

4" J-FORCE™ GEN III

JF4X15 (PN 67029)

JF4X22 (PNs 67030, 67031, 67032)

PRODUCT INSTRUCTIONS

PI-197



The 4" J-Force™ Gen III is a self-powered rotating nozzle designed to easily navigate and clean 4" pipes with up to 90° bends. The 4" J-Force Gen III has front, side, and rear jets that clear blockages, clean, and provide thrust to propel the tool down the pipe. The nozzle comes equipped with an eddy-current braking system which controls rotation speed for maximum cleaning power and minimum wear.

Read these instructions thoroughly before installing, connecting, or using the J-Force tool. If any questions remain, call JETSTREAM at (800) 231-8192 or (832) 590-1300. Also read the yellow JETSTREAM SAFETY WARNING pamphlet included with the shipment of your new J-Force tool and reproduced inside this publication. This product is sold with the understanding that the purchaser agrees to thoroughly train all operators and maintenance personnel in the correct and safe installation, operation and maintenance of the product and to provide adequate supervision of personnel at all times. Retain these instructions for future reference. If this product is resold or otherwise conveyed, purchaser must pass on the instructions to the new user.

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SECTION 1: SAFETY



Incorrect Use of High Pressure Waterblast
Equipment May Cause Serious Injury
Read these instructions in their entirety
before using any JETSTREAM products.

This information was prepared to aid in the identification of potentially unsafe conditions when using high pressure waterblast equipment. It should be noted that other potential hazards may exist which might have not been mentioned in this brochure.

In all cases, JETSTREAM products are sold with the understanding that the purchaser agrees to thoroughly train all operating and maintenance personnel in the correct and safe installation, operation of maintenance of waterblast equipment and to provide adequate supervision of personnel at all times.

Read the following in its entirety before connecting, operating or repairing equipment. Purchasers and operators also should be familiar with the current version of the “Industry Best Practices for the Use of High Pressure Waterjetting Equipment” published by the Waterjet Technology Association, as well as any applicable OSHA regulations, standards and guidelines.

Should any questions arise concerning safe and proper procedure, contact JETSTREAM prior to the installation or use at (800) 231-8192 or (832) 590-1300.

GENERAL WATERBLAST

1. Use only clear, clean water in high pressure system.
2. Place barricades with warning signs or barricade tape around work area.
3. Outfit all operators with Personal Protective Equipment (PPE). Hard hat with plastic face shield, rainsuit, non-skid knee boots **with metatarsal protection**, gloves, ear protection and body armor rated for operating pressures are considered minimum safety equipment. Proper respiratory protection is required where dangerous fumes or dust is present or created by the waterblasting operation. Follow applicable OSHA regulations, standards and guidelines regarding the use of respiratory protection if harmful fumes or dust is present during, or created by the waterblasting operation.
4. Use products intended for high pressure waterblasting only.
5. **No product should be altered** without written consent of the manufacturer.
6. **Read and follow all manufacturer's instructions** prior to using any waterblast product. Contact manufacturer.
7. Thoroughly review alternative methods before initiating any potentially dangerous waterblasting operation. Fully automated, semi-automated, and/or mechanized methods should all be considered first. Contact the applicable waterblasting manufacturers for assistance and recommendations.
8. The operator handling the cleaning device (with nozzle) must always have control of water pressure. A surface cleaning operator should operate a trigger style control gun capable of instantaneously stopping pressure to nozzle. A tube cleaning lance operator should operate a foot gun capable of instantaneously stopping pressure to the lance.
9. Inspect the condition of all components prior to use. Use no items which are in questionable condition.
10. Check the condition of thread connections prior to the make-up of any high pressure connection. Use Teflon tape and anti-seize on male pipe (NPT) thread for sealing purposes. Do not let tape overlap the male pipe thread end. Tape fragments may enter system water stream and clog nozzle's orifices.

Do Not use a component with missing or damaged threads on the high pressure connections.

11. Properly tighten all high pressure connections. All NPT connections must have a minimum engagement of four (4) threads. Pipe (NPT) connections should be made up hand tight plus two (2) full wrenched turns. Do not tighten NPT threads past two (2) wrenched turns.

⚠ CAUTION Use wrench flats (when available) or a properly adjusted smooth jaw plier wrench (JS PN 64119) for tightening components. Avoid using pipe wrench as wrench marks will cause high pressure components to crack and fail.

12. All high pressure hose connections require a hose restraint (whip check), including connection at fluid end discharge.

13. Before attaching a nozzle to the control gun or tube cleaning lance, **operate the pump at low speed to purge** dirt and debris from system. **Dirt and debris can clog nozzle orifice(s) and cause excessive system pressure which could lead to a lance failure.**

14. With nozzle installed, **operate the pump at a low speed (low pressure) for test.** Should system repairs or adjustments be necessary, stop pump and relieve all pressure before making required repairs or adjustments. The pump operator should watch the nozzle operator at all times in case any difficulty arises and it becomes necessary to depressurize system. If the pump operator does not have a clear line of sight to the nozzle operator, it may be necessary to have another employee available to communicate between the nozzle and pump operators.

15. With the system operating properly, **increase pump speed slowly until operating pressure is reached** and adjusted. Pressure adjustments should always be made slowly. The nozzle operator shall be warned before any pressure adjustment is made by the pump operator. A sudden change in reaction force may cause the nozzle operator to lose balance.

16. Use **minimum pressure required** for cleaning. Do not exceed the operating pressure of the system's lowest pressure-rated component. All equipment pressure rating markers and warning tags should be left intact.

17. Waterblast operators must be made aware that the **cleaning nozzle's discharge jets(s) can inflict serious body wounds.** Supervisors should demonstrate the potential danger of discharge jet(s) by showing all new operators the effect of a waterjet by cutting a scrap piece of wood such as a 2" x 4".

18. If equipment malfunctions or a system malfunction is suspected, immediately stop cleaning activity and relieve the pressure in the system before attempting any repairs. Always follow the manufacturer's repair instructions.

19. Only trained persons should be authorized to perform any maintenance or repair.

20. Following any repairs, the system should be operated at low pressure for test. Bring equipment up to operating pressure slowly.

21. For shutdown in freezing conditions, even for brief periods, drain water from all components. Prior to starting operations in freezing conditions, the operation of all equipment components must be checked carefully to make sure components are not frozen and can be operated.

22. Store components properly by protecting them from damage when not in use. Be sure all safety warning tags and markers remain intact.

PRESSURE RELIEF DEVICES

1. **Read General Safety** section prior to installing Relief Valve and/or Pressure Relief Devices.

2. A waterblast system should include both primary and secondary pressure relief protection:

A. For primary protection a primary rupture disc assembly or spring-loaded relief set at 1.2 times, maximum operating pressure is recommended (i.e. relief valve is set at 12,000 psi if maximum operating pressure is 10,000 psi)

B. For secondary protection a rupture disc assembly containing a manufacturer's approved disc having a burst rating of 1.4 times maximum operating pressure is recommended.

⚠ WARNING Only use a rupture disc holder which will NOT permit the use of coins or other objects in place of discs.

3. Relief devices should never be mounted so the discharge could strike personnel.

4. Never install a shut-off valve between the pump and relief device.

5. "Set pressure" must be prominently displayed on all relief devices. Never install or use a relief device unless its "set pressure" is known.

6. Do not attempt to correct a leaking relief valve by increasing spring tension as this will increase its set pressure.
7. Do not use a pressure relief valve as a combination relief and throttling device.
8. Keep relief valve dry during freezing conditions.

NOTE: Pressure relief devices are imperative for the protection of both operator and equipment from dangerous over-pressurization.

HIGH PRESSURE HOSE

1. **Read General Safety** section prior to connecting high pressure hose.
2. Do not use a high pressure hose with a burst rating less than 2.5 times the pressure at which it will operate. 10,000 psi operating pressure high pressure must have a minimum 25,000 psi burst rating. 8,000 psi operating hose must have a minimum 22,000 psi burst rating.
3. Do not use a high pressure hose that has an unknown burst rating or manufacturer's operating pressure rating.
4. Use of a Safety Shroud is strongly recommended for added safety where hose connects to control gun.
5. Use of hose restraint (whip check) is required at all hose connections, including connections at fluid end.
6. Always apply wrench to wrench flats when making threaded connections. Do not apply wrench on the end fitting ferrule (collar).
7. **Remove hose from service if:**
 - A. Cover is damaged and reinforcing wires are exposed to rust and corrosion;
 - B. Cover is loose, has blisters or bulges;
 - C. Hose has been crushed or kinked;
 - D. End fitting shows evidence of damage, slippage, or leakage.
 - E. Hose has been exposed to pressures greater than 50% of burst rating; or
 - F. Hose is three or more years old, regardless of condition.
8. Disconnect, drain, coil and store hose properly after use.
9. Never attempt to repair or recouple high pressure hoses in field. High pressure hose end fittings are the permanently crimped type and can

only be properly installed with hydraulic crimping equipment.

NOZZLES

1. Read **General Safety** section.

2. Nozzle flow ratings must be compatible with pump discharge and pump pressure rating. (See Nozzle Flow Rating Chart on page 25.)

3. Use only nozzles with a manufacturer's pressure rating of at least the operating pressure or a burst rating or no less than 3.0 times the desired operating pressure.

4. Prior to installation, make sure the nozzle has no clogged orifices.

5. Apply 3 - 4 wraps of Teflon tape to male connection threads on the nozzle. Apply anti-seize compound over the sealant tape for additional protection against galling in connection threads. Wrench connection 1 1/2 - 2 turns past hand tight. A minimal thread engagement of four (4) threads should exist on all Jetstream NPT pipe connections.

6. **⚠ CAUTION** Use wrench flats (when available) or a properly adjusted smooth jaw plier wrench (JS PN 64119) to tighten nozzle. Avoid using pipe wrench as wrench marks will cause nozzles to crack and fail.

7. Blocked orifice(s) can cause excessive system pressure and failure. If orifice(s) appear clogged or partially blocked with dirt or debris, remove nozzle from J-Force and clean immediately.

8. Remove nozzle from service if:

- A. Nozzle is split or damaged;
- B. Nozzle sidewall is worn by more than 25% at any point;
- C. Nozzle's ability to hold pressure is questionable
- D. Threads are missing or damaged

FLEXIBLE TUBE CLEANING LANCES

1. Read **General Safety** section and Nozzle Safety Warnings prior to connecting flex lances.

2. **Do not** use a flex lance with a burst rating less than 2.25 times the pressure at which it will operate. 10,000 psi operating pressure flex lances **must** have a **minimum** 22,000 psi burst rating. 8,000 psi operating pressure flex lances **must** have a **minimum** 18,000 psi burst rating.

3. **Do not** use a flex lance that has an unknown burst or unknown manufacturer's operating pressure rating.
4. **Never use a lance which is kinked, worn, frayed** or whose abilities to hold pressure is questionable.
5. **Do not** use a lance which has damaged or missing threads.
6. **Clearance** between lance and tube deposits **must be sufficient** to allow unrestricted backflow of water and debris. With tubes containing hard deposits this clearance should be 1/8" **minimum** on the diameter (or 1/16" per side) of the lance. With tubes containing soft, pliable deposits this clearance should be greater. **Insufficient side clearance may cause lance to blow back toward operator.**
7. **⚠ WARNING** Serious injury may occur should a lance with live nozzle exit tube. Use anti-withdrawal device to prevent lance from exiting tube unexpectedly.
8. The following **JETSTREAM** lance accessories are **strongly recommended** for safer lance operation:
 - A. **Lance Strain Relief** –Helps prevent lance inlet end fitting failure.
 - B. **Lance Stinger** - Affords the operator greater control of nozzle. Establishes a "safety zone" so operator knows when nozzle is about to exit tube; will eliminate possibility of nozzle and lance "double back" toward operator within large diameter pipe.
 - C. **Anti-withdrawal device** prevents the lance from exiting the tube or pipe. Contact JETSTREAM for additional information regarding these products.
9. **Use only nozzles designed for use with flex lances** (i.e. nozzle drilled with sufficient rearward orifices so nozzle pulls lance through tube.)
10. If lance end fittings do not have wrench flats, use properly adjusted smooth jaw plier wrench (JS PN 64119) to connect lance to pressure source and nozzle onto lance. Apply wrench on lance and fitting **directly behind end fitting thread (not on fitting ferrule or collar)** when installing nozzle on lance. Do not clamp on the lance hose itself with vise when installing nozzle.
11. Avoid rough handling, stretching or straining of lance.
12. Never attempt to "ramrod" flex lance through blockages or to repair or recouple lances.

13. After use, drain, coil and store lance properly. Be sure safety tags remain intact.

RIGID TUBE CLEANING LANCES

- 1. Read General Safety** section and Nozzle Safety Warnings prior to connecting rigid lances.
2. Do not use a rigid lance with a burst rating less than 3.0 times the pressure at which it will operate. 10,000 psi operating pressure rigid lances must have a minimum 30,000 psi burst rating. Do not use a rigid lance that has an unknown burst or unknown manufacturer's operating pressure rating.
3. Clearance between lance and tube must be sufficient to permit the unrestricted backflow of water and debris. With tubes containing hard deposits this clearance should be 1/8" minimum on the diameter (or 1/16" per side) of the lance. With tubes containing soft, pliable deposits this clearance should be greater. Insufficient side clearance may cause lance to blow back toward operator.
4. Be sure nozzle, lance and adapter thread sizes are compatible before installing nozzle and adapter on lance. Do not use a rigid lance that has damaged or missing threads.
5. Use wrench flats (when available) or a properly adjusted smooth jaw plier wrench (JS PN 64119) to connect lance. Do not use pipe wrench as wrench marks will cause high pressure components to crack and fail.
6. A rigid lance over 4 ft long requires two men for support and safe operation. Operator at tube should use a foot control gun so he can instantly relieve system pressure in case of emergency.
7. When using and moving lance, support it in a manner to avoid stress and possible breakage at inlet end connection.
8. Never "ramrod" lance into tube blockage.
9. Transport and store lances in tubes or racks to avoid bending, corrosion or other damage. Damaged lances (bends, mars) should be removed from service.

HIGH PRESSURE FITTINGS

1. **Read General Safety** section prior to installing fittings in system.
2. Use non-brass or non-cast iron fittings which are made for high pressure waterblast use.
3. Use only high pressure fittings which are clearly marked with the operating pressure.
4. High pressure fittings should have a known burst rating of not less than 3.0 times system operating pressure. Never use a damaged or corroded fitting or one with damaged or missing threads.
5. Use only high pressure rated fittings and hose in the waterblast system. For 10,000 psi waterblast service all fittings and hose should have a minimum burst rating of 25,000 psi; for 15,000 psi service they should have a minimum burst rating of 37,500 psi; for 20,000 psi service they should have a minimum burst rating of 50,000 psi.
6. Use wrench flats (when available) or a properly adjusted smooth jaw plier wrench (JS PN 64119) to tighten fittings. Avoid using pipe wrench as wrench marks will cause high pressure fittings to crack and fail.

REPLACEMENT PARTS

1. **Read General Safety** section prior to repairing equipment and installing replacement parts.
2. Only trained persons should be authorized to perform maintenance or repairs to equipment.
3. Read and follow all manufacturer's repair instructions. All tool, torque, clearance and lubrication recommendations should be followed.
4. During replacement of any part, inspect mating part for wear and replace if necessary.
5. Do not attempt to install or use a part whose dimensions, clearances, function or use are suspect.
6. Test repaired equipment carefully and thoroughly before putting it into service. Do not put any piece of repaired equipment into service if its performance is questionable. If repaired equipment performance is questionable, call manufacturer of repair parts for assistance.

This section concludes all the same information included in the yellow JETSTREAM SAFETY WARNING pamphlet (PI-082).

SECTION 2: PRODUCT DESCRIPTION

The 4" J-Force™ Gen III is a self-powered rotating nozzle that uses up to 8 JS2 or P2TCS nozzles.

The 4" J-Force Gen III has many features, including:

- Spins on a film of high pressure water and has no ball bearings to replace. No oil or grease is needed for lubrication.
- Comes equipped with an eddy-current braking system which controls rotation speed for maximum cleaning power and minimum wear.
- Completely field repairable (in less than 5 minutes)
- 10° forward, 45° forward, 100° radial, 135° rearward nozzle angles
- Designed to easily navigate and clean 4" pipes with 90° bends.

⚠ WARNING This system contains several high-energy, rare-earth magnets that produce a magnetic field. Persons with a pacemaker or other electronic medical device must use extreme caution when handling or in close proximity. It is recommended that a minimum distance of 6 inches (152mm) be maintained at all times between the J-Force and any electronic medical devices.

⚠ CAUTION The use of gloves is recommended when handling the tool after operation as the body may reach temperatures greater than 200°F.

Product Specifications

Model Name	JF4X15	JF4X22
Maximum Operating Pressure (psi)	15,000	22,000
Minimum Operating Pressure (psi)	2,500	
Maximum Flow (gpm)	40	
Maximum Operating Pressure (bar)	1000	1550
Minimum Operating Pressure (bar)	170	
Maximum Flow (l/min)	150	
Inlet Connection	3/8" NPT	3/4" Type M 9/16" MP LH/RH
Tube or Pipe I.D. (in)	4	
Tube or Pipe I.D. (mm)	102	
Speed Range (rpm)	1000 - 2000	
Nozzle Types Accepted	JS2, P2TCS	
Nozzle Pattern	2 @ 10°, 2 @ 45°, 2 @ 100°, 2 @ 135°	
Diameter (in)	2.75	
Length (in)	3.85	
Weight (lbs)	3.85	3.90
Diameter (mm)	70	
Length (mm)	98	
Weight (kg)	1.75	1.77

SECTION 3: PREPARATION FOR USE

3.0 The 4" J-Force Gen III is mounted to a flexible rubber waterblast hose that allows it to navigate 4" pipes with bends up to 90°.

3.1 Before use, disassemble the 4" J-Force Gen III and inspect the mandrel and bushing for wear, damage, o-ring condition, etc. and repair or rebuild as necessary.

3.2 Clean the 4" J-Force Gen III by wiping internal components using a soft cloth and a water dispersing lubricant like WD-40.

3.3 See Flow Charts in Appendix C to choose nozzle configuration, flow rate, and desired operating pressure. The 4" J-Force Gen III is equipped with two forward-facing ports at 10°, two forward-facing ports at 45°, two radial ports at 100°, and two rearward-facing ports at 135°. Choose the nozzle configuration based on the type of cleaning application and desired operating pressure and flow.

SECTION 4: SETUP

4.0 CONNECTING 4" J-FORCE GEN III

Prior to installing the 4" J-Force Gen III onto the hose, flush the system to clear any debris.

For 22,000 psi operation (3/4" Type M Male, 9/16"MP LH/RH Inlet)

1. Apply anti-seize compound to the threads of the Type M connection or to the male 9/16"MP hose/lance end.
2. Install the JF4X22 and tighten to 90 lb-ft.

For 15,000 psi operation (NPT Female Inlet)

1. Apply 3-4 wraps of Teflon thread sealant tape to the male NPT hose end.
2. Apply anti-seize compound over the sealant tape for protection against galling in connection threads.
3. Tighten the connection 1-1/2 to 2 turns past hand tight. All NPT pipe connections should have a minimum thread engagement of 4 threads.

4.1 Prior to installing nozzles in the 4" J-Force Gen III, turn on the pump and run at low pressure to flush debris from the system. Refer to nozzle charts in Appendix C to select the proper nozzle configuration for your application.

NOTE: Nozzle configurations must be carefully selected to ensure that they provide the necessary pull and torque. If a non-standard configuration is required, contact a Jetstream representative to verify that it is safe and that the tool will function properly.

4.2 An anti-withdrawal device (backout preventer) should be used to prevent the tool from accidentally exiting the pipe under high pressure. Hose restraints (whip checks) should be used at all high pressure hose connections including the fluid end discharge. See Appendix B for a list of backout preventers.

4.3 Contact Jetstream representative for assistance.

SECTION 5: OPERATION

5.0 OPERATING J-FORCE

As per the WJTA-IMCA Recommended Practices, all operators shall follow the OSHA regulations for personal protective equipment. (OSHA guidelines for Personal Protective Equipment are available in document number 3151-12R 2004, which can be obtained from www.osha.gov.) All operators shall be issued suitable head protection, eye protection, hearing protection, body protection, hand and foot protection and respiratory protection (if needed). For detailed specifications on all protections required, refer to the WJTA-IMCA 'Recommended Practices for the Use of High Pressure Waterjetting Equipment' Section 6, Protective Equipment For Personnel.

⚠ CAUTION The 4" J-Force Gen III can be used for minimum service temperature of -20°C (-4°F) and a maximum service temperature of 115°C (240°F). Use at lower or higher than recommended temperatures may result in premature o-ring seal failure.

5.1 Start by slowly increasing pressure to 500 psi and check the entire system, including all connections, for leaks. Increase pressure in increments, pausing at each to inspect system for leaks, proper rotation of tool, temperature, and other operational anomalies. If any problems are discovered, lower pressure back to zero and turn off source of power before making any adjustments.

5.2 During operation, it is normal for water to leak out of the front of the head from around the front nozzle (or front plug). This leak-by water comes from the water-bearing that the tool operates on.

5.3 When removing the JF4X22 nozzle with the 3/4" Type M male hose connection (PN 67030) from the hose, the Type M Adapter may unscrew from the inlet nut (PN 65922) and stick in the hose end. The Type M Adapter (PN 65923) has a 3/16" internal hex cutout that allows an allen wrench or hex key to be used to remove the adapter from the hose end. Using a wrench on the external threads of the adapter will damage the threads.

SECTION 6: SERVICE

JF4X15 (PN 67029) & JF4X22 (PN 67030, 67031, 67032)

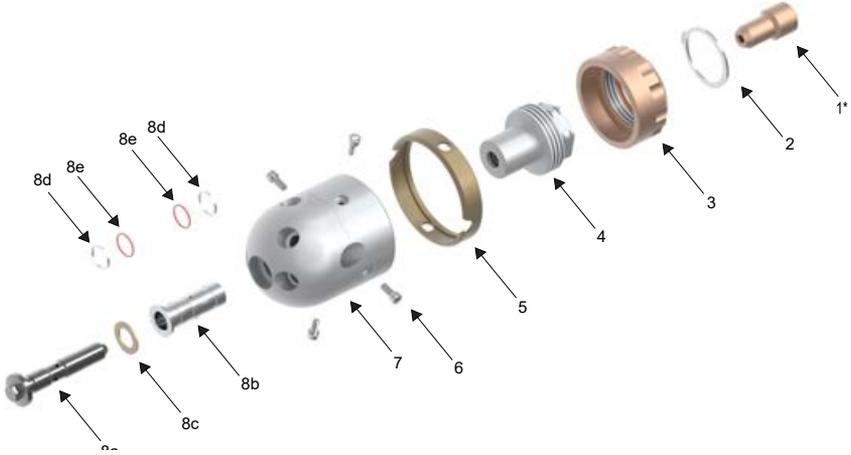


Figure A

Item	Qty	Part Number	Description
1	1	65923	Adapter, 3/4 Type M (ONLY used in 67030)
2	1	64864	Retaining Ring
3	1	64007	Brake Adjuster
4	1	65906	Inlet Nut (Assy 67029 - 3/8 NPT)
		65922	Inlet Nut (Assy 67030 - 3/4 Type M)
		65921	Inlet Nut (Assy 67031 - 9/16 MP LH)
		65919	Inlet Nut (Assy 67032 - 9/16 MP RH)
5	1	64103	Wear Ring
6	4	66220	Wear Ring Screws
7	1	67028	Head Assembly
8a-8e	1	66248	Rebuild Kit
8a	1	66336	Mandrel
8b	1	52349	Flange Bushing
8c	1	64100	Thrust Bearing
8d	2	52683	Backup Ring, Bushing
8e	2	26760	O-ring, Bushing

NOTE: Part numbers & descriptions subject to change without notice.

6.0 4" J-FORCE GEN III MAINTENANCE

When not in use, the 4" J-Force Gen III should be cleaned to remove any debris, deposits, or contaminants that could impede rotation, and sprayed with water-dispersing lubricant (e.g. WD-40) for storage until next use.

The 4" J-Force Gen III utilizes water-bearing technology coupled with an eddy-current braking system to control the rotation speed. No oil is required, allowing for a quick and pain-free rebuild of the tool.

See YouTube for videos showing the 4" J-Force Gen III.

 **YouTube** <https://www.youtube.com/user/JetstreamWaterblast>

⚠ CAUTION The use of gloves is recommended when handling the tool after operation as the body may reach temperatures greater than 200:F.

6.1 DISASSEMBLY FOR MAINTENANCE (See Figure A)

1. While holding the inlet nut (4) stationary in a vice or with a 1-1/4" wrench, unscrew the mandrel (8a) by turning it counterclockwise with a 3/8" socket wrench.
2. Once the mandrel is unthreaded from the inlet nut, the inlet nut and adjuster (3) will separate from the head assembly (7). Once the magnets in the back of the head assembly are exposed, take care to protect them from mechanical damage. The magnets are fragile and will crack upon any significant impact.
3. Remove the mandrel (8a) and thrust bearing (8c) from the head assembly (7).
4. Remove the flange bushing (8b) from the head assembly (7) by pushing it out from the back side. The bushing removal tool (PN 67013) may be used to make contact with the back edge of the flange bushing to push it out, as shown below. Note orientation of tool.



6.2 ASSEMBLY (See Figure A)

1. Ensure the new mandrel (8a), flange bushing (8b), and head assembly (7) are clean.
2. Install new o-rings (8e) and backup rings (8d) onto the flange bushing (8b). Apply a light coat of o-ring lube to o-rings to reduce friction and ease installation. See Figure B for proper orientation of o-rings when installed.



Figure B

3. Wet o-rings (8e) on the flange bushing (8b) very lightly with water or grease. Slide the flange bushing (8b) into the head assembly (7) from the front side.
4. Thread the adjuster (3) onto the inlet nut (4) until the inlet nut (4) seats fully into the adjuster (3).
5. Insert the assembled adjuster and inlet nut into the back of the head assembly. The adjuster (3) should slide in easily without binding between the OD of the magnet ring and ID of the groove in the head.
6. Insert the thrust bearing (8c) into the front bore of the head assembly (7) so that it sits flat against the flange of the flange bushing (8b).
7. Apply Loctite 242 Blue Medium-Strength Threadlocker to the thread at the end of the mandrel (8a). Hold the inlet nut (4) hex stationary in a vice or with a 1-1/4" wrench and push the mandrel (8a) through the flange bushing (8b) into the inlet nut (4). Use a 3/8" socket wrench to torque to approximately 30 lb-ft.
8. Slide the wear ring (5) onto the head assembly (7) with the nozzle installation clearance cutouts facing the front end of the head assembly. Attach the wear ring (5) to the head assembly (7) by rotating the wear ring (5) so that the holes in the wear ring (5) line up with the holes in the head assembly (7) and threading the wear ring screws (6) into the head assembly (7).
9. Use retaining ring pliers to install the retaining ring (1) into the groove closest to the adjuster (3) on the inlet nut (4).

SECTION 7: TROUBLESHOOTING

7.0 4" J-FORCE GEN III TROUBLESHOOTING

Problem	Possible Cause	Remedy
Will not spin	Nozzles worn, plugged, or wrong size	Replace nozzles
	O-ring / backup ring failure	Replace o-rings / backup rings
	Galling between mandrel and flange bushing	Replace damaged components (rebuild kit)
	Debris	Clean*
Spins slowly	Incorrect nozzle size or worn nozzles	Replace nozzles
	Debris	Clean*
Low pressure	Nozzles worn, plugged, or wrong size	Replace nozzles
	O-ring / backup ring failure	Replace o-rings / backup rings
	Connections not tight, leak	Find and repair leak
Low Pull	Nozzles worn, plugged, or wrong size	Replace Nozzles
Type M Adapter stuck in hose end	--	See Section 5.3

* To clean the J-Force follow 6.1 DISASSEMBLY FOR MAINTENANCE. If the mandrel and bushing surfaces are free from high spots and major scratches during inspection and cleaning, and the problem is not resolved, the parts must be replaced. Reassemble according to 6.2 ASSEMBLY..

APPENDIX A

Exploded Views

JF4X15 (PN 67029) & JF4X22 (PN 67030, 67031, 67032)

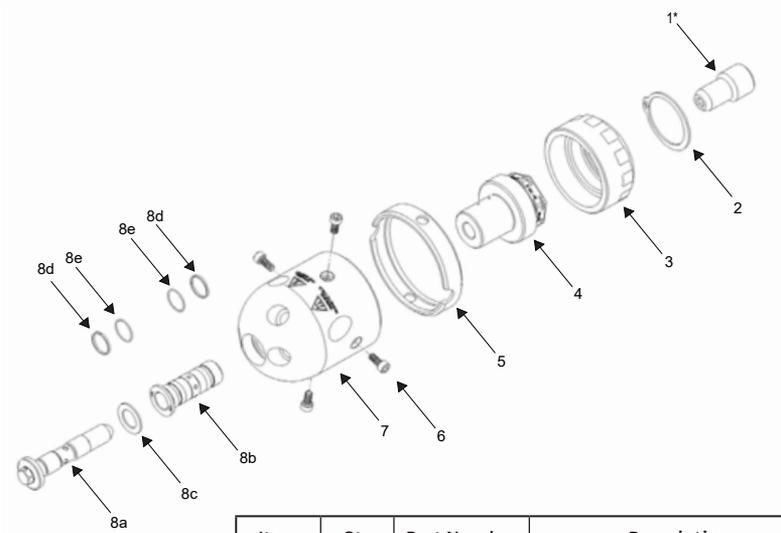


Figure C

Item	Qty	Part Number	Description
1	1	65923	Adapter, 3/4 Type M (ONLY used in 67030)
2	1	64864	Retaining Ring
3	1	64007	Brake Adjuster
4	1	65906	Inlet Nut (Assy 67029 - 3/8 NPT)
		65922	Inlet Nut (Assy 67030 - 3/4 Type M)
		65921	Inlet Nut (Assy 67031 - 9/16 MP LH)
		65919	Inlet Nut (Assy 67032 - 9/16 MP RH)
5	1	64103	Wear Ring
6	4	66220	Wear Ring Screws
7	1	67028	Head Assembly
8a-8e	1	66248	Rebuild Kit
8a	1	66336	Mandrel
8b	1	52349	Flange Bushing
8c	1	64100	Thrust Bearing
8d	2	52683	Backup Ring, Bushing
8e	2	26760	O-ring, Bushing

NOTE: Part numbers & descriptions subject to change without notice.

Parts Placement

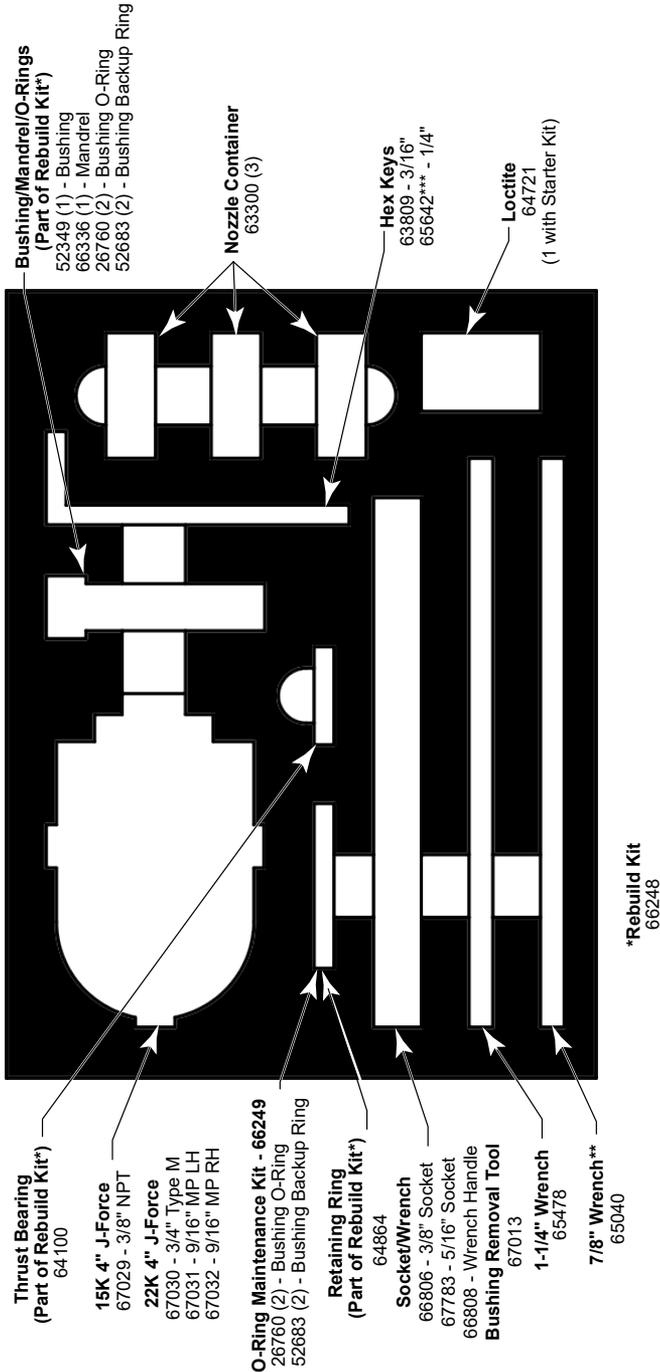


Figure D

KIT PN	TOOL PN	INLET CONNECTION	KIT TYPE	MAX PSI
67627	67029	3/8" NPT	STARTER	15K
67628	67029	3/8" NPT	PREMIUM	15K
67629	67030	3/4" TYPE M Male	STARTER	22K
67630	67030	3/4" TYPE M Male	PREMIUM	22K
67631	67031	9/16" MP Tube LH	STARTER	22K
67632	67031	9/16" MP Tube LH	PREMIUM	22K
67633	67032	9/16" MP Tube RH	STARTER	22K
67634	67032	9/16" MP Tube RH	PREMIUM	22K

* Items part of Rebuild Kit PN 66248 (Premium Kits only)

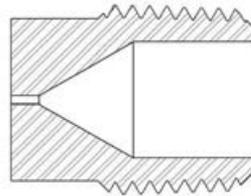
** Items only part of NPT kits

*** Items only part of Type M kits

APPENDIX B

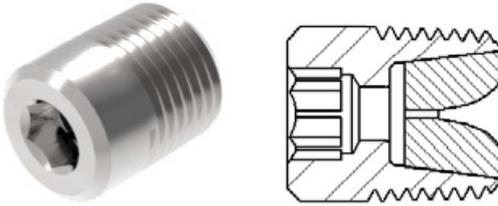
Accessories

JS2 Nozzles/Plug



- Low profile design for unobstructed pipe cleaning
- Stainless steel, corrosion-resistant
- Precision-drilled orifice
- Tapered geometry provides highly cohesive, distortion-free waterjets for concentrated, work saving cleaning and cutting power
- Straight (0°) pattern
- 1/8" NPT male connection

P2TCS Nozzles



- Low profile design for unobstructed pipe cleaning
- Tungsten carbide orifice inserts significantly outlast conventional nozzle orifice material
- Tapered geometry provides highly cohesive, distortion-free waterjets for concentrated, work savings cleaning and cutting power
- Straight (0°) pattern
- 1/8" NPT male connection

Backout Preventer



- Prevents nozzle from exiting pipe
- 4" - 8" (100-200mm) pipes
- Includes clamp for securing backout preventer to pipe
- Diameter of nozzle must be at least 1-1/2" (38mm)

Bushing Removal Tool (PN 67013)



- Aids in bushing removal during rebuild

APPENDIX C

Flow Charts



4" J-Force, Polisher (Forward Nozzles Plugged)									
Flow (gpm)	2500 psi			5000 psi			7500 psi		
	Pull (lbf)	Side x 2	Rear x 2	Pull (lbf)	Side x 2	Rear x 2	Pull (lbf)	Side x 2	Rear x 2
13							-28	0.020	0.042
14							-26	0.032	0.038
15				-25	0.035	0.047	-35	0.022	0.047
16				-30	0.032	0.052	-27	0.038	0.038
17				-34	0.026	0.057	-42	0.020	0.052
18				-35	0.032	0.057	-43	0.026	0.052
19	-26	0.042	0.069	-41	0.022	0.063	-44	0.029	0.052
20	-27	0.047	0.069	-42	0.029	0.063	-51	0.024	0.057
21	-35	0.024	0.082	-42	0.032	0.063	-40	0.042	0.047
22	-35	0.032	0.082	-49	0.022	0.069	-53	0.032	0.057
23	-28	0.057	0.069	-50	0.029	0.069	-41	0.047	0.047
24	-41	0.018	0.090	-50	0.032	0.069	-62	0.026	0.063
25	-29	0.063	0.069	-58	0.020	0.075	-27	0.063	0.029
26	-42	0.032	0.090	-58	0.026	0.075	-39	0.057	0.042
27	-30	0.069	0.069	-29	0.069	0.042	-33	0.063	0.035
28	-43	0.042	0.090	-60	0.035	0.075	-57	0.047	0.057
29	-49	0.026	0.098	-60	0.038	0.075	-41	0.063	0.042
30	-50	0.032	0.098	-61	0.042	0.075	-26	0.075	0.018
31	-50	0.038	0.098	-25	0.082	0.029	-28	0.075	0.022
32	-45	0.057	0.090	-50	0.063	0.063	-31	0.075	0.026
33	-57	0.022	0.106	-31	0.082	0.038	-44	0.069	0.042
34	-46	0.063	0.090	-41	0.075	0.052	-55	0.063	0.052
35	-58	0.035	0.106	-58	0.063	0.069	-51	0.069	0.047
36	-52	0.057	0.098	-39	0.082	0.047	-32	0.082	0.022
37	-59	0.042	0.106	-30	0.090	0.032	-47	0.075	0.042
38	-53	0.063	0.098	-44	0.082	0.052			
39	-60	0.052	0.106	-54	0.075	0.063			

4" J-Force, Polisher (Forward Nozzles Plugged)									
Flow (gpm)	10000 psi			12500 psi			15000 psi		
	Pull (lbf)			Pull (lbf)			Pull (lbf)		
		Side x 2	Rear x 2		Side x 2	Rear x 2		Side x 2	Rear x 2
11				-28	0.018	0.032	-28	0.018	0.029
12	-27	0.022	0.035	-29	0.022	0.032	-29	0.022	0.029
13	-28	0.026	0.035	-33	0.020	0.035	-34	0.020	0.032
14	-29	0.029	0.035	-34	0.024	0.035	-35	0.024	0.032
15	-38	0.022	0.042	-40	0.024	0.038	-46	0.018	0.038
16	-39	0.026	0.042	-47	0.020	0.042	-42	0.026	0.035
17	-46	0.020	0.047	-30	0.038	0.029	-38	0.032	0.032
18	-29	0.042	0.032	-43	0.032	0.038	-56	0.020	0.042
19	-42	0.035	0.042	-58	0.020	0.047	-57	0.024	0.042
20	-57	0.022	0.052	-59	0.024	0.047	-26	0.047	0.018
21	-58	0.026	0.052	-52	0.035	0.042	-53	0.035	0.038
22	-59	0.029	0.052	-27	0.052	0.020	-44	0.042	0.032
23	-26	0.057	0.022	-31	0.052	0.024	-50	0.042	0.035
24	-30	0.057	0.026	-44	0.047	0.035	-32	0.052	0.020
25	-62	0.038	0.052	-30	0.057	0.020	-37	0.052	0.024
26	-37	0.057	0.032	-35	0.057	0.024	-53	0.047	0.035
27	-41	0.057	0.035	-58	0.047	0.042	-45	0.052	0.029
28	-45	0.057	0.038	-53	0.052	0.038	-51	0.052	0.032
29	-58	0.052	0.047	-33	0.063	0.018			
30	-52	0.057	0.042	-37	0.063	0.022			
31	-33	0.069	0.022						
32	-49	0.063	0.038						
33	-40	0.069	0.029						

4" J-Force, Polisher (Forward Nozzles Plugged)									
Flow (gpm)	17500 psi			20000 psi			22000 psi		
	Pull (lbf)			Pull (lbf)			Pull (lbf)		
		Side x 2	Rear x 2		Side x 2	Rear x 2		Side x 2	Rear x 2
11	-27	0.018	0.026	-26	0.018	0.024	-26	0.020	0.022
12	-25	0.024	0.024	-28	0.022	0.024	-30	0.020	0.024
13	-34	0.022	0.029	-32	0.022	0.026	-34	0.020	0.026
14	-39	0.020	0.032	-39	0.022	0.029	-42	0.020	0.029
15	-41	0.024	0.032	-45	0.020	0.032	-49	0.018	0.032
16	-47	0.022	0.035	-47	0.024	0.032	-51	0.022	0.032
17	-43	0.029	0.032	-48	0.026	0.032	-52	0.024	0.032
18	-56	0.024	0.038	-62	0.020	0.038	-59	0.022	0.035
19	-29	0.042	0.020	-63	0.022	0.038	-54	0.029	0.032
20	-58	0.029	0.038	-65	0.026	0.038	-41	0.038	0.024
21	-54	0.035	0.035	-37	0.042	0.022	-46	0.038	0.026
22	-45	0.042	0.029	-41	0.042	0.024	-41	0.042	0.022
23	-36	0.047	0.022	-55	0.038	0.032	-45	0.042	0.024
24	-43	0.047	0.026	-51	0.042	0.029	-61	0.038	0.032
25	-58	0.042	0.035	-45	0.047	0.024			
26	-37	0.052	0.020						
27	-40	0.052	0.022						



Flow (gpm)	4" J-Force, Unpluggler (Side Nozzles Plugged)															
	2500 psi					5000 psi					7500 psi					
	Pull (lbf)	Fwd (10) x 2	Fwd (45) x 2	Rear x 2	Pull (lbf)	Fwd (10) x 2	Fwd (45) x 2	Rear x 2	Pull (lbf)	Fwd (10) x 2	Fwd (45) x 2	Rear x 2	Pull (lbf)	Fwd (10) x 2	Fwd (45) x 2	Rear x 2
18													-29	0.018	0.018	0.052
19													-26	0.022	0.018	0.052
20					-30	0.020	0.020	0.063					-25	0.018	0.024	0.052
21	-30	0.018	0.018	0.082	-28	0.022	0.022	0.063					-36	0.020	0.018	0.057
22	-28	0.022	0.022	0.082	-25	0.024	0.026	0.063					-32	0.022	0.022	0.057
23	-26	0.026	0.026	0.082	-38	0.020	0.020	0.069					-28	0.024	0.024	0.057
24	-25	0.022	0.032	0.082	-36	0.022	0.022	0.069					-48	0.018	0.018	0.063
25	-37	0.018	0.018	0.090	-33	0.026	0.024	0.069					-44	0.022	0.020	0.063
26	-35	0.022	0.022	0.090	-49	0.018	0.018	0.075					-40	0.024	0.022	0.063
27	-33	0.026	0.026	0.090	-45	0.022	0.022	0.075					-37	0.026	0.024	0.063
28	-31	0.029	0.029	0.090	-43	0.024	0.024	0.075					-59	0.020	0.018	0.069
29	-28	0.032	0.032	0.090	-39	0.029	0.024	0.075					-27	0.035	0.022	0.063
30	-26	0.035	0.035	0.090	-36	0.029	0.029	0.075					-51	0.024	0.024	0.069
31	-40	0.026	0.026	0.098	-57	0.022	0.020	0.082					-47	0.026	0.026	0.069
32	-38	0.029	0.029	0.098	-54	0.024	0.024	0.082					-44	0.029	0.026	0.069
33	-36	0.032	0.032	0.098	-27	0.035	0.035	0.075					-39	0.035	0.022	0.069
34	-52	0.020	0.020	0.106	-47	0.029	0.029	0.082					-64	0.024	0.024	0.075
35	-31	0.038	0.038	0.098	-44	0.035	0.026	0.082					-60	0.029	0.022	0.075
36	-46	0.029	0.029	0.106	-40	0.035	0.032	0.082					-57	0.029	0.026	0.075
37	-27	0.042	0.042	0.098	-38	0.035	0.035	0.082					-50	0.035	0.024	0.075
38	-42	0.035	0.035	0.106	-65	0.029	0.022	0.090					-46	0.038	0.024	0.075
39	-62	0.020	0.020	0.115	-31	0.042	0.035	0.082					-42	0.042	0.020	0.075
40	-61	0.022	0.022	0.115	-28	0.042	0.038	0.082					-39	0.042	0.024	0.075

4" J-Force, Unplugged (Side Nozzles Plugged)																			
Flow (gpm)	10000 psi						12500 psi						15000 psi						
	Pull (lbf)	Fwd (10) x 2		Fwd (45) x 2		Rear x 2	Pull (lbf)	Fwd (10) x 2		Fwd (45) x 2		Rear x 2	Pull (lbf)	Fwd (10) x 2		Fwd (45) x 2		Rear x 2	
18	-29	0.018	0.018	0.018	0.018	0.047													
19	-25	0.020	0.020	0.020	0.020	0.047													
20																			
21	-39	0.018	0.018	0.018	0.018	0.052	-33	0.020	0.018	0.018	0.047		-27	0.020	0.018	0.018	0.042		
22	-34	0.022	0.018	0.018	0.018	0.052	-29	0.022	0.020	0.020	0.047								
23	-29	0.024	0.022	0.022	0.018	0.052	-48	0.018	0.018	0.018	0.052		-40	0.020	0.018	0.018	0.047		
24	-50	0.018	0.018	0.018	0.018	0.057	-44	0.020	0.020	0.020	0.052		-34	0.022	0.020	0.020	0.047		
25	-44	0.022	0.020	0.020	0.020	0.057	-39	0.022	0.022	0.022	0.052		-28	0.024	0.022	0.022	0.047		
26	-39	0.024	0.022	0.022	0.024	0.057	-34	0.026	0.020	0.020	0.052		-55	0.020	0.018	0.018	0.052		
27	-35	0.026	0.024	0.024	0.024	0.057	-30	0.026	0.024	0.024	0.052		-49	0.022	0.020	0.020	0.052		
28	-30	0.029	0.024	0.024	0.024	0.057	-55	0.022	0.020	0.020	0.057		-43	0.026	0.018	0.018	0.052		
29	-58	0.022	0.020	0.020	0.020	0.063	-49	0.024	0.024	0.022	0.057		-40	0.024	0.024	0.024	0.052		
30	-54	0.024	0.022	0.022	0.024	0.063	-44	0.026	0.024	0.024	0.057		-32	0.029	0.022	0.022	0.052		
31	-49	0.026	0.024	0.024	0.024	0.063	-41	0.026	0.026	0.026	0.057		-26	0.029	0.026	0.026	0.052		
32	-45	0.029	0.024	0.024	0.024	0.063	-35	0.029	0.029	0.026	0.057								
33	-40	0.032	0.024	0.024	0.024	0.063	-29	0.032	0.032	0.026	0.057								
34	-34	0.035	0.024	0.024	0.024	0.063	-26	0.029	0.032	0.032	0.057								
35	-28	0.038	0.024	0.024	0.024	0.063													
36	-61	0.029	0.024	0.024	0.024	0.069													
37	-55	0.032	0.024	0.024	0.024	0.069													
38	-49	0.038	0.018	0.018	0.018	0.069													
39	-46	0.038	0.022	0.022	0.022	0.069													
40	-40	0.042	0.018	0.018	0.018	0.069													

4" J-Force, Unplugging (Side Nozzles Plugged)												
17500 psi					20000 psi					22000 psi		
Flow (gpm)	Pull (lbf)	Pull (lbf)		Rear x 2	Fwd (10) x 2	Fwd (45) x 2	Rear x 2	Fwd (10) x 2	Fwd (45) x 2	Rear x 2	Pull (lbf)	
		Fwd (10) x 2	Fwd (45) x 2								Fwd (10) x 2	Fwd (45) x 2
20					0.018	0.018	0.038	0.018	0.018	0.038		
21	-35	0.018	0.018	0.042							-27	-30
22	-28	0.020	0.020	0.042	0.018	0.018	0.042	0.018	0.018	0.042	-40	-26
23	-25	0.020	0.022	0.042	0.020	0.018	0.042	0.020	0.018	0.042	-36	-44
24	-50	0.018	0.018	0.047	0.022	0.020	0.042	0.022	0.020	0.042	-28	-39
25	-44	0.020	0.020	0.047	0.018	0.026	0.042	0.018	0.026	0.042	-26	-34
26	-37	0.022	0.022	0.047	0.018	0.018	0.047	0.018	0.018	0.047	-58	-27
27	-32	0.024	0.022	0.047	0.020	0.020	0.047	0.020	0.020	0.047	-50	
28	-64	0.020	0.018	0.052	0.022	0.022	0.047	0.022	0.022	0.047	-42	
29	-60	0.022	0.018	0.052	0.026	0.020	0.047	0.026	0.020	0.047	-35	
30	-51	0.026	0.018	0.052	0.029	0.020	0.047	0.029	0.020	0.047	-26	



Flow (gpm)	2500 psi				5000 psi				7500 psi			
	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)	
		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2
21				-33	0.018	0.063	-28	0.020	0.052			
22	-30	0.018	0.082	-31	0.020	0.063	-39	0.018	0.057			
23	-29	0.020	0.082	-29	0.022	0.063	-36	0.020	0.057			
24	-28	0.024	0.082	-27	0.024	0.063	-33	0.022	0.057			
25	-27	0.026	0.082	-25	0.026	0.063	-49	0.018	0.063			
26	-37	0.018	0.090	-37	0.022	0.069	-30	0.024	0.057			
27	-35	0.022	0.090	-35	0.024	0.069	-27	0.026	0.057			
28	-35	0.024	0.090	-33	0.026	0.069	-44	0.022	0.063			
29	-33	0.026	0.090	-46	0.022	0.075	-41	0.024	0.063			
30	-32	0.029	0.090	-44	0.024	0.075	-59	0.020	0.069			
31	-43	0.022	0.098	-42	0.026	0.075	-38	0.026	0.063			
32	-42	0.024	0.098	-25	0.032	0.069	-56	0.022	0.069			
33	-27	0.035	0.090	-57	0.022	0.082	-53	0.024	0.069			
34	-39	0.029	0.098	-55	0.024	0.082	-50	0.026	0.069			
35	-25	0.038	0.090	-34	0.032	0.075	-27	0.032	0.063			
36	-51	0.022	0.106									
37	-49	0.026	0.106	-49	0.029	0.082	-45	0.029	0.069			
38	-47	0.029	0.106	-30	0.035	0.075	-63	0.026	0.075			
39	-33	0.038	0.098	-45	0.032	0.082	-39	0.032	0.069			
40	-63	0.018	0.115									

4" J-Force, Universal										
Flow (gpm)	10000 psi				12500 psi				15000 psi	
	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		
		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2	
21	-27	0.020	0.047							
22				-38	0.018	0.047				
23	-40	0.018	0.052				-27	0.020	0.042	
24	-37	0.020	0.052	-34	0.020	0.047				
25	-33	0.022	0.052	-29	0.022	0.047	-46	0.018	0.047	
26	-51	0.018	0.057				-41	0.020	0.047	
27	-48	0.020	0.057	-46	0.020	0.052				
28	-44	0.022	0.057	-42	0.022	0.052	-35	0.022	0.047	
29				-64	0.018	0.057	-56	0.020	0.052	
30	-40	0.024	0.057	-60	0.020	0.057				
31	-36	0.026	0.057							
32	-59	0.022	0.063	-31	0.026	0.052				
34	-29	0.029	0.057							
35	-51	0.026	0.063							

4" J-Force, Universal

Flow (gpm)	17500 psi				20000 psi				22000 psi				
	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		
		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2		Fwd x 4, Side x 2	Rear x 2	
23	-38	0.018	0.042										
24										-33	0.018	0.038	
25	-32	0.020	0.042	-43	0.018	0.042	-26	0.020	0.038				
26										-47	0.018	0.042	
27	-26	0.022	0.042	-36	0.020	0.042							
28	-48	0.020	0.047										



4" J-Force, Puller (Rear Jets)									
Flow (gpm)	2500 psi			5000 psi			7500 psi		
	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)	
		Front, Fwd x 2, Side x 2	Rear x 2		Front, Fwd x 2, Side x 2	Rear x 2		Front, Fwd x 2, Side x 2	Rear x 2
13								Plug	0.047
14				-33	Plug	0.057			
15							-41	Plug	0.052
17				-40	Plug	0.063			
18							-49	Plug	0.057
20	-33	Plug	0.082	-48	Plug	0.069			
21							-60	Plug	0.063
23	-41	Plug	0.090						
24				-57	Plug	0.075			
27	-48	Plug	0.098						
32	-56	Plug	0.106						

4" J-Force, Puller (Rear Jets)													
		10000 psi				12500 psi				15000 psi			
Flow (gpm)	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		
		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2	
12	-35	Plug	0.042	-36	Plug	0.038	-37	Plug	0.035	-44	Plug	0.038	
13				-44	Plug	0.042				-53	Plug	0.042	
14													
15	-44	Plug	0.047	-55	Plug	0.047							
17	-54	Plug	0.052										

4" J-Force, Puller (Rear Jets)													
		17500 psi				20000 psi				22000 psi			
Flow (gpm)	Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		Pull (lbf)	Nozzle Diameter (inches)		
		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2		Front,Fwd x 2,Side x 2	Rear x 2	
10				-34	Plug	0.029							
11	-36	Plug	0.032	-41	Plug	0.032	-37	Plug	0.029	-45	Plug	0.032	
12				-49	Plug	0.035							
13	-43	Plug	0.035	-58	Plug	0.038	-54	Plug	0.035				
14	-51	Plug	0.038										
15													
16	-62	Plug	0.042				-64	Plug	0.038				

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WARRANTY

Limited Warranty. Each Waterblast Unit, Bareshaft Pump, and Fluid End manufactured by Jetstream is warranted against defects in material and workmanship for a period of 12 months or 1,000 hours, provided it is used in a normal and reasonable manner and in accordance with all operating instructions. If sold to an end user, the applicable warranty period commences from the date of delivery to the end user. If used for rental purposes, the applicable warranty period commences from the date of delivery to the party holding the equipment available for rent. This limited warranty may be enforced by any subsequent transferee during the warranty period. This limited warranty is the sole and exclusive warranty given by Jetstream.

Exclusive Remedy. Should any warranted product fail during the warranty period, Jetstream will cause to be repaired or replaced, as Jetstream may elect, any part or parts of such Waterblast Unit, Bareshaft Pump, or Fluid End that the examination discloses in Jetstream's sole judgment to be defective in material or factory workmanship. Repairs or replacements are to be made at Jetstream in Houston, Jetstream FS Solutions Rental Center, the customer's location, or at other locations approved by Jetstream. Labor is furnished only when the unit or part is returned to the factory or when travel and expenses are paid by the purchaser. Freight, travel and expenses incurred in connection with repair or warranty are excluded from this warranty and shall be paid by the purchaser. The foregoing remedies shall be the sole and exclusive remedies of any party making a valid warranty claim.

The Jetstream Limited Warranty shall NOT apply to (and Jetstream shall NOT be responsible for):

1. Major components or trade accessories that have a separate warranty from their original manufacturer, such as, but not limited to: diesel engines, electric motors, electronic soft starter and/or across the line starter panels, axles, PTO's, clutch packs, high pressure gauges, high pressure hoses, flex lances, etc.
2. Normal adjustments and maintenance services.
3. Normal wear parts such as, but not limited to: oil, clutches, belts, filters, packing, cartridges, univalves, face seals, diffusers, gland nut bushings, plungers, nozzles, rupture disks, etc.
4. Failures resulting from the machine being operated in a

manner or for a purpose not recommended by Jetstream including failures or malfunctions resulting from corrosion, misapplication, overpressurization, inadequate pump suction conditions, improper water quality, improper maintenance, or misuse.

5. Repairs, modifications or alterations which in Jetstream's sole judgment, have adversely affected the machine's stability, operation or reliability as originally designed and manufactured.

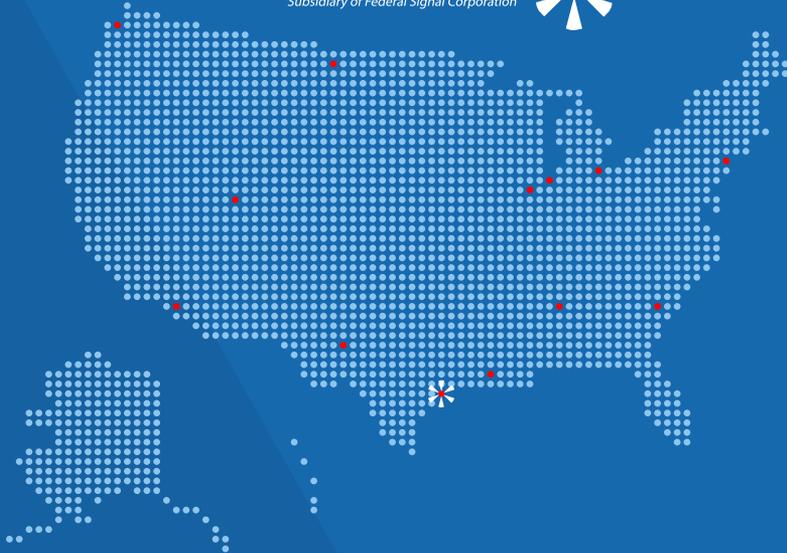
6. Items subject to misuse, negligence, accident or improper maintenance.

NOTE The use of any part other than ones approved by Jetstream may invalidate this warranty. Jetstream reserves the right to determine, in its sole discretion, if the use of non-approved parts invalidates the warranty. Nothing contained in this warranty shall make Jetstream liable for loss, injury, or damage of any kind to any person or entity resulting from any defect or failure in the machine or part.

THIS WARRANTY IS, AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE DISCLAIMED. THIS DISCLAIMER AND EXCLUSION SHALL APPLY EVEN IF ANY WARRANTY POSSIBLY ASSERTED FAILS OF ITS ESSENTIAL PURPOSE.

This warranty is in lieu of all other obligations or liabilities, contractual and otherwise, on the part of Jetstream. For the avoidance of doubt, Jetstream shall not be liable for any indirect, special, incidental or consequential damages, including, but not limited to, loss of use or lost profits. Jetstream makes no representation that the unit has the capacity to perform any functions other than as contained in Jetstream's written literature, catalogs or specifications accompanying delivery of the machine. No person or affiliated company representative is authorized to alter the terms of this warranty, to give any other warranties or to assume any other liability on behalf of Jetstream in connection with the sale, servicing or repair of any machine manufactured by Jetstream. Any legal action based hereon must be commenced within eighteen (18) months of the event or facts giving rise to such action.

Jetstream reserves the right to make design changes or improvements in its products without imposing any obligation upon itself to change or improve previously manufactured products.



Jetstream products are also serviced by FS Solutions. With 13 convenient locations across the United States, FS Solutions provides high-performance parts, accessories, Jetstream rentals, repair, rebuild and safety training.



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Application Policy

Capacity ratings, features, and specifications vary depending upon the model and type of service. Application approvals must be obtained from Jetstream; contact your representative for application approval. We reserve the right to change or modify our product specifications, configurations, or dimensions at any time without notice.