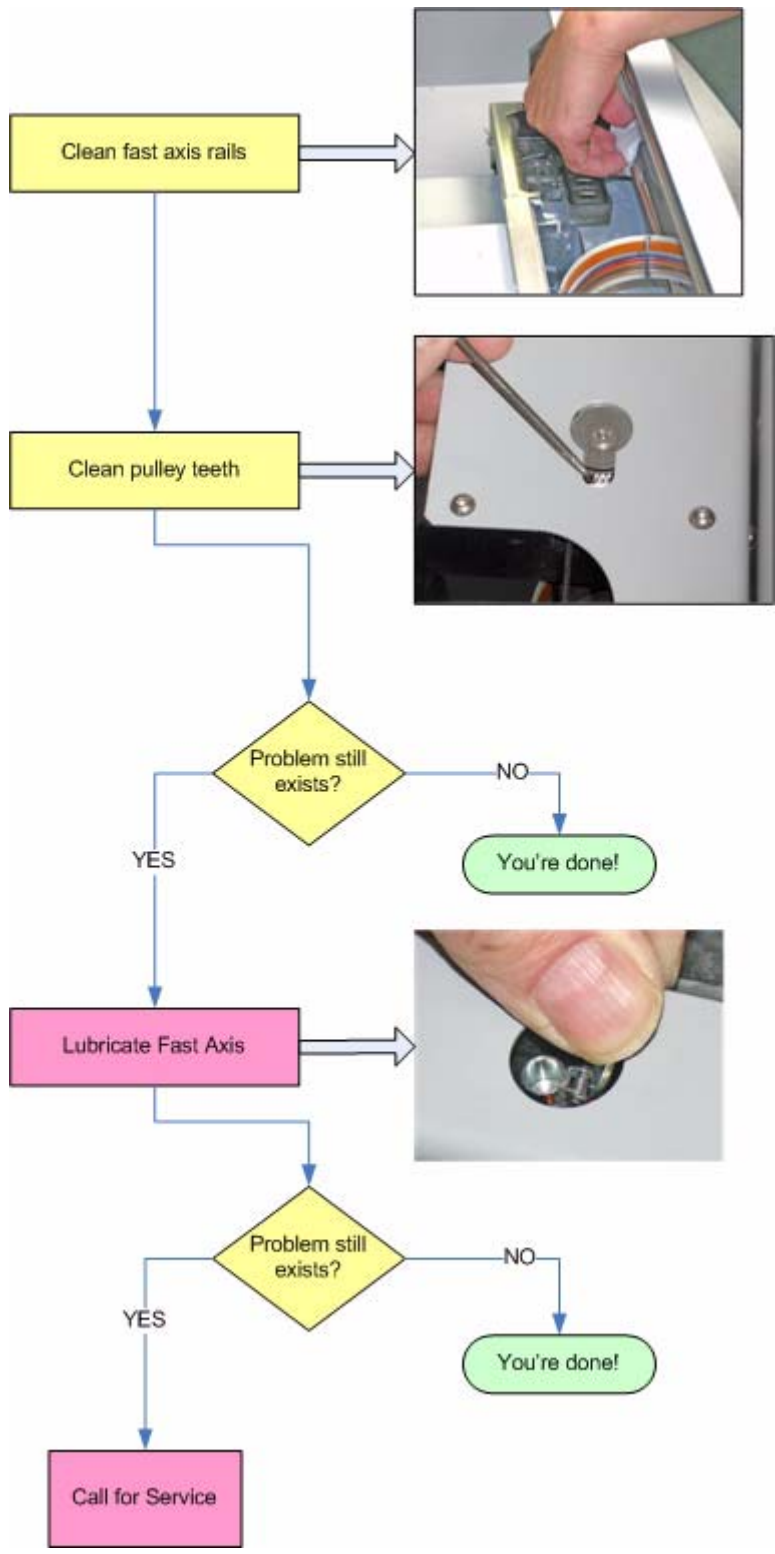
7.6 Motion Errors - Slow Axis

There are a number of Error Codes the printer may report that all relate to the **Slow Axis**, and that all share a common set of solutions.

Error Codes covered in this section:

*   Error 2301:0 Motors Not Rezeroed
*   Error 2303:0 x Axis Pos Error
*   Error 2305:0 x Axis Settle Error
*   Error 2400:0 x Axis Seek Error
*   Error 3011 System Error
*   Error 3013 Sequencer Timeout
*   Error 43000 Sequencer Timeout

For more detailed information on what these errors mean, see *Section 7.13, 'Error Codes and Messages - Background Details'*.

How to do it

To perform the cleaning and lubrication called for in the flowchart, see:

*   *Section 6.7, 'Clean The Slow Axis Rails and Pulleys'*
*   *Section 6.4, 'Slow Axis Bearing Lubrication'*

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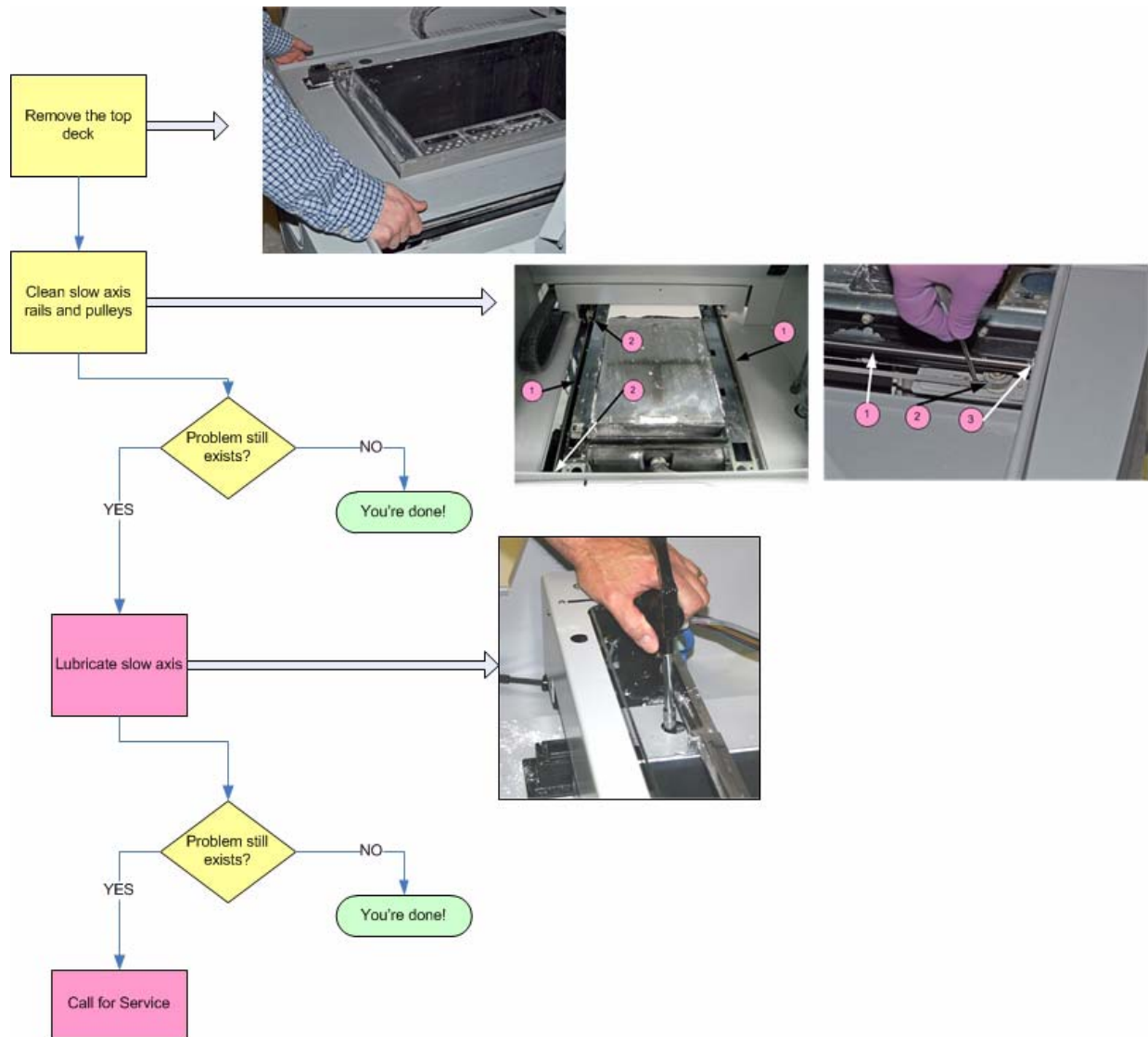
7.7 Network Errors - Cannot Connect to Printer

If you have trouble connecting to your printer over the network, follow the troubleshooting flowchart below.
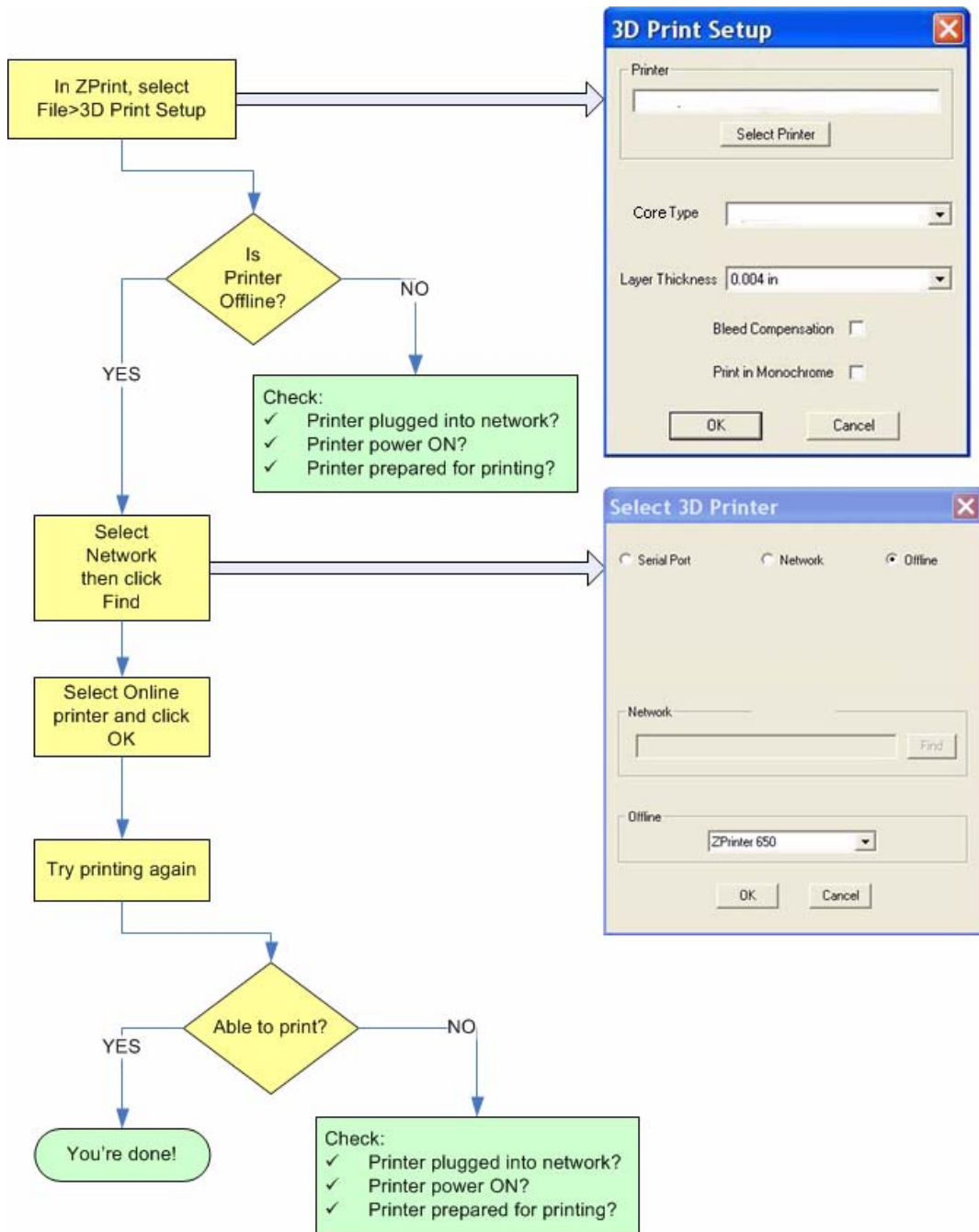
7.8 Network Errors - Packet Timeout

Explanation: The Packet Time Out error is a result of lost or impaired communication between the printer and the PC.

A Packet Time Out error may also occur if the file is too large and the PC cannot transfer the file data fast enough. For example, some files may be layer-data heavy, meaning that the bulk of the data is in a small quantity of layers.

Solution: Check for these problems:
* The PC used to control the printer may
    * Be too busy running other applications.
    * Be running a virus or spyware scan.
    * Be in a "sleep" or "suspend" mode due to power management settings.
    * Not meet the minimum system requirements. See *Section 1.3, 'Computer/System Requirements'*.
* The printer's network connection may be lost
    * Printer's network cable may be unplugged, or damaged.
    * Server is not responding.
    * Network is too busy.

7.9 Part Quality Issues - General

There can be many causes to part quality issues. Refer to the sections that follow to find your problem, and the suggested solutions.

7.9.1 Part Colors Do Not Match PC Monitor Colors

Explanation: PC monitor settings are adjustable, and monitors vary in color accuracy. Monitor colors should not be used to gauge the color of printed parts. In addition, color cannot be properly judged until the part has been infiltrated and cured.

Solution:
* Infiltrate and cure your parts before judging color.

* Be sure to check that your Core settings in 3DPrint match the Core/printer combination that you are using.
* Cleaning the Service Station after every build also plays a key role in color quality.

7.9.2 Parts Broken After Automatic Gross Cleaning

Explanation: Either your parts are too small or too delicate to handle the vibration when the build chamber empties, or your parts are not printing correctly.

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Solution: If your parts are thin-walled or just small, you may want to consider not using the automatic Empty Build Chamber feature. We also recommend that you generate a fixture with bumpers to support your part during the automatic empty build chamber cycle. In the screen shown below, the red area is the fixture and bumpers generated by 3D Print.

Also try these:

- Check the saturation levels for your Core type. If you load a *.zbd* file, it will load the saturation values saved for that part, so double check after you load your parts.
- Check for striped or streaky printing (see *Section 7.10, 'Part Quality Issues - Streaky or Striped Parts, Delamination'*).
- Clean the service station and the parking caps. Ensure the printer has cleaning solution.
- Clean the Fast Axis rail of any debris and reboot the printer.

7.10 Part Quality Issues - Streaky or Striped Parts, Delamination

Explanation: Streaky or striped parts are caused either by Core buildup on the print head, a failed print head, or an electrical issue within the printer. Delamination (layers splitting apart) may be due to a print head that is caked with Core, or a pause in network communications.

Solution - Both:

- Clean the service station. See *Section 3.5, 'Clean The Service Station'*.
- Clean the parking caps. See *Section 3.3, 'Clean The Parking Caps'*.
- Ensure the printer has cleaning solution.
- Realign the print heads to ensure proper alignment.
- Clean the Fast Axis Rails of any debris and reboot the printer. See *Section 3.4, 'Clean The Fast Axis Rails and Carriage'*.

If the problem persists,

- Clean the pogo pins and the print head contacts.
- Realign the heads. If the pattern shows striping or streaking, one or more print heads may have failed. Change the print head and realign the heads. See *Section 7.4, 'Alignment Errors'*.
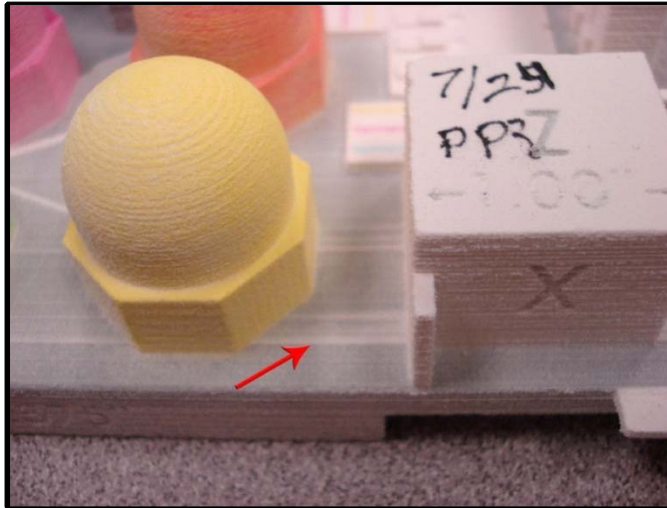
Additional Solution - Delamination

Check your PC settings. The printer may be pausing as it waits for additional data from the PC. While pausing, the printed part begins to dry and as a result the next layer does not stick to the last layer printed. Your PC should be dedicated to 3D Print. Your PC Power Management software should be completely shut off.

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7.11 Part Quality Issues - Bad Surface Finish

The problems behind bad surface finish on parts will be different depending on whether the rough surface is in the vertical plane or the horizontal plane.

7.11.1 Bad Horizontal Surface Finish

Explanation:

A bad surface finish on **horizontal** surfaces is usually the result of debris buildup on the Spreader Roller. The debris sticks to the Roller and prevents it from spreading a smooth, flat layer of Core.
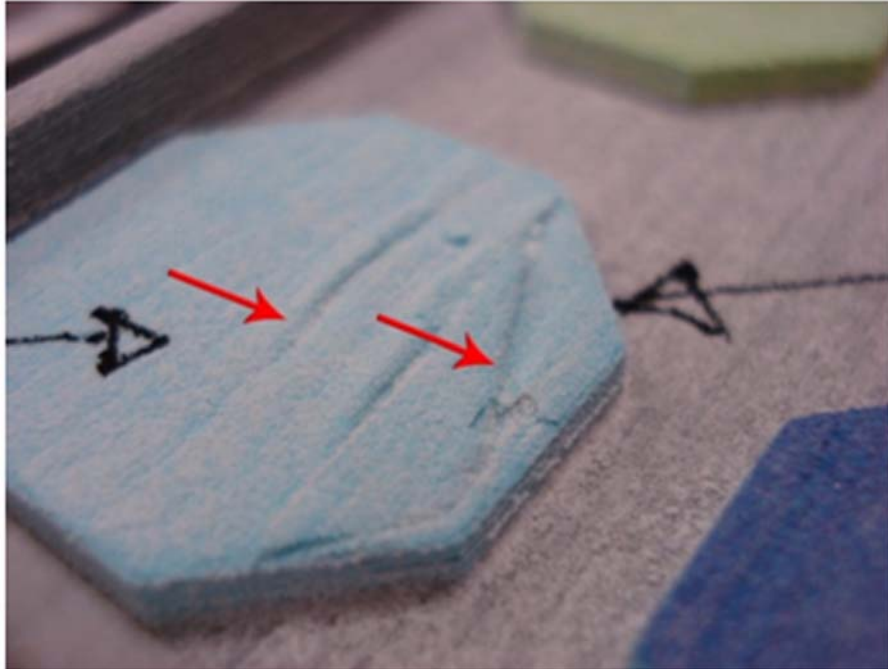
Solution

Clean the Spreader Roller. See *Section 6.8, 'Clean The Spreader Roller'*.

7.11.2 Bad Vertical Surface Finish

Explanation:

A bad surface finish on **vertical** surfaces is usually the result of either or both of these:

- A problem with the print heads.
- A motion problem with either the Fast Axis or the Slow Axis.

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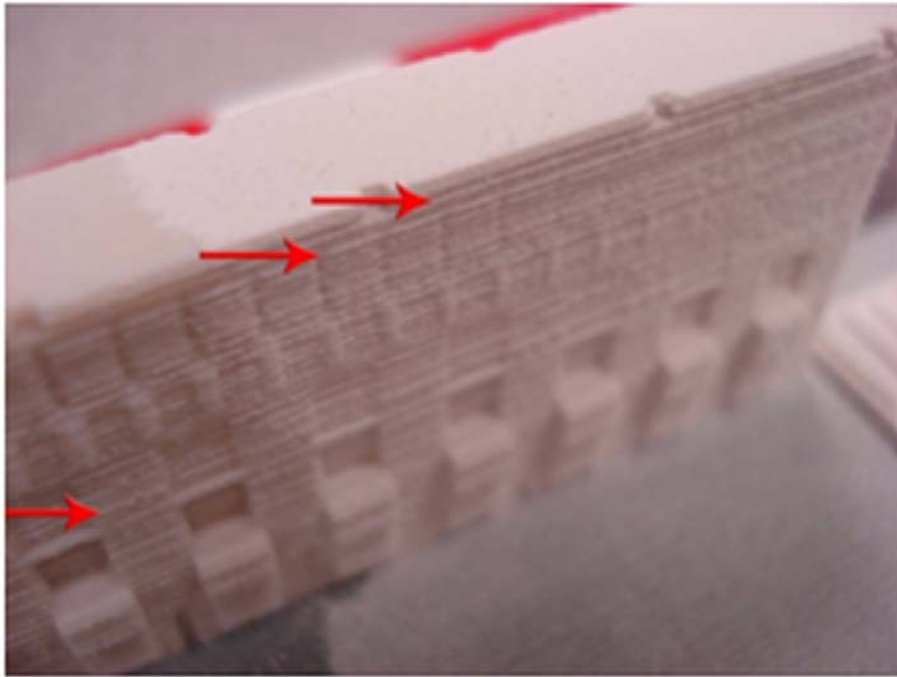
Solution - Print Heads

Troubleshoot using *Section 7.3, 'Print Head Errors/ Weak Parts'*.

Solution - Motion Problems
- Clean the Fast Axis Rails. See *Section 3.4, 'Clean The Fast Axis Rails and Carriage'*.
- Clean the Fast Axis Pulleys. See *Section 6.6, 'Clean The Fast Axis Pulleys'*.
- Clean the Slow Axis Rails and Pulleys. See *Section 6.7, 'Clean The Slow Axis Rails and Pulleys'*.

7.12 Miscellaneous Problems

7.12.1 Vacuum Has Low/No Suction

Explanation: This is usually an indication that the Debris Separator needs to be emptied and cleaned.

Solution:
- Remove the Debris Separator and empty the contents into a waste receptacle.
- Check that its gasket is not damaged. Also check that all four magnets are in place on the back of the Separator. These magnets hold the Separator against the panel.
- When you replace the Debris Separator, ensure that it is flush against the panel.
- Check the vacuum hose is not plugged with debris.
- Check that the vacuum hose is not cut or torn.

If, after checking these items the problem persists, contact your Service Provider.

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7.12.2 Binder Cartridge is Full But 3DPrint Indicates Empty

Explanation: This is usually caused by a damaged binder cartridge, or a failure in the binder cartridge pocket.

Solution:

- Remove and reseat the binder cartridge. Check the following:
    - Be sure it's the correct cartridge for that pocket.
    - Check the label to be sure it's oriented correctly.
    - Snap it fully into place in the pocket.

If that doesn't solve the problem, try a new binder cartridge.

If a new binder cartridge doesn't solve the problem, contact your Service Provider.

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7.13 Error Codes and Messages - Background Details

Below is a more detailed explanation of some of the error codes and messages the printer may report.

ERROR CODE	
Error 40800 *Error 1004* *Error 1010* *Error 1009* *Error 1003* *Error 1008*	**Explanation:** 1000ml is the expected life of a print head that uses clear binder; 500ml is expected life for a color or black print head. In the rare instances where they do not, the reasons are varied. Some print heads may fail if the printer does not run a build on a regular basis. They may also prematurely fail if the printer is turned off for long periods. Color print heads will also be affected by the printer sitting too long without running. **Solution:** We recommend leaving your printer turned on when not in use. Doing this will allow the printer to automatically maintain the print heads with a routine it runs between builds. Also, when changing a print head, be sure to clean the pogo pins at the same time. Failure to clean the pogo pins may result in poor contact to the print head, causing the system to report an error and preventing operation of the printer.
Error 1006	**Explanation:** This error is most likely caused by a print head reaching the end of its life. As a print head ages, it overheats and eventually reports this error. It could also be a failed connection between the printer and the print head. **Solution:** This error is most often avoided by following best practices for keeping the printer clear of excess Core and to clean the pogo contacts every time a print head is changed. Even if only one print head is replaced, it is good practice to clean the contacts for ***all 5*** print heads every time a print head is replaced. The ProJet x60*Pro* will prompt you when a print head has reached its maximum life and requires changing. Change the print head according to the instructions in this manual. When a print head is changed, the ProJet x60*Pro* will run an automatic purge cycle for the binder cartridge only. Once the purge cycle is complete, the printer runs the auto-alignment pattern to align the clear and color print heads.

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ERROR CODE	
Error 2303 (0) *Error 2303 (1)*	**Explanation:** If the error shows 2303 **(0)** it means that there is excessive friction on the **slow** axis rails, or something is obstructing the travel path of the axis. If the error is 2303 **(1)**, it means that there is excessive friction on the **fast** axis rails, or something is obstructing the travel path of the axis. **Solution:** First, ensure there is nothing blocking the travel path of either axis. If there is no obstruction, then it usually means that the fast or slow axis needs to be greased. Follow the instructions in the *Printer Maintenance* chapter for greasing the slow or fast axis. Also, inspect the pulleys for debris buildup. If the pulleys need cleaning, refer to the instructions in the *Printer Maintenance* chapter.
Error 1905	**Explanation:** This error is caused by a layer that is too large for the printer's buffer. The printer is unable to process the layer and reports the error. This is most common with GIS, architecture, and scanned files, which are usually very large. **Solution:** Try rotating the part on the X-Z-axis to increase the layer count and reduce the size of each layer. The risk in doing this is 3DPrint is unable to check for layer size before it begins the build. We recommend reducing the detail on the file and trying the print again.

7.14 Additional Information

7.14.1 Materials

Visit the Materials section of our Web site to get the latest information on:
* Materials that are compatible with your printer.
* Best Practices to help you create the very best parts.
    3dscentral.3dsystems.com

7.14.2 Service

Visit the Support section of our Web site for tips on maintaining your printer, troubleshooting problems, or to contact our Service staff:
    3dscentral.3dsystems.com

7.15 Calling for Service

If you are still experiencing problems after troubleshooting contact your local Service Provider with the below information.
* Serial Number
* Company Name and Contact Info

- Log File (obtainable through the 3DPrint Software Service Menu)
- .INI File (Obtainable through the 3DPrint Software Service Menu)
- SPREAD.CSV File (Obtainable through the 3DPrint Software Service Menu, Receive File option)
- Head Report Information (Obtainable through the 3DPrint Software Service Menu)
- Binder/Core Types
- Binder/Core Expiration Dates
- EXACT Error Code/ Description of Problem

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