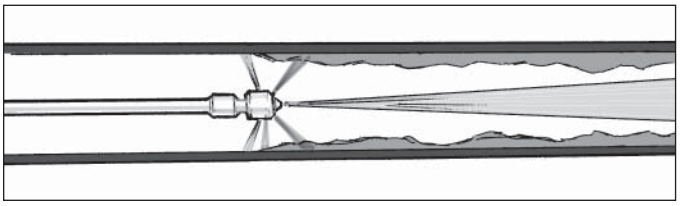
Waterjet cleaning using a flex-lance

Waterjet systems are used for cutting and cleaning in a variety of industries. This technology uses a high-pressure stream of water to blast through materials, such as residue that collects inside pipes or vessels. The stream of high-pressure water has enough power to slice through solid materials—or to damage any part of the human body.

Cleaning pipes with a flex-lance

Some pipes can be cleaned with a rigid lance made of metal tubing. However, if a pipe is long or has bends in it, a flex-lance is usually used. A flex-lance is a high-pressure hose with a cleaning head or nozzle on the end. The nozzle on a flex-lance is self-propelling. It moves forward through the pipe as the water blasts out under high pressure in different directions.



A self-propelling nozzle moves through the pipe to clean out residue.

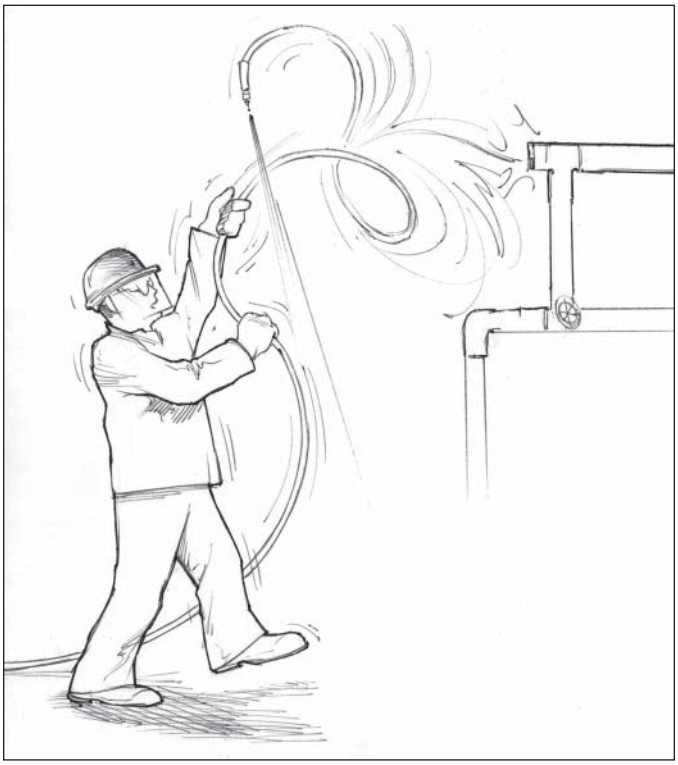
To clean the inside of a pipe, the nozzle is placed inside the pipe, where the worker cannot usually see the nozzle or the stream of high-pressure water. The worker must take extra precautions to know where the nozzle is and to prevent it from coming back out of the pipe in an uncontrolled manner.

One safe work practice is to clean the open end near the worker with a jetting gun before using a flex-lance to clean the rest of the pipe. If there is no room to use a jetting gun, consider alternatives to avoid cleaning the open end with a flex-lance. For example, it may be possible to clean this end from another opening in the pipe.

A fatal incident

In a recent incident, a worker was using a flex-lance to remove the lime residue that had accumulated inside a 3-inch diameter pipe. He was using a self-propelling nozzle with a new hose, which retained its tight coil. The pressure was approximately 18,000 psi (pounds per square inch).

The worker was withdrawing the nozzle and flex-lance from the pipe to clean out the residue that remained within a few inches of the open pipe end. As the nozzle came near the open end, he lost control of the flex-lance. The nozzle came out of the pipe, the hose recoiled, and the nozzle penetrated his upper body. His injuries were fatal.



In a recent incident the flex-hose came out of the pipe and recoiled toward the worker.

To see a slide show on this incident, go to www2.worksafebc.com/publications/multimedia/slideshows.asp

Keeping control of a flex-lance

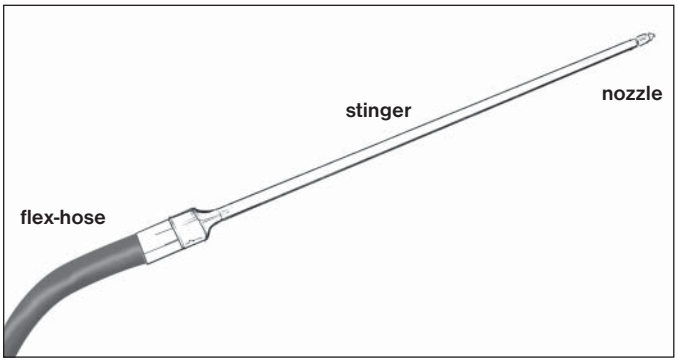
When using a flex-lance inside a pipe, the operator cannot see the nozzle. The hazard is greatest when the operator is withdrawing the flex-lance from the pipe and it approaches the open end near the worker. There are two main hazards:

- The nozzle turns around inside the pipe and sprays the operator at the open end with high-pressure water.
- The operator loses control when withdrawing the flex-lance from the pipe and the nozzle or high-pressure spray hits the operator.

The operator can have better control of the flex-lance by using, where appropriate, a stinger and a backout preventer and by following safe work practices.

Metal tube (stinger)

If the inside diameter of the pipe would allow the nozzle to turn back on itself, attach a metal connecting tube (also called a stinger or lance). A stinger is connected between the hose and the nozzle to prevent the nozzle from turning around inside the pipe and shooting out under pressure from the open end of the pipe. Stingers come in different lengths. It is recommended that the length of the stinger plus the end fitting and the nozzle be equal to 1.5 times the inside diameter of the pipe.



A stinger, or lance, is attached between the flex-hose and the nozzle.

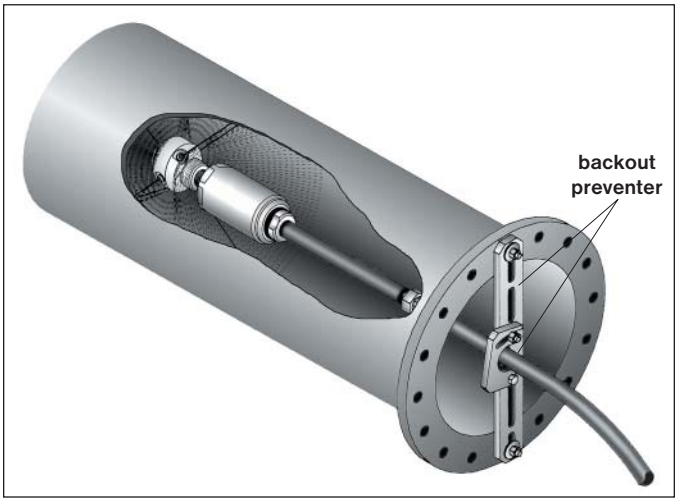
A stinger also lets the operator know where the nozzle is as the flex-lance is being withdrawn from the pipe. When the stinger is visible, the operator knows how close the nozzle is to the open end.

Backout preventer

A backout preventer provides control when the flex-lance is inside the pipe:

- It prevents the flex-lance from backing out of the pipe if the spray is uncontrolled because of a plugged orifice in the nozzle.
- It prevents the pressurized flex-lance from being inadvertently pulled out of the open end.

A backout preventer is attached to a permanent or temporary flange at the open end of the pipe. The hose, stinger, and nozzle are put into the pipe through an adjustable opening in the backout preventer before pressurization. The adjustable opening is then made smaller to allow the hose to move freely but not to allow the nozzle, hose fitting, or stinger to exit.



This type of backout preventer is attached across the diameter of the open pipe end. The opening for the hose is adjustable.

Backout preventers can be used with both large- and small-diameter pipes. They are not suitable for cleaning fixed tube bundles (heat exchangers), so alternative methods of controlling the withdrawal of the flex-lance may be needed.

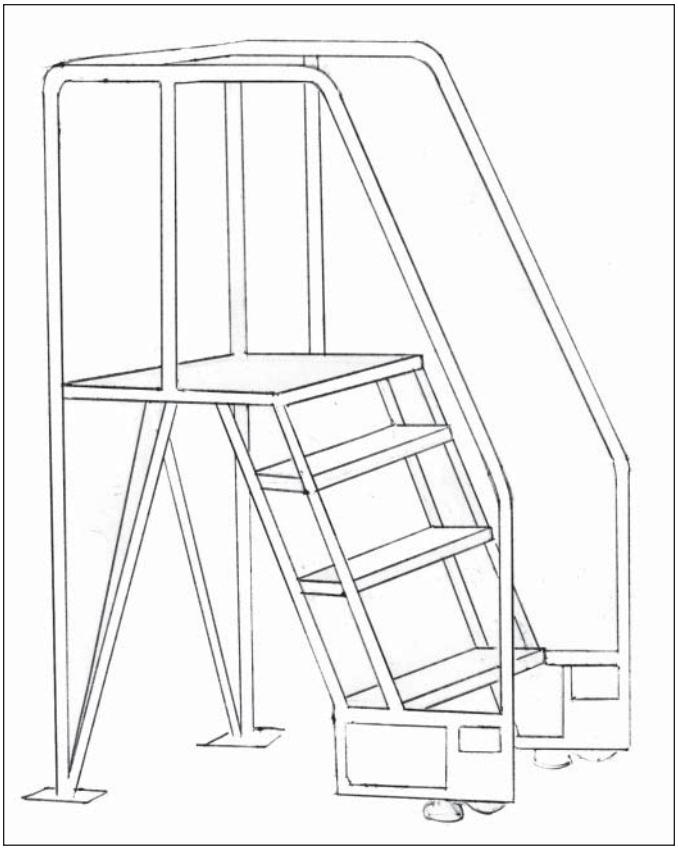
Safe work practices

The following safe work practices will help the operator maintain control of the flex-lance as it is withdrawn from the open end of the pipe:

- Place a mark on the hose about 2 feet from the nozzle end. This mark will allow the operator to know how close the nozzle is to the open end of the pipe. As the mark wears off, re-mark the hose.
- The worker operating the flex-lance must also operate the pressure-relief device (foot dump valve). The operator can react more quickly than a second worker if pressure must be decreased quickly.
- Depressurize the flex-lance before removing it from the pipe.

The operator must stand in a position that is safe and allows control of the flex-lance. Safe work practices include the following:

- Long hoses store a great deal of energy, and flex-lance hoses have a tendency to recoil. Keep the length of hose between the operator and the pipe as short as practical.
- Operate the flex-lance between foot and shoulder height only. It is difficult to control the flex-lance if it is higher than the shoulder.
- Use a work platform or scaffold to provide firm footing if the operator needs to be raised up to a safe working position. The platform must allow room for the worker to operate the foot dump valve.



It is difficult to control the flex-lance if it is higher than the operator's shoulder. A work platform can raise the operator to a safe working height and provide a firm footing.

Other requirements

This bulletin focuses on the safe use of flex-lances to clean the inside of pipes. It does not cover other topics such hazard assessment, required personal protective equipment, surface cleaning, and working in confined spaces. Waterjet operators must be trained in standard safety practices before operating the equipment. The hazards of each situation must be individually assessed and appropriate controls must be used.