

Setup and Operation



HV-2100 Jet

3A6244A

Diaphragm-Jet™ Technology

EN

**For non-contact dispensing of viscous material in industrial environments.
For professional use only.**

Models - See page 3 for model information.



Important Safety Instructions

Read all warnings and instructions in this manual and all related manuals before using this equipment. Save these instructions.



Model 25B310

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Models

Part Number	Model
25B310	HV-2100 Jet, 30 cc syringe
25B311	HV-2100 Jet, 30 cc syringe, heated feed tube
25B312	HV-2100 Jet, 6 oz syringe, heated feed tube

Related Manuals

Manuals are available at www.graco.com. Component manuals below are in English:

Part Number	Manual
3A6226	HV-2100C Jet Controller Setup and Operation
3A6326	HV-2100 Jet Maintenance and Repair
3A5937	Jet Dispensing Parameters Supplement
3A5908	Jet Maintenance Tool Kits

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 WARNING	
 	<p>ELECTRIC SHOCK HAZARD This equipment must be grounded. Improper grounding, setup, or usage of the system can cause electric shock.</p> <ul style="list-style-type: none"> ▪ Turn off and disconnect power cord before servicing equipment. ▪ Connect only to grounded electrical outlets. ▪ Use only 3-wire extension cords. ▪ Ensure ground prongs are intact on power and extension cords.
	<p>TOXIC FLUID OR FUMES HAZARD Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> ▪ Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using. ▪ Store hazardous fluid in approved containers and dispose of it according to applicable guidelines.
	<p>BURN HAZARD Equipment surfaces and fluid that is heated can become very hot during operation. To avoid severe burns: Do not touch hot fluid or equipment.</p>
	<p>PERSONAL PROTECTIVE EQUIPMENT Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. Protective equipment includes but is not limited to:</p> <ul style="list-style-type: none"> ▪ Protective eyewear, and hearing protection. ▪ Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.
 	<p>EQUIPMENT MISUSE HAZARD Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> ▪ Do not operate the unit when fatigued or under the influence of drugs or alcohol. ▪ Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See Technical Specifications in all equipment manuals. ▪ Use fluids and solvents that are compatible with equipment wetted parts. See Technical Specifications in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer. ▪ Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only. ▪ Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards. ▪ Make sure all equipment is rated and approved for the environment in which it is used. ▪ Use equipment only for its intended purpose. Contact your distributor for information. ▪ Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces. ▪ Do not kink or over bend hoses or use hoses to pull equipment. ▪ Keep children and animals away from work area. ▪ Comply with all applicable safety regulations.

1. Specifications

1.1 Technical Specifications

Size (including mounting bracket)	Width: 25.4 mm (1.00 in) Height: 116.1 mm (4.57 in) Depth: 106.8 mm (4.20 in) Weight: 446 grams (0.98 lb)
Viscosity Range	1-400K mPa*s (cPs)
Speed	Up to 300 drops/sec
Fluid Syringes	5, 10, 30 and 55 cc
Nozzle Features	Tungsten Carbide and long-life ceramic Sizes from 50 µm to 600 µm Extended tips available from 3 mm to 6 mm
Wetted Parts	17-4 Stainless Steel, Tungsten Carbide, Ceramic, FKM, FFKM, Silicone
Nozzle Heater	Heating up to 70 °C max (158 °F)
Fluid Pressure	0.41 MPa (60 psi) max
Jet Pressure	0.24 MPa (35 psi) min 0.62 MPa (90 psi) max
Operating Temperature	15 °C to 50 °C (59 °F to 122 °F)
Operating Noise Sound pressure measured 1.5 m (4.9 ft) from applicator at 40 psi (225 kPa), per EN ISO 3746	79.4 dB(A)

1.2 Technical Assistance

For customer service and technical assistance:

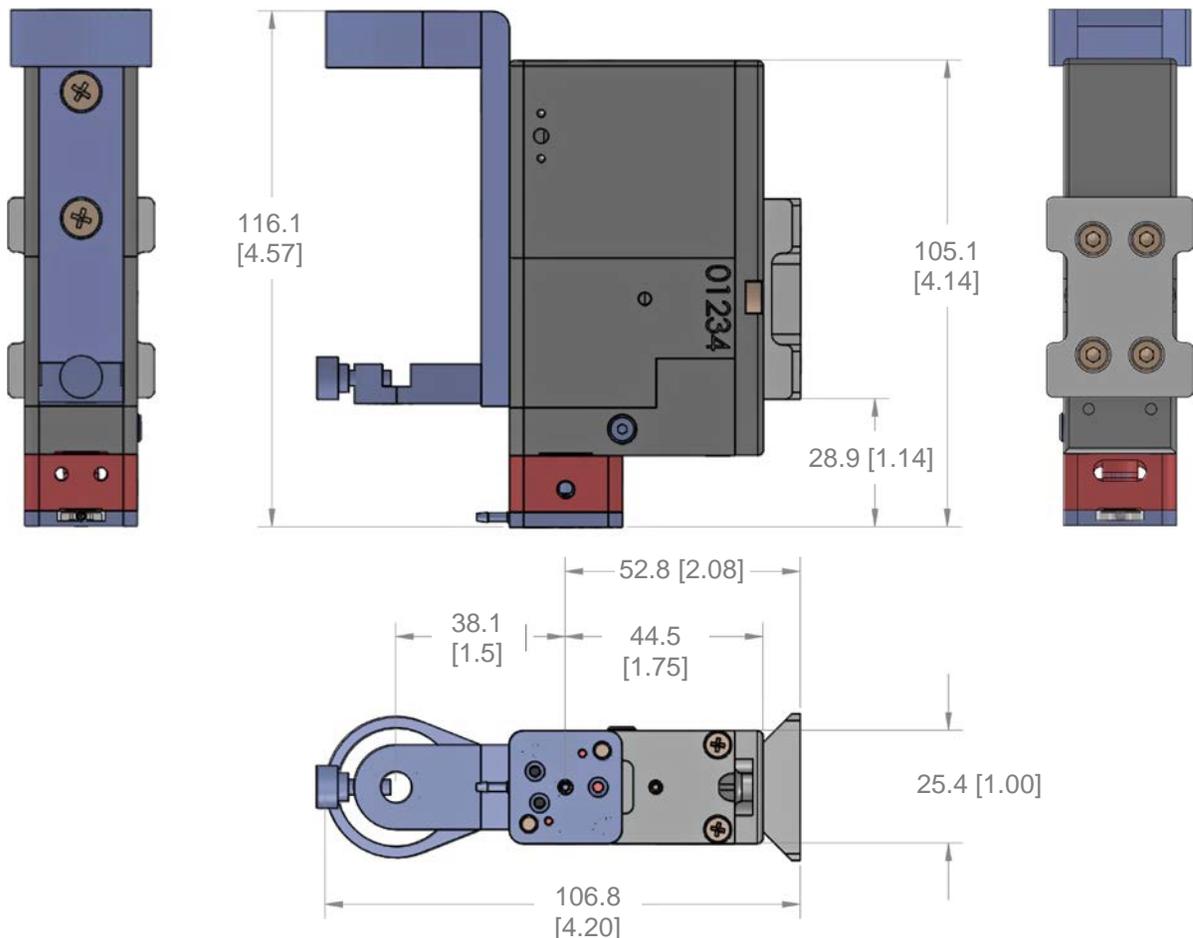
Advanjet
926 Andreasen Dr. # 108
Escondido, CA 92029
USA

Phone: +1 800 333 4877
Web: www.advanjet.com
E-mail: info@advanjet.com

1.3 HV-2100 Jet Dimensions

Shown below are the mechanical dimensions of the HV-2100. Units are in millimeters [inches].

- The HV-2100 can be mounted to a variety of robots when X-Y-Z motion is desired. It can also be mounted rigidly over a transporting mechanism like a conveyor belt or shuttle table.
- The HV-2100 provides a dovetail rear mounting plate for rigid attachment to a robot's XYZ stage. An optional mating dovetail mount is available from Advanjet (P/N 03-2312).
- The dispense tip relative to the mounting holes and the rear mounting plate dimensions are shown in mm in the figure below. It is highly recommended that any mounting scheme allow for vertical adjustment so the dispensing tip to dispensing surface can be easily adjusted.



2. Installation and Setup

2.1 Dispensing Components

The HV-2100 has three essential components that contact the fluid: the nozzle plate, the diaphragm, and the feed tube. The feed tube is disposable; the other components can be disassembled, cleaned and reused. Cleaning procedures are in Section 4 - Cleaning the Jet.

The diaphragm should be inspected each time the nozzle plate is removed. If there are signs of wear, cracks, or deformation, the diaphragm should be replaced. Consideration should be made of dispensing and cleaning fluids that could damage the jet's wetted parts. The materials of these components are listed in Section 1.1 - Technical Specifications. In particular, cyanoacrylates or pre-mixed two-part adhesives with a short pot life are not recommended, as these materials can harden in the nozzle plate. See Section 4.3 - Solvent and Diaphragm Compatibility for details.

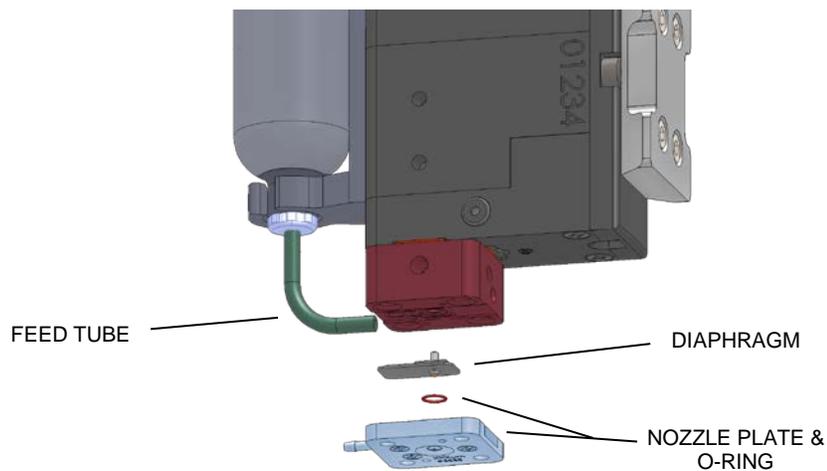


Figure 2-1: HV-2100 Jet Dispensing Components

2.2 Pneumatic Connections

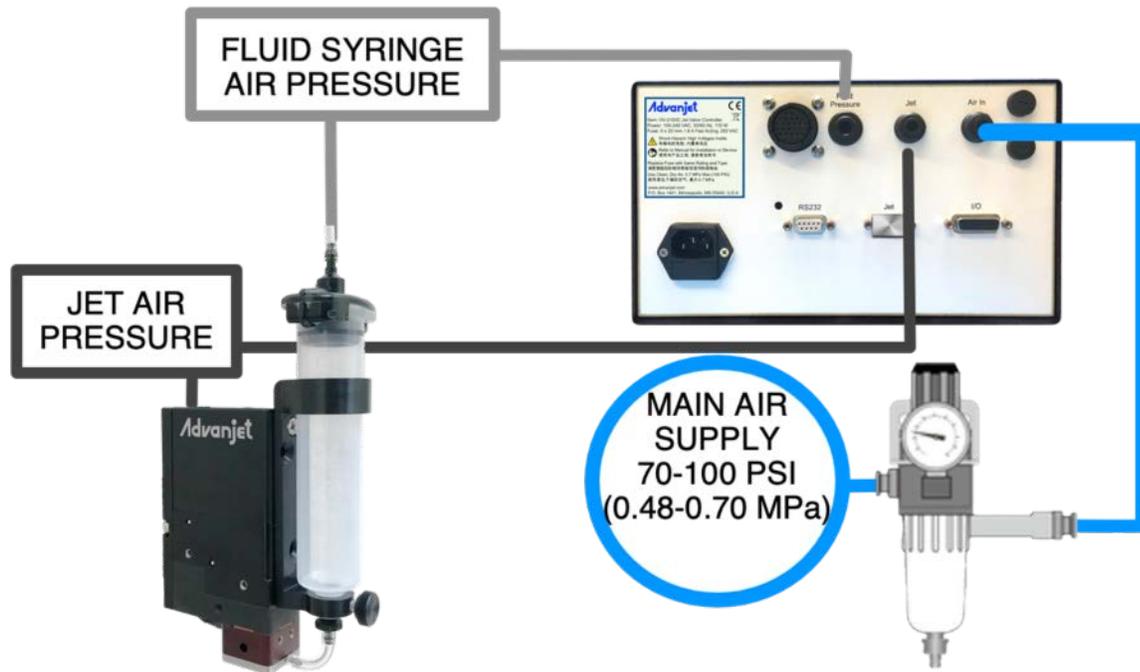


Figure 2-2: HV-2100 Pneumatic Connections

Main Air Supply: Connect a filtered (40-micron filter or better) and independently regulated main air source. It is highly recommended to place a drying system or desiccant dryer in line with the main air line. A 6mm OD air tube with a slip connect coupler is supplied to connect the HV-2100C to the main air supply. The main air supply pressure should be between 70 and 100 psi (0.48 and 0.70 MPa).

Fluid Syringe Air Pressure: The HV-2100C delivers fluid syringe air pressure through clear 4 mm OD tubing that is attached to the receiver head and has a twist-lock connector to the controller. The fluid syringe air supply should be at maximum 60 psi (0.41 MPa); normal fluid pressure is usually between 10 and 50 psi (0.06 and 0.34 MPa). Variations in the air pressure source can adversely affect the consistency of the drop size.

Jet Air Pressure: The HV-2100C delivers jet air pressure through black 6 mm OD tubing with a quick-connect coupler to the controller and an air fitting for the jet. The jet air supply must be clean and dry and at a maximum pressure of 75 psi (0.51 MPa); normal jet air operation is usually between 35 and 75 psi (0.24 and 0.51 MPa).

NOTICE

It is imperative that the air supplied to the HV-2100 is clean, dry, and free from debris and water. A 40-micron filter is highly recommended. If the air is not clean and dry, serious damage can occur to the air solenoid valves.

2.3 Cable Connections

The cable connections for a typical dispensing system are illustrated below. To assure proper connections, each of the component cables supplied by Advanjet has a distinct connector. Be sure that all power is off when connecting and disconnecting any cable to the Advanjet controller.

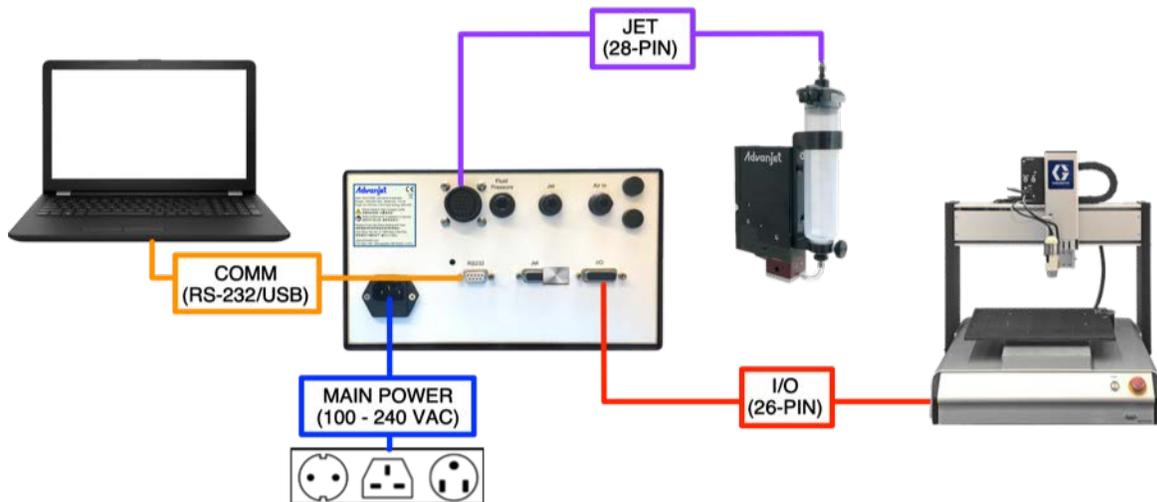


Figure 2-3: Cable Connections for the HV-2100 in a Typical Dispensing System

Jet: A 28-pin cable (P/N 06-1095-00) mates with the HV-2100 jet cable to connect it to the HV-2100C controller. Section 2.4 provides HV-2100 Jet Cable pin assignments.

I/O: When using the HV-2100 jet with the HV-2100C controller and a robot, six TTL trigger lines control jet operations through a 26-pin cable (P/N CB26-005).

COMM: A PC can be connected to the controller via RS-232C/USB to operate the HV-2100 using software instead of the front panel touch screen.

2.4 Jet Cable Input/Output

A 28-pin cable is supplied with the HV-2100 Jet. The table lists the jet cable pin assignments.



Figure 2-4: CPC-28 Jet Cable

JET CABLE PIN ASSIGNMENTS	
PIN	
1	--
2-3	Jet Solenoid
4-5	Jet Heater
6-7	Jet RTD
8-28	--

3. Assembling the HV-2100 Jet

The HV-2100 jet is shipped fully assembled except for the diaphragm and nozzle plate. A specific diaphragm material and nozzle plate orifice diameter should be chosen based on the application and dispensing fluid. The steps required to correctly assemble the diaphragm and nozzle plate on the jet body are detailed below.

Before assembling the jet, make the necessary pneumatic and electrical connections as described in Sections 2.2 and 2.3.

3.1 Jet Assembly Overview

Figure 3-1 below shows the alignment of the heater block, diaphragm, O-ring, and nozzle plate.

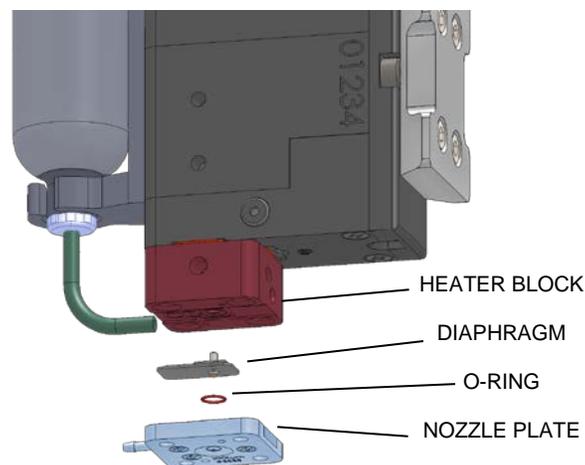


Figure 3-1: HV-2100 Heater Block, Diaphragm, O-Ring and Nozzle Plate

- There is a grooved pattern on the bottom face of the heater block that matches the raised embossments on the diaphragm. The grooves position the diaphragm correctly on the heater block.
- The diaphragm also has a metal insert with a post that must be inserted into the central hole on the heater block.
- Although a diaphragm can be inserted without the jet connected to an air source, it will not sit flat on the heater. It is recommended to OPEN the jet before assembling the diaphragm. Detailed instructions are in Section 3.4 - Install the Diaphragm and Nozzle Plate.

3.2 Inspect the Nozzle Plate for Cleanliness

It is important to inspect the jet nozzle plate for debris before mounting it onto the Jet. A clean nozzle looks like this:



Figure 3-2: A Clean Nozzle

If the nozzle plate is not clean, it could affect the dispensing quality. These dispensing problems are symptoms of a contaminated jet:

- Unclean or uneven dispensing
- Drops become irregular or vary in size
- Residual flow or drooling out of the tip when the jet is in the closed position
- Interrupted dispensing (places where fluid no longer is dispensed)
- Splatter or satellites

For best results, Advanjet cleaning kits contain tools appropriately sized to the nozzle plate. For example, if you are using the 125 μm nozzle plate, order the 125 μm cleaning kit (Advanjet P/N CL-125).

Refer to Section 4 for complete instructions on cleaning the jet.

NOTICE

Never submerge the diaphragm in solvents as it might result in damage.
Diaphragms can be cleaned successfully with
a small amount of solvent and a soft brush and cotton swab.
Do not submerge the diaphragm into the ultrasonic cleaner because
it will deteriorate the diaphragm and shorten its life.

3.3 Install the Nozzle Insert

When the nozzle becomes damaged or plugged, a new nozzle insert and O-ring may be required. Installation is simple, but correct and careful assembly is important.

NOZZLE INSERT O-RING PART NUMBER		NOZZLE PLATE O-RING PART NUMBER	
SILICONE	FKM	SILICONE	FKM
NP09-2830	NP09-2851	NP09-2820	NP09-2850

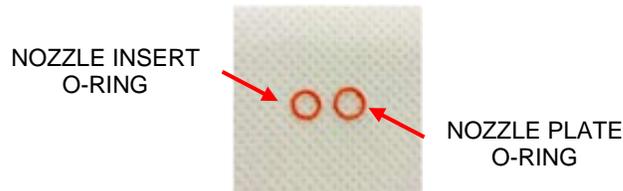


Figure 3-3: Nozzle Insert O-Ring (left) Compared to Nozzle Plate O-ring (right)

<ol style="list-style-type: none"> 1. Disassemble the nozzle plate by removing the three screws from the nozzle plate bottom. 2. Flip over and remove the nozzle plate top and the nozzle insert. Save the O-ring. 3. Clean as needed. 	
<ol style="list-style-type: none"> 4. Set the nozzle insert with the O-ring facing up in the groove of bottom plate as shown below. 	<ol style="list-style-type: none"> 5. Replace the nozzle plate top. Holding the top and bottom plates together, flip the nozzle over. Replace the three screws.
<ol style="list-style-type: none"> 6. Flip the nozzle top side up and set the nozzle plate O-ring in the groove. <p>Note: When installing the nozzle, the O-ring must face up.</p>	

3.4 Install the Diaphragm and Nozzle Plate



Material inside the applicator can be near setpoint temperature. To avoid severe burns, wear protective gloves.

1. Turn the main power ON.
2. Set the jet pressure to 40 psi (.28 MPa).
3. On the Advanjet controller home screen, tap **Jet** to OPEN the jet.

4. Note the rectangular grooves on the heater block that align with the grooves on the diaphragm.



ALIGN THE GROOVES

5. Gently press the diaphragm into the heater block until the diaphragm pin is inserted in the center and the rectangular grooves are firmly in place.

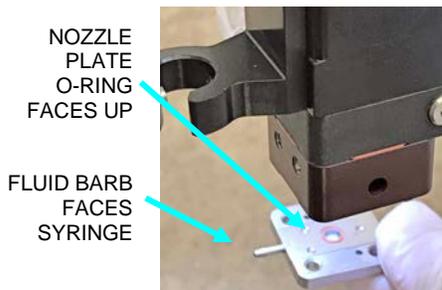


6. Note that the heater block has two pins that align with two holes in the nozzle plate.

ALIGN PINS TO HOLES



7. Use the pins to align the nozzle plate on the heater block. The nozzle plate O-ring faces up, and the fluid barb faces the fluid syringe.



8. Tighten the two embedded screws with a 3-mm hex driver. Do not over-tighten; it is possible to strip the screws. An optional torque wrench is available for this purpose (P/N NT09-2500).



9. Before installing the fluid syringe, CLOSE the jet.

3.5 Install the Feed Tube and Fluid Syringe



Material inside the applicator can be near setpoint temperature. To avoid severe burns, wear protective gloves.

1. If the syringe is smaller than 30 cc, insert a syringe spacer ring. Adapters are available in 3-cc, 5-cc, and 10-cc.



SPACER RING

2. Check the receiver head O-ring for wear, debris, or deformity. These conditions could cause fluid to leak. Clean or replace if necessary.



CLEAN O-RING

3. Turn **Fluid Air OFF**. Insert the receiver head into the syringe and twist to lock.



4. Attach a new feed tube to the luer (metal luer shown; selection of feed tube material depends on the dispensing fluid).



5. Attach the feed tube to the syringe and place the syringe in the jet.



THUMB SCREW

Tighten the thumbscrew to secure.

6. Slip the feed tube onto the barb end of the nozzle plate.



NOZZLE PLATE BARB

3.6 Prime the Jet

Note: HV-2100C Controller shown for illustrative purposes.

1. Prior to dispensing, it is necessary to prime the jet in order to purge residual air from the system. In order to do this, the fluid must be brought to dispensing temperature.

From the HV-2100C front panel, use the following procedure to turn on the heater.

- Press  (INDEX) until Run-Stop (r-S) is displayed on the Present Value (PV) line.
- Use the   arrows to select the rUn setting on the Set Value (SV) line.
- Press  (ENTER) to save the change. Heater is ON.
- Press  again to return to the main screen
- Use the   arrows to change Set Value (SV) to the dispensing temperature for the fluid being used.
- Wait ten minutes for the temperature of the nozzle to be stable.

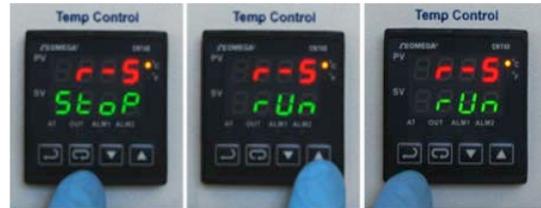


Figure 3-4: Turn the Heater ON

2. Position a purge cup under the jet nozzle.
3. Turn the **Fluid Air** OFF (“O” on **Air** switch).
4. On the controller touch panel:

- Tap on **Fluid Pressure** and set to 0.
- Tap on **Jet** to OPEN.

5. Turn the **Fluid Air** ON (“I” on **Air** switch).
6. Keep the purge cup positioned under the nozzle. While watching for fluid flow from the nozzle, increase **Fluid Pressure** in small increments.

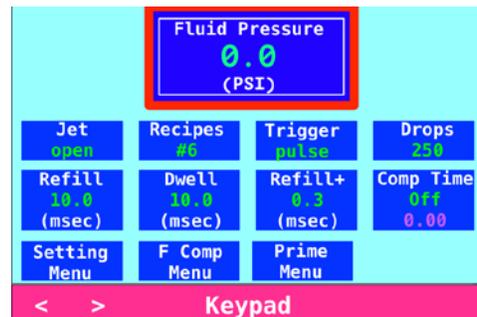


Figure 3-5: Fluid Pressure 0, Jet OPEN

Once fluid begins to slowly flow, continue at that pressure until there are no bubbles in the fluid.

7. Tap on **Jet** to CLOSE.
8. Tap on **Jet Pressure** and set to 45 psi.
9. It is useful to designate a recipe on the HV-2100C controller for the priming process. Use these parameters:

- Refill = 10.0 ms
- Dwell = 10.0 ms
- Refill+ = 0.3 ms
- Drops = 250

This recipe allows most fluids to flow through the jet easily.

3.6 Prime the Jet, continued

10. Remove the purge cup and place a glass slide or piece of substrate under the nozzle.
 - Press the **Trigger** button to run the recipe once.
 - Observe the quality of the drops.
 - Repeat this several times to ensure adequate priming.
11. Wipe the nozzle tip of any accumulation. The jet is ready to operate with the appropriate recipe settings for dispensing.



Figure 3-6: Trigger Button

3.7 Check for Fluid Leaks

Before running a program, it is important to check for fluid leaks. Fluid should not drip through the orifice. If fluid is leaking through the nozzle tip when the jet valve is closed, check to see if the jet pressure is set to at least 35 psi (0.24 MPa). Increase the pressure to 60 psi (0.42 MPa) and check to see if the leak stops.

There are several areas to check for fluid leaks:

- Check to see if fluid leaks out of the weep hole in the heater block shown in Figure 3-7. If fluid is leaking, the diaphragm is either missing or damaged and should be replaced. The heater block will need to be removed and the leaking fluid should be cleaned.
- Fluid can leak out of the Luer fitting that attaches the syringe to the feed tube. Sometimes the Luer fitting is a little snug and hard to twist in completely. If fluid is leaking, give the fitting an extra turn to seat it completely. If this does not solve the leaking, change the feed tube and/or the syringe and check again.
- Fluid can leak at the junction between the feed tube and the nozzle plate inlet fitting. The feed tube is connected using a standard barb to the inlet fitting. If fluid is leaking at the barb end of the fitting, replace the feed tube.
- Check for leaks between the diaphragm and the nozzle plate. The nozzle plate must be attached correctly with screws well tightened. Make sure the Jet valve is closed. If fluid can be seen leaking under the diaphragm, then the Jet has not been assembled correctly. Disassemble the dispensing components and inspect, clean, and/or replace the diaphragm as required. If the leak continues, the diaphragm or nozzle plate is most likely damaged or dirty, and it should be cleaned or replaced.

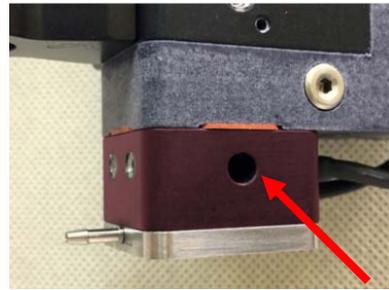


Figure 3-7: Check for Leaks at Weep Hole

If fluid leaks between the diaphragm and the nozzle plate, the jet will not function correctly. Dispensing should be discontinued, and the components should be cleaned or replaced as required.

4. Cleaning the Jet

4.1 Cleaning the Exterior of the Jet

To clean the exterior of the jet, use a soft cotton or cellulose cloth. If the jet exterior is extremely dirty, a small amount of alcohol can be used.

				
To avoid personal injury, move the nozzle close to the paper so there is minimal misting of the solvent during flushing. Be sure there is proper ventilation and wear appropriate eye and skin protection as instructed by the solvent manufacturer.				

NOTICE

To prevent damage to the jet:

- Do not use a dripping wet cloth or pour solvents, alcohol, water, or other liquids directly on the jet.
- Do not submerge the jet in the cleaning agent.

4.2 Cleaning the Interior of the Jet

The Advanjet HV-2100 is a high precision jet for dispensing minute amounts of fluid. Dispensing nozzles can become blocked or clogged by the smallest contaminants, which will adversely affect dispensing results.

These are symptoms of a contaminated jet:

- Unclean or uneven dispensing
- Drops become irregular or vary in size
- Residual flow or drooling out of the tip when the jet is in the closed position
- Interrupted dispensing (places where fluid no longer is dispensed)
- Splatter or satellites

The importance of clean jetting is a key design element of the HV-2100, resulting in a jet that is quick and easy to clean. Following these simple cleaning steps will optimize jetting quality and maximize productivity.

4.3 Solvent and Diaphragm Compatibility

Advanjet uses four different diaphragm materials: FKM (fluoroelastomers), silicone, FFKM (perfluoroelastomers), and EPDM (ethylene propylene diene terpolymer). In general, if the diaphragm material is incompatible with a solvent, the diaphragm will exhibit slight swelling around the metal insert. If swelling occurs, the performance of the jet will be adversely affected.

Use this table as a guide for selecting an appropriate cleaning solvent.

	FKM	Silicone	FFKM	EPDM
Chemical				
Acetone	X	X	✓	✓
Ethanol	X	✓	✓	✓
Isopropanol	✓	✓	✓	✓
Methyl Ethyl Ketone	X	X	✓	✓
Toluene	✓	X	✓	X
Xylene	✓	X	✓	X

✓ = Compatible; X = DO NOT USE

4.4 Flush the Fluid System

1. Turn the fluid air OFF.

Note: It is important to first turn off the air before cleaning the jet. If the feed tube is dismounted under pressure, the fluid from the syringe will make a mess.

2. Remove the receiver head.
3. Remove the feed tube from the nozzle plate.
4. Remove the syringe from the jet.
5. Install an empty syringe with a feed tube onto the fluid barb of the nozzle plate.

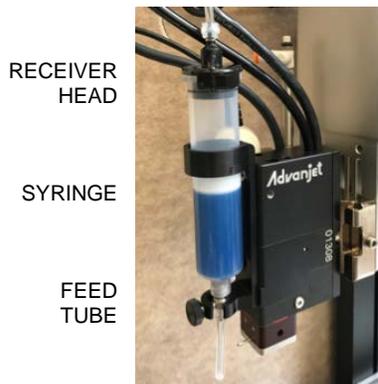


Figure 4-3: Disassemble and Remove Syringe



Figure 4-3: Install an Empty Syringe and Fill With Solvent



Figure 4-3: Replace Receiver Head

6. Fill the syringe with about 3 cc of mild solvent compatible with your fluid material.
7. Replace the receiver head onto the syringe.
8. Set up a test recipe using the following parameters:
 - 10.0 msec Refill
 - 10.0 msec Dwell
 - 0.3 msec Refill+
 - 250 Drops
9. Turn the fluid air ON.
10. Place a paper towel or aluminum-foil dish under the nozzle.
11. Run the test recipe, which flushes the jet.
 - Continue to run the recipe until the liquid coming out of the nozzle is clear and clean, or all 3 cc of the solvent is flushed. It normally requires about 5 or 6 flushes of 250 drops.
 - If there is too much solvent in the syringe, you can open the jet to let out the remaining solvent.

To avoid personal injury, move the nozzle close to the paper so there is minimal misting of the solvent during flushing. Be sure there is proper ventilation and wear appropriate eye and skin protection as instructed by the solvent manufacturer.				

Note: It is easier to work with an empty syringe – let the remaining solvent drain completely to manage the solvent in the cleanest way.

4.5 Clean the Nozzle

1. Turn the fluid air OFF.
2. Remove the flushing syringe.
3. Use the 3 mm driver to remove the nozzle plate.
4. Remove the diaphragm from the heater block.
5. Inspect if the diaphragm or nozzle plate requires further cleaning. Normally, the flushing process achieves 90% clean.
6. Hand-clean the diaphragm with a mild solvent such as rubbing alcohol and a brush. A suitable cleaning brush, pictured above, can be ordered from Advanjet (P/N CLB-01).
7. The nozzle plate can be cleaned with a stronger solvent than the one used for the diaphragm. If necessary, insert the nozzle plate in a small container of acetone or isopropanol alcohol and immerse the container in an ultrasonic cleaner for 5-10 minutes. If necessary, repeat a second time. Do not submerge the nozzle plate for extended periods of time.



Figure 4-4 – Cleaning Brush
(Advanjet P/N CLB-01)

NOTICE

Diaphragms can be cleaned successfully with a small amount of solvent and a soft brush and cotton swab. Never submerge the diaphragm in solvents as it might result in damage. Do not submerge the diaphragm into the ultrasonic cleaner because it will deteriorate the diaphragm and shorten its life.

8. When the ultrasonic cleaning is finished, remove the nozzle from its container and wrap it in a paper towel, making sure the barb is still exposed. Use an air hose to cover the barb and blow air through the plate for about three seconds as shown in Figure 4-5.
9. Using the tools in the Advanjet cleaning kit (P/N CL-XXX; XXX = nozzle size), pass the cleaning drill through the nozzle plate barb to scrape out excess material (see below center). Use the air hose again to blow out loosened material.
10. To make sure the nozzle is absolutely clean, run a cleaning wire through the nozzle (photo below). Make sure it is the correct size and that it is able to pass through the hole. If not, either the wire is too big or the nozzle is still clogged. Repeat ultrasonic cleaning, blowing out, and cleaning with the drill and wire.

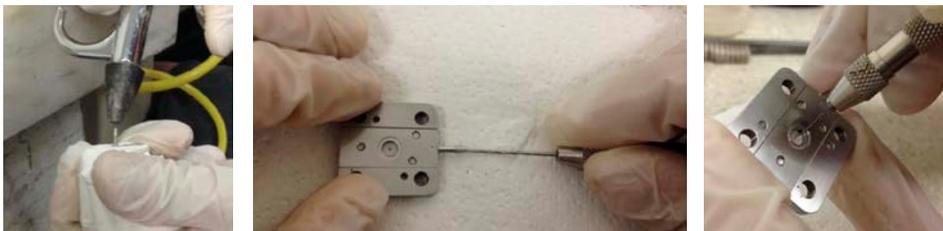


Figure 4-5: (l-r) Blow Air Into Barb; Cleaning Drill; Cleaning Wire

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

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If calling from the US: 800-333-4877

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