Jetstream
Subsidiary of Federal Signal Corporation

# SAFETY PAMPHLET

# ⚠ WARNING

**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, i**ncrease 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.

## CONTROL GUNS AND DEVICES

1. **Read General Safety** section before connecting or using control guns or control devices.
2. Thoroughly review alternative methods before initiating any potentially dangerous shotgunning or hand lancing operation. Fully automated, semi-automated, and/or mechanized methods should all be considered first. Contact the applicable waterblasting manufacturers for assistance and recommendations.

**WARNING:** As described in the Industry Best Practices for the Use of High Pressure Waterblasting Equipment published by the Waterjet Technology Association, the standard shotgun barrel length shall be a minimum length of 48" to minimize the risk of nozzle discharge accidentally striking the operator's feet, legs, or body. See Section 11.10.6. The WJTA has recognized that deviations or variances from these best practices may be acceptable under certain circumstances. See Section 2.7. If users believe deviation from this 48" standard is acceptable, they should follow procedures outlined in Section 2.7 to minimize risk to the operator. Among other things, users should ensure that other measures to perform the work have been considered and exhausted, senior safety management and customers have considered and approved the deviation, operators have been properly trained and warned about any increased risk associated with the deviation, and operators are wearing all appropriate PPE, including body armor rated for the operating pressure.

3. Prior to use, thoroughly check control gun or control device for smooth and proper operation. Control guns and control devices should also be checked for proper operation before each operating shift. Do not use any control gun or control device that has not been checked before your operating shift.
4. A control gun operator using a hand-held gun should position and brace his body for the gun's rearward reaction force before depressing gun trigger. Gun's rearward reaction should be a maximum force of 40 to 50 lbs (or 1/3 body weight of operator.) The control gun operator should maintain firm, solid footing to counter gun's rearward reaction.
5. The use of a Safety Shroud and a Safety Whip Hose with handheld control guns is strongly recommended for additional operator protection against a burst occurring in the high pressure hose connected to the gun. Use of Hand Grip and Shoulder Stock in hand-held control guns will provide greater operator comfort and safety.
6. Fall protection should be provided when blasting on scaffolding or sloping surface per OSHA guidelines. Do not operate a hand-held gun while standing on slippery surfaces.
7. The control gun operator should always start blasting with a low system pressure and slowly increase blasting pressure. Depress and release control gun trigger/pedal several times at operating pressure to check the control gun's operation before starting cleaning operations.
8. A dump type control gun should always open fully and reduce the system pressure to near zero immediately when its trigger/pedal is released. If this type of control gun does not relieve system pressure immediately or system pressure does not fall below 200 psi when trigger/pedal is released, do not use the control gun.
9. The control gun operator should never pass a control gun to another operator without first stopping the pump and water flow to the control gun. Passing off a control gun without first stopping system waterflow is dangerous because of possible accidental trigger actuation.
10. Do not use a control gun or control device that has malfunctioned or you suspect malfunctioned without having it repaired and/or thoroughly checked for proper operation by a qualified high pressure maintenance mechanic or your supervisor.
11. Do not use a control gun that does not have a trigger guard.
12. Never tie, wedge or clamp a control gun's trigger in the closed position.
13. All electric throttle control cords should be rated for wet conditions. All cord connections and switches should be kept out of water.
14. Any hose used for transporting dump water back to pump should have a large enough diameter and short enough length so that potentially dangerous back pressure is kept low. Protect hose from traffic.
15. Hand-operated control guns should never be used as foot-operated devices.

## 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 that 2.5 time 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 20,000 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. Read the appropriate Safety Warning (i.e. Flexible Tube Cleaning Lances or Rigid Tube Cleaning Lances) prior to installing nozzle on lance.
2. Nozzle flow ratings must be compatible with pump discharge and pump pressure rating. A flow rating is stamped on the side of JETSTREAM'S nozzles. (See Nozzle Flow Rating Chart in JETSTREAM Catalog.)
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. **For 15,000 psi models** - Apply 3 - 4 wraps of Teflon tape to male connection thread on the barrel. 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.
   **For 20,000 psi models** - Apply anti-gall compound to the gland threads and male cone on control gun front barrel. DO NOT use Teflon tape. Check blast nozzle size before installing the nozzle. Make sure the nozzle orifices are not too small in order to prevent excessive system pressure when the gun's control valve trigger/pedal is depressed.
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. Special nozzles requiring a thread locking pin must have the pin installed prior to use or the nozzle may unscrew from the lance while in service and cause the lance to blow back toward the operator.
8. With nozzles requiring adjustment, always read applicable instructions.
9. 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 control gun or lance and clean immediately.
10. **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** 22,500 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 - H***elps 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 that 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.