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WaterJet Technology Association

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Hydrodemolition On The Rio Verde Viaduct In Italy

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See article on page 6.

2009 American WJTA Conference And Expo

August 18-20, 2009
Marriott Houston Westchase Hotel
Houston, Texas

Details and registration information are enclosed.

On the inside

Announcing The Industrial And Municipal Cleaning (IMC) Division Of The WJTA

In May 2009 the WJTA Board of Directors voted to create the Industrial and Municipal Cleaning (IMC) Division of the WJTA, a special interest group within the association for WJTA members who have an active interest in industrial cleaning.

The purpose of the IMC is to provide a more focused forum for WJTA members who are involved in industrial cleaning to communicate with each other, share ideas and knowledge, and foster closer collaboration.

IMC membership will be limited to WJTA members in good standing, and there will be no additional charge to join the special interest group.

Objectives of the group include, but are not limited to:

- Live and online workshops, meetings, webinars, and other educational programs focused on issues specific to industrial cleaning;
- Establishment and periodic review of recommended safety and operational practices;
- Representation before legislative and regulatory bodies; and
- Access to industry experts for consultation, networking, and/or troubleshooting.

Plans are underway for the first WJTA-IMC Expo to be held August 17-19, 2010, at the George R. Brown Convention Center in Houston, Texas. The Expo is a new activity that will be held during even-numbered years while the WJTA biennial conferences will continue to be held during odd-numbered years. The WJTA-IMC Expo features an expanded exhibit hall and boot camp. Research papers will not be presented at the WJTA-IMC Expo, but will be reserved for the 2011 WJTA American Waterjet Conference.

Details regarding the 2010 Expo and other plans and activities for the IMC will be available soon.

Static Electricity – The "Invisible Enemy" Of The Vacuum Truck Industry

By: *Alan R. Browne, President, Stewart R. Browne Mfg. Co., Inc., alan@srbrowne.com*

Daily fleets of vacuum trucks clean tanks, vessels, and spills of flammable chemicals and explosive powders. With each vacuuming operation the industry faces the potential of an explosion or fire caused by the "Invisible Enemy," STATIC ELECTRICITY!

Static electricity is a major cause of fires in the chemical and dust/powder industries. The personal injuries and financial losses make understanding this phenomena essential to all of us in the vacuum truck industry. Understanding the causes and proper methods of controlling static charges is essential in keeping the vacuum truck industry safe.

Regulations and standards established by NFPA77, API 12219, and OSHA 29CFR 1910.106 all lay out the strict requirements of how the problem of static electricity must be addressed before any operation in the movement of flammable chemical, powder, or dust can begin.

Static electricity, according to NFPA statistics, causes 280 fires and 780 injuries a year. Those are only the reportable accidents and don't include small flash fires and static arcs that often don't result in a reportable accident. Just the same, they are only one step from a disaster. Everyday the industrial vacuum truck industry, with its thousands of trucks, must meet the static electrical challenge.

Static electricity is generated whenever two dissimilar materials are in relative motion to each other, such as flammable chemicals moving through vacuum hoses. The faster the movement of the liquid or powder, the greater the buildup of static electricity. Thus reducing the vacuum speed would reduce the charge buildup, but is not always financially acceptable. The use of a properly installed grounding and bonding system can result in a safe method of disposing of the static charge and increasing the total safety of the operation.

First, let's understand the two terms that must be understood regarding static electrical systems. The following are their definitions:

Bonding – equalizes the potential difference between conductive

(continued on page 21)

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Charlie Underwood, Operations Manager
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Abrasion Resistant Valves In Waterjetting Applications

By: *Mike Woodward, Ph.D., Gardner Denver Water Jetting Systems, Inc.*

A.R. (Abrasion Resistant) valves were developed many years ago for use in plunger and piston style pumps to overcome the problem of reliably pumping products such as, but not limited to, drilling mud, cement and sand in oilfield pumps. In conventional metal to metal type valves and seats the solid particles in the pumped fluid would both stop the valves from fully closing, causing a reduction in pump efficiency and uneven running. This would lead to rapid deterioration of the valves and seats due to erosion, thereby requiring frequent replacement.

The solution to this problem lay in the development of the A.R. style of valves. The A.R. valve has an elastomeric member inserted into it during manufacturing. On closing against a valve seat where particulate matter is present in the pumped fluid, the elastomeric member deforms around the particle causing a complete seal, leading to no reduction in pump efficiency. On valve opening the elastomer regains its original form as the particle is flushed through by the incoming pumped fluid and is thereby ready for more particulate matter in the next stroke of the pump. The appropriate selection of materials for construction of these elastomeric members provides extremely long valve and seat life in the most demanding pumping applications.

This valve technology has found application in waterjetting pumps when, for a variety of reasons, particulate matter appears or may be added to the water being pumped. Included in these applications is underwater abrasive jet cutting. In this application water, gel and abrasives are mixed and the resultant slurry is run directly through the high pressure pump by means of a rubber lined high pressure hose conducted to a high pressure (typically tungsten carbide) nozzle. The resultant high speed abrasive stream is then utilized for a variety of underwater cutting applications.

Another increasingly popular application of the valves is created by the increasing desire to recycle blast water for both water conservation and other environmental reasons. Recycled water may well contain both solid particles (produced by the high pressure cleaning operation itself), as well as high levels of dissolved minerals, both causing premature wear on conventional metal to metal valve seats. These conditions are readily handled by A.R. valves.

Another popular application is when large high volume pumps are utilized (typically 50 gpm or greater) in plants where the process fluid (ash water, for example) would require either extensive filtering and/or the rapid replacement of conventional metal to metal valves. Here again the A.R. valve has found an application.

In summary, whenever a fluid containing particulate matter is required to be pumped at high pressures, A.R. valving may well be the solution to an otherwise vexing pump problem. Gardner Denver Water Jetting has made A.R. valve technology available in a large number of their high pressure pumps. For more information, call (800)231-3628 or visit www.waterjetting.com.

Gardner Denver Celebrates Sesquicentennial

Since 1859, when founder Robert Gardner manufactured the first effective speed controls for steam engines, Gardner Denver, Inc. has been engineering innovative products for industry.

Gardner Denver Water Jetting Systems, Inc. is an international water jetting industry leader, building upon their Gardner Denver, Inc. tradition, with creatively engineered water jetting pumps and accessories.

Gardner Denver Water Jetting Systems and their international distributors form a well-known resource for quality pumps and accessories, and are the largest distributors for Parker Polyflex Hose Products, Peinemann 1-LTC Equipment, and StoneAge Waterblast Tools.

Gardner Denver Water Jetting Systems recently launched their simplified pump pressure range conversion capabilities with “IPRC Technology” (“Instant Pressure Range Convertibility”). With “IPRC Technology” pump pressure range conversions can now be quickly accomplished in the field, eliminating down time and transit time to mechanical maintenance shops.

Robert Gardner would certainly be amazed at the organization and products that developed from his original engineering innovation 150 years ago!

Today, Gardner Denver, Inc. is a recognized engineering leader, providing compressed air and gas, vacuum and fluid transfer technologies to industries throughout the world.

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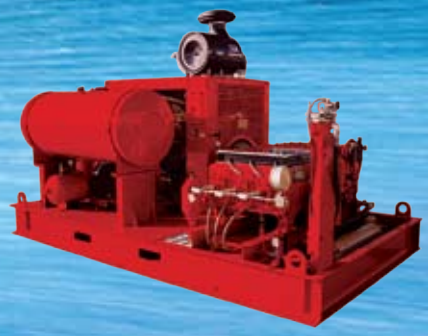
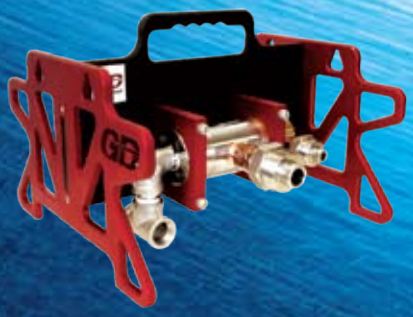


40/50K MULTI-BLASTER

10/20K MULTI-BLASTER



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Hydrodemolition On The Rio Verde Viaduct In Italy

The hydrodemolition technique, which uses high-pressure waterjets to remove damaged concrete, has played a vital role in the repairs and strengthening of the Italian multi-span Rio Verde Viaduct. The viaduct is one of the tallest in Europe and carries the busy dual two lane A15/E33 Autostrada della Cisa over a steep sided valley in the municipality of Pontremoli. Conjet hydrodemolition equipment was used to remove damaged concrete from the faces of the viaduct's rectangular concrete piers, which rise up to 136m from the valley bottom to the steel deck, followed by replacement with a new and thicker concrete skin.

The 960m long twin steel deck viaduct, which is supported on eight reinforced concrete hollow pillars, is a major structure in the link between Parma and La Spezia on Italy's Mediterranean coast, 100km south of Genova. The spectacular viaduct was opened in 1975, but inspection by maintenance engineers showed the bridge piers were suffering from extensive calcium chloride decay, forcing the Italian Highways Authority and the Highway Engineering Department of Cisa Ltd to carryout extensive repairs and strengthening.

The specialist hydrodemolition contractor SEI-Idrojet, working for the main viaduct repair contractor A.B.C.Construczioni S.P.A., carried out the concrete removal on one pier at a time. The repairs were performed from a special, purpose built cradle and working platform that wrapped round all four sides of the piers. The piers are 21m long and 8.5m wide at the base and tapering to 2.5 wide at the apex. The ends of the platform were adjustable to compensate for the changing width of the piers. The whole platform was supported and raised and lowered on wire ropes, which went up to pulleys on a steel support cradle at the top of the pier and back down to four synchronised winches anchored at ground level.

Repairs to the Rio Verde viaduct were performed from a special, purpose built cradle and working platform that wrapped round all four sides of the piers and supported by wire ropes connected to winches at ground level.

Conjet modified a standard robot feedbeam to fit onto and run along a rack on the inner sides of the platform in the fixed space between the pier and the platform. A Conjet Computer Control Unit, also mounted on the platform, was used to control the feedbeam and integral jetting nozzle. A Conjet 345-400kW Powerpack at ground level provided the high-pressure water at 1000bar and flow of 200l/min to the feedbeam's nozzle. The feedbeam and nozzle, travelling back and forth along the platform's rack, selectively removed damaged concrete to a depth of 70mm and below any exposed reinforcing. The process continued on one face of a pier as the platform was slowly raised to the top. On completion of removal of the concrete from one face, the platform was lowered and the Conjet feedbeam moved to another side of the platform for the process to be repeated on all

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Configuring A Waterblast System

By: *D. Wright and S. Hardy, StoneAge, Inc., Durango, Colorado, U.S.A.*

ABSTRACT

When configuring a waterblast system, it is necessary to determine the pressure, flow rate and components to effectively complete a job. The purpose of this paper is to describe and explain the considerations involved in selecting the best combination of pump and equipment. Parameters such as deposit properties, pressure loss, nozzle effectiveness, standoff distance, and rotation speed are discussed and shown how to evaluate to achieve the most effective combination.

1. INTRODUCTION

The planning of a waterblast operation begins with determining the type of material to be removed and the size and shape of the equipment to be cleaned; these are fixed parameters on which the selection of pressure, flow and tooling are based. The access is often fixed, but in some situations provisions may be provided by the plant to allow for more effective cleaning operations. The time allowed for setup and cleaning may be somewhat variable, but is still a controlling factor. Just as important as efficiency, the safety of the operators must also be taken into consideration when selecting the means for performing the cleaning.

2. SELECTION OF PRESSURE AND FLOW

2.1 Material Properties

The jetting properties of the material to be removed and the surface to which the material is attached determine the selection of the operating pressure and flow rate. Every material has a minimum energy impact at which it will begin to be cut or fractured by a waterjet; this is known as the threshold. If the material is being removed by cutting, such as a rubber lining or other thick non-brittle deposits, or materials well bonded to the surface to be cleaned, the most efficient pressure to operate at is typically three times the minimum pressure at which the waterjet just begins to cut the material. If the material is brittle, thin, and not well bonded to the surface, higher flow rates at pressures just above the threshold can be more effective and efficient than increased pressure.

For a given flow rate from a pump, the flow is divided among the orifices used in the cleaning head. As the quantity of orifices is increased in a head, the orifice sizes must all get smaller to maintain the same flow rate. If the material deposit is thick and massive amounts of material need to be removed, the fewest possible, largest orifices should be used. For thin deposits, or if just the top surface of a material needs to be evenly removed, then more, smaller orifices should be used.

2.2 Pressure Loss

Another consideration when selecting the operating pressure and flow is the pressure loss through the hoses, fittings, and the tooling used, particularly in small tube cleaning and in long runs through pipes. Pressure loss over long runs from the pump to the cleaning site should also be considered. The pressure loss is determined from the inside diameter and the length of the hose or lance being used and the flow rate passing through. The operating pressure has no effect on the amount of loss, but it is used to determine the pressure at the nozzle orifice. To calculate the pressure loss through a hose or lance, equation 1 is used.

$$\text{(1) Pressure loss (MPa)} = \left(\text{Flow (lpm)} \,/\, \left(.387 \times \text{I.D. of hose (mm)}^{2.5} \,/\, \text{Length of hose (m)}^{.5}\right)\right)^2$$

$$\text{(1) Pressure loss (psi)} = \left(\text{Flow (gpm)} \,/\, \left(53 \times \text{I.D. of hose (in.)}^{2.5} \,/\, \text{Length of hose (ft)}^{.5}\right)\right)^2$$

The allowable pressure loss depends on several parameters. If a specific pressure is known to remove the material being cleaned, the pressure loss subtracted from the pressure at the pump must be equal to or greater than this pressure, as in equation 2.

$$\text{(2) Pressure at nozzle orifice} = \text{Pressure at pump} - \text{Pressure loss}$$

The maximum power combination of pressure and flow occurs when the pressure loss equals 1/3 of the pump pressure, and the maximum pulling force occurs when the pressure loss equals 1/2 of the pump pressure. In no case should pressure loss be more than 1/2 of the pump pressure.

When cleaning small diameter tubes in heat exchangers, the size of the tube being cleaned limits the size of the flex or rigid lance, and the length of lance is determined by the length of the tubes being cleaned. In this case, the flow rate will be determined by the allowable pressure loss. If a pump is to be operated at 138 MPa (20,000 psi), and it is known that at least 103 MPa (15,000 psi) is needed to clean the tube, and the lance to be used has an inside diameter of 4 mm and a length of 15 m (50 ft), the maximum flow rate should be limited to 21 lpm (5.5 gpm), as this produces a pressure loss of 34.5 MPa (5,000 psi).

When making long runs from the pump to the cleaning location within a plant,

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Hydrodemolition Of Concrete Surfaces

Using waterjets for hydrodemolition is not news any more. A review of Schmid's article* of 20 years ago refreshes our memory and provides some basic facts about this technology for those who are interested. But keep it in mind that some numbers may need updating.

There were about 250,000 bridges that needed to be repaired in the USA and the money for the repair work amounted to approximately 4.4 billion dollars. Freeze and thaw cycling causes micro-cracking in the concrete structure. These micro-cracks allow water and chloride based de-icers to reach and corrode the steel reinforcing bar lattice. The expanding force of the corrosion further cracks the surrounding concrete. To repair the damaged concrete structure, the top layer of concrete needs to be removed to expose the steel rebar from top and below. The traditional tools for this type of repair work are jackhammers. The size of jackhammer is limited to 30 pounds to prevent additional damage caused by the impact.

Hydrodemolition equipment includes a high pressure water pump, a cutting head mounted on a cutting robot (tractor), and a carrying truck. The high pressure pump is diesel-driven and runs at a pressure from 13,000 to 35,000 psi and a water flow rate between 13 to 70 GPM (300 – 500 horsepowers). The high pressure cutting head can move on a linear traverse mechanism back and forth perpendicular to the direction of travel of the tractor. The multiple waterjets are positioned such that they can remove the concrete above and below the steel rebar. The productivity of a single hydrodemolition unit is about 20-30 cubit feet per hour, equivalent to approximately 20 jackhammers. It costs about 12 US dollars per cubit foot. It is more cost effective than the labor-intensive jackhammering where the labor costs are more than 12 US dollars per hour. It is more suitable for large projects that need to remove 5,000 cubic feet or more of concrete and when the project schedule is tight.

Tests were done to compare the bond strength of an overlaid surface that was prepared with hydrodemolition versus with jackhammering. The test results indicated 2.3 times higher in shear strength and 3.1 times higher in pull-off strength in favor of hydrodemolition. Peterographic

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the desired operating pressure and flow is typically considered to be fixed, and the hose size is increased to reduce the pressure loss. Another alternative in this case is to run two hoses in parallel as far as possible before combining the flow into a single hose. This reduces pressure loss because only half the flow rate is passing through each separate hose. For example, if 151 lpm (40 gpm) will be used, and the pump is 60 m (200 ft) from the cleaning site, a single 13 mm hose would produce a pressure loss of 25 MPa (3600 psi). If two 13 mm hoses were used in parallel, the pressure loss would only be 6 MPa (900 psi). The best solution is to use a larger hose, such as 19 mm, through which only 3.5 MPa (500 psi) would be lost.

2.3 Standoff Distance

The size and shape of the equipment being cleaned, as well as the waterjet tooling being used determine the standoff distance, which is the distance that the jet must travel through the air from the exit of the orifice to the surface being cleaned. As a jet travels through the air, it loses power at a rate inversely proportional to the orifice diameter. This loss has been measured by testing, and a typical chart of these results is shown in Figure 1. If you are at a standoff distance of 400 nozzle diameters, the jet power will be 40% of what it would be with no standoff distance. So if you are operating at 69 MPa (10,000 psi) at the pump, the impact at the surface is comparable to 27.6 MPa (4,000 psi) in this case. To determine the standoff distance in nozzle diameters, divide the standoff distance by the orifice size; for example, this ratio with a 610 mm (24 in.) standoff distance using a 1.6 mm (.062 in.) nozzle is 387.

If it is known that the material to be removed requires an equivalent impact of at least 34.5 MPa (5000 psi), one can use this curve to calculate the required combination of pressure and flow to achieve this. Increasing flow while keeping the pressure at 69 MPa (10,000 psi) would increase the size of the orifice being used, thus changing the ratio of standoff distance to nozzle diameter. To achieve a relative impact of 50%, the orifice size would have to be increased to achieve a ratio of 250; the orifice size can be determined from this by dividing the 610 mm (24 in.) standoff distance by 250, which would be a 2.4 mm (.096 in.) orifice.

The other approach would be to increase the operating pressure; if it were increased to 103 MPa (15,000 psi), the power could deteriorate to 33% and still achieve the relative impact of 34.5 MPa (5000 psi). This occurs at a ratio of 550, resulting in an orifice size of 1.1 mm (.044 in.) The power to produce these two possible combinations can be compared as well: the lower pressure, higher flow requires 100 kW (134 hp), while the higher pressure, lower flow requires only 42 kW (56 hp). While it is obvious which is the most efficient, the decision may be based on available pumps, hoses, fittings and tooling.

In some situations, it is possible to use extension arms to reduce the standoff distance, which has an additional beneficial side effect beyond just moving the jet closer to the surface to be cleaned. The extension arm acts as a flow straightener for the water going to the nozzle orifice, resulting in a more coherent jet that travels further with less deterioration. Figure 2 compares the curves for jet performance with an extension arm to the curve from Figure 1, which was measured with a jet exiting directly from a nozzle head, as illustrated in Figure 3.

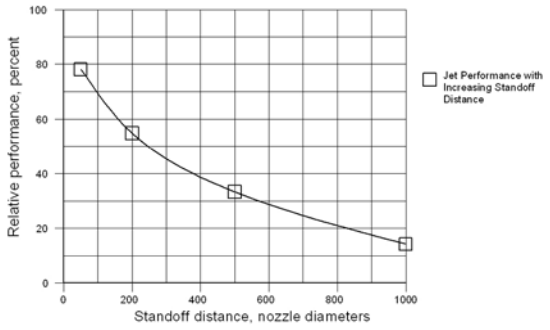

Figure 1. Jet Performance Relative to Standoff Distance

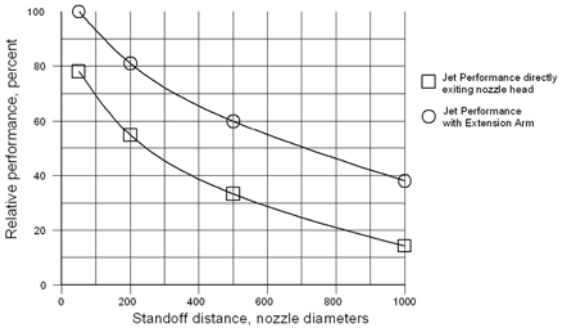

Figure 2. Relative Jet Performance of Extension Arm Compared to Directly Exiting Nozzle Head

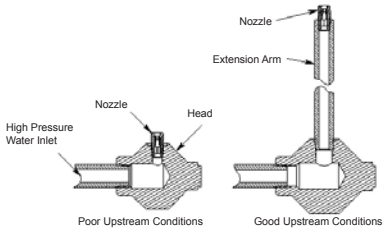

Figure 3. Illustration of Nozzle Exiting Head and Nozzle Exiting from Extension Arm

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Jetstream Creates Visual Safety System For Waterblasting Equipment

Virtually all industrial high-pressure waterblasting equipment and components are marked in some way with a pressure rating. However, with the wide range of operating pressures and the often confusing array of connection types—coupled with the high labor turnover resulting in only marginally trained operators—there is an increased risk that control gun operators might connect an insufficiently rated tool to the system. Over time, the pressure rating marked on the unit might become covered in muck or abrasion, or worn beyond legibility. In the event the operator is in a hurry or gets distracted, the pressure rating on the equipment may not even be confirmed before starting the project at hand.

To help contractor customers visually identify the pressure rating of the hand-held control guns used in industrial cleaning and surface preparation applications, Jetstream, a leading manufacturer of industrial high-pressure waterblasting equipment operated at pressures up to 40,000 psi, recently developed a unique safety decal system for waterblasting equipment and components.

"At Jetstream, we're committed to creating a safer, more productive working environment for our customers and the people and facilities around them," says Mike Bullard, parts marketing specialist at Jetstream. "With input from our customers we devised a series of color-coded decals that can be applied to all waterblasting equipment and components—not just control guns."

The new Jetstream visual safety system includes a safety sign and four decals in high-visibility colors to represent the four most common water pressure ratings used in waterblasting. Devices with a 10,000 psi rating are coded yellow, while devices rated for 15,000 psi, 20,000 psi and 40,000 psi are coded green, blue and purple respectively.

"Safety is a high priority at the facilities serviced by our contractor customers. The safety officers and foreman at these facilities want their contractors to comply with good safety practices," Bullard says. "With our visual safety system, the intent is to have the safety sign posted either on the unit or outside the blasting area to identify the pressure rating associated with each decal. Those responsible for ensuring safety can then read the pressure gauge on the waterblast unit, identify the distinct, highly visible color of the decal on the control gun from a safe distance and check the sign to verify that the control gun in use is sufficiently rated for the operating pressure."

According to Bullard, Jetstream's safety decals incorporate both a shape and a color so that they become more recognizable as use of the visual safety system increases.

"We have plans to expand the visual safety system to include special rolls of color-coded tape to mark smaller tools and components, as well as hoses and lances," Bullard says.

In addition to the new visual safety system, Bullard added that operator safety can be further enhanced by participating in operator training, practicing general safety precautions and wearing protective clothing and safety apparel including face shields, safety goggles, hard hats, gloves and boots.

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StoneAge Introduces The New 3D Torus

StoneAge announces the release of The Torus, a new 3D tank cleaning tool. The Torus is a direct replacement for both the Hurricane and Cyclean 3D tools. The Torus is capable of handling pressures from 5k – 22k psi by changing the manifold and inlet coupling. StoneAge offers three manifolds that control flows from 17-80 gpm. The manifolds bolt on and off with ease, allowing for quick and easy adaptation to different working pressures and applications.

The most impressive feature of the Torus is the simplicity of the design and is easily repairable in the field. It has very few parts and can be assembled with common hand tools. And as we all know, easy maintenance means reduced downtime.

The Torus offers a long lasting and durable magnetic speed control. While operating the Torus an operator can quickly adjust the magnetic rotation speed to effortlessly adapt to different applications. The operator simply adjusts this dial to decrease the speed for difficult applications and increase the speed for the easier applications.

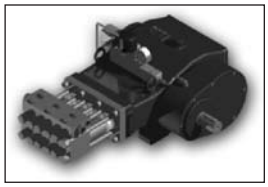
There are two primary components inside the Torus, the speed control and the angle block assembly. The magnetic speed control can be replaced as a complete unit, which is easily accessed with the removal of the cover plates.

This 3D tool has accessories designed to achieve the best results. The TR 408-SS Cage Centralizer is used in applications where debris or internal structures may interfere with the cleaning operation. For vessels over 12 ft in diameter StoneAge recommends using inexpensive and versatile Extension Nipples and Positioning Booms.

Visit stoneagetools.com or call 866-795-1586 for all the technical specifications and operation manuals.

New UHP Direct Drive Pump

OH Precision (Taiwan), with over 25 years of manufacturing experience of UHP pumps and after-market spare parts of leading waterjet brands, has introduced the latest addition to its direct drive pump product line: H100/UH100 pump. Its pressure range is from 20K to 50K psi, and the detail data sheet is shown in the chart below. It features compact size, easy field maintenance, and forced lubrication. With this addition, OHP now offers direct drive pumps at 30, 100, 160, 200, and 300 hp. OHP pumps are built on the same technology that has been use for the UHP water cutting industry. The same high-pressure seals that endure 60K psi are now "soothed" with lower operating pressure.



For more information, contact OHP's US sales office QualJet at (866)782-5538 or info@qualjet.com. (QualJet is the publisher of the online *Quality Waterjet Newsletter*.) Come and visit our booth #421 at 2009 WJTA Conference in Houston, TX.

Type	HP / kW	STROKE	PLUNGER DIA.	PRESSURE (psi / bar)	Flow Rate (gpm / lpm)	Power Speed (rpm)	Pump Speed (rpm)	Reduce Rate
H100-20K	91 / 68	60	16	20,300 / 1,400	7 / 26.7	1500	738	2.034
H100-20K	92 / 69	60	16	20,300 / 1,400	7.1 / 26.9	1800	743	2.423
H100-30K	109 / 81	60	16	29,000 / 2,000	5.9 / 22.4	1500	619	2.423
H100-30K	105 / 79	60	16	29,000 / 2,000	5.6 / 21.4	1800	592	3.04
UH100-40K	100 / 75	60	12	40,000 / 2,760	4 / 15	1800	743	2.423
UH100-40K	100 / 75	60	12	40,000 / 2,760	4 / 15	1500	738	2.034
UH100-50K	100 / 75	60	12	50,000 / 3,450	3.1 / 12	1800	592	3.04
UH100-50K	106 / 80	60	12	50,000 / 3,450	3.3 / 12.6	1500	619	2.423

New Location For NLB Branch In Texas

NLB Corp. has relocated its Houston-area branch to larger quarters to better serve customers who need high-pressure waterjet units, accessories and service. The new, 10,800-square-foot facility is more than twice the size of the one NLB occupied for the previous 20 years and is located just minutes away at 11506 Spencer Highway, LaPorte, Texas. The telephone number remains the same: (281) 471-7761.

The new branch has NLB high-pressure and ultra-high pressure waterjet pump units for sale, rent or lease with a wide range of waterjet accessories. These are displayed with a convertible NLB pump unit in an 800-square-foot showroom, thought to be the largest in the industry. There is also a large service area, a parts department with a substantial inventory, and a training room for customers' operating and maintenance personnel.

The NLB Texas branch is staffed by factory-trained professionals with many years of waterjet industry experience. They are led by manager Larry Slavin, whose quarter-century in the industry includes 15 years with NLB.

NLB Corp., a leader in high-pressure and ultra-high pressure water jet productivity, manufactures a full line of quality waterjetting systems and accessories for contractor and industrial uses. These include product removal, surface preparation, pavement stripe and rubber removal, tank and tube cleaning, concrete hydrodemolition, concrete and pipe cutting, and more.

For more information, visit www.nlbcorp.com.

3. SELECTION OF TOOLING

The selection of tooling to use on the end of the hose is primarily based on what will fit into the pipe or vessel to be cleaned, and on getting the jets close enough to the surface being cleaned to be effective. The other criteria in tool selection are pressure and flow capacity of the tool, the possible porting configurations, and the rotation speed range.

3.1 Pipe Cleaning

The basic parameters for tool selection in pipe cleaning are the pipe diameter, whether the pipe is straight or has elbows, and the length of the run. Depending on the difficulty of the material to be removed, the use of centralizers and extension arms may be needed to reduce the standoff distance in larger pipes, and whether the pipe has scale or is partially or fully blocked will determine the location and number of orifices in the cleaning head. Rotation speed of the head is determined by the size of the pipe and the nature of the deposit to be removed.

3.1.1 Tool Selection

Many sizes and configurations of self-rotary pipe cleaning tools are available. Typically, larger tools are more durable and have greater flow capacities than smaller tools. Figure 4 illustrates a self-rotary tool with a centralizer and extension arms as would be used in straight runs of pipe larger than 305 mm (12 in.) diameter, while Figure 5 shows a shorter self-rotary tool specifically designed for use in pipes with elbows. Always make sure that the rigid length of the tool and hose end is at least 1.5 times the inside diameter of the pipe to prevent the tool from turning around; use a rigid stinger between the hose and the tool if necessary to achieve this, as shown in Figure 6. The tool will still be able to go around an elbow at this 1.5 ratio.

3.1.2 Jetting Configurations

Self-rotary tools have the advantage of using fewer and thus larger orifices than non-rotary heads while achieving complete coverage of the walls of the pipe being cleaned. The location and quantity of the orifices in the rotary head are dependent on whether the pipe is blocked requiring forward facing jets, or has scale on the walls, requiring outward (radial) jets, and how much pulling force is needed, requiring rearward facing jets. Orifices of equal sizes should be installed opposite each other to balance the head from side to side.

When a tool is making a horizontal run, each pound of pulling force from the jets will pull between 1.5 and 3 m (5 and 10 ft) of hose, depending on the weight of the hose and the vibration created by the pump pulsations. If a tool must climb straight up, the jet pull must be at least equal to the weight of the tool and the weight of the length of hose being lifted.

3.1.3 Rotation Speed

The rotation speed of the head is limited by the available speed range of the tool being used, but many have adjustable speed. Rotating slower than necessary will increase the time it takes to complete the cleaning, as the rate at which the tool is advanced through the pipe should be reduced to achieve complete coverage. However, in the case of very thick deposits on the pipe wall, a slower rotation speed may be most effective. The jet can penetrate through the deposit and by means of pressurizing between the pipe wall and the material, cause the material to break loose from the pipe wall.

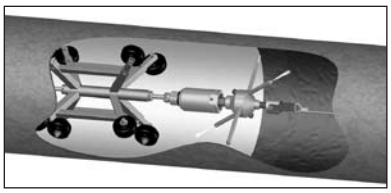


Figure 4. Self-Rotary Nozzle with Extension Arms and Centralizer for Large Pipe Cleaning

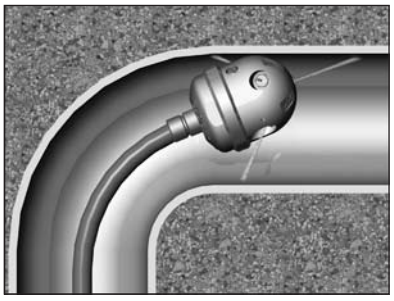


Figure 5. Self-Rotary Nozzle for Cleaning Pipe with Elbows

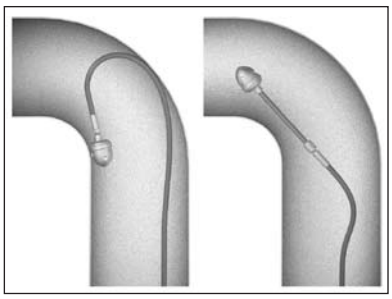


Figure 6. Use of a Rigid Stinger in Pipe Cleaning to Prevent Tool from Turning Around in Pipe

The maximum rotation speed is dependent on the diameter of the pipe and the standoff distance. As the pipe gets larger, the jet will be moving faster across the surface for the same rotation speed. In a pipe with 305 mm (12 in.) diameter and a head rotating 300 rpm, the surface speed is 4.6 m/s (15 ft/s); the same rotation speed in a 915 mm (36 in.) pipe has a surface speed of 14.3 m/s (47 ft/s). The effect of surface speed is shown in Figure 7; at close standoff distance, a surface speed of up to 16.8 m/s (55 ft/s) does not lose any effectiveness, but as the standoff

(continued on page 17)

Jet Edge 36K 280hp Diesel-Powered Waterjet Intensifier Pump

Jet Edge, Inc., has introduced the iP36-280DS diesel-powered waterjet intensifer pump, ideal for use in remote and/or mobile locations where electricity is scarce, the iP36-280DS is powered by a reliable 280hp Cummins turbo diesel engine that meets domestic and international Tier 3 emissions standards. It is capable of producing a flow rate of up to 7.2 gallons (27 liters) per minute of 36,000 psi (2,500 bar) ultra-high pressure water for waterjet cutting, surface preparation and cleaning applications.

The iP36-280DS waterjet intensifier pump utilizes a pressure-compensated hydraulic system to drive dual plunger-style intensifiers. The use of hydraulic fluid power provides smooth flowing UHP water resulting in long system life. Reliable and precise control of the electronically shifted intensifiers ensures superior performance standards with reduced operating costs. The water jet pump is built on a skid-mounted frame with lifting eyes and forklift guides provided for increased mobility. It also is available in a 55,000 psi (4,100 bar) model.

For more information, visit www.jetedge.com or call 1-800-JET-EDGE (538-3343).

Jet Edge Mid Rail Gantry Waterjet Cutting Machine Featured In New Video

Jet Edge, Inc. has available a new video featuring its Mid Rail Gantry waterjet cutting machine. The video can be viewed at www.jetedge.com.

In the video, Jet Edge highlights the performance features and capabilities of its latest waterjet cutting system, which is capable of cutting virtually any material. The Jet Edge Mid Rail Gantry waterjet system features an exposed tank that easily accommodates overhead loading. It comes standard with one abrasivejet cutting head; a second cutting head can be added to increase productivity. The Mid Rail Gantry is available in a wide range of sizes, including 5'x5', 5'x13', 8'x5', 8'x13', 21'x5'and 21'x13'.

The Mid Rail Gantry is ball-screw driven for higher accuracy. Its sturdy heavy-wall tubular steel construction eliminates vibration and increases longevity. The Mid Rail Gantry utilizes an industrial PC controller and can be configured so that all three axes are fully programmable (Z optional). It also features direct-couple AC brushless digital servo motors and single or double carriages. Critical bearing components are protected with heavy metal covers with brush seals. Optional mirroring capabilities make it possible to cut part cycle time in half.

The Jet Edge Mid Rail Gantry is powered by a Jet Edge waterjet intensifier pump. Jet Edge waterjet pumps are available in 60,000 psi (4,100 bar) and 90,000 psi (6,200 bar) models, and range in horsepower from 30hp to 280hp. Like all Jet Edge waterjets, the Mid Rail Gantry is proudly made in the U.S.A.

For more information, visit www.jetedge.com, e-mail sales@jetedge.com, call 1-800-JET-EDGE (538-3343) or 763-497-8700.

Jet Edge Selects Distributors in Japan and Canada

Jet Edge, Inc. has announced that Sunny Limited of Tokyo, Japan, has been selected as its new waterjet systems distributor for Japan. Sunny Limited is authorized to sell, install and service Jet Edge waterjet intensifier pumps, waterjet cutting machines and water blasting, surface preparation and cleaning equipment throughout Japan.

Sunny Limited is a well-established importer/exporter of industrial equipment with nearly 50 years of industrial experience. The company operates from its head office in Tokyo and seven other offices throughout Japan including Kagoshima, Osaka, Nagoya, Fukuoka, Takatsuki, Yokohama, and Tsukuba. Like Jet Edge, Sunny Limited provides 24/7/365 technical support and service to their customers for the products they import and distribute.

For more information about Sunny Limited, visit www.sunnyltd.co.jp, call +81-3-3254-7101 or e-mail sunnyltd@sunnyltd.co.jp.

Jet Edge, Inc. has also announced that Elliott-Matsuura Canada Inc. has been selected as its exclusive waterjet systems distributor for Canada. As coast-to-coast distributor of Jet Edge waterjets, Elliott-Matsuura carries Jet Edge's full line of precision waterjet cutting equipment, including waterjet cutting machines and waterjet intensifier pumps. The company's service engineers are authorized to provide installation, repairs, calibration and maintenance for Jet Edge waterjet equipment.

Based in Oakville, Ontario, Elliott-Matsuura Canada Inc. has been supplying and supporting quality machine tools to the Canadian metal cutting industry since 1950.

For more information about Elliott-Matsuura Canada Inc., visit http://elliottmachinery.com, call 905-829-2211 or e-mail sales@elliottmachinery.com.

For more information about Jet Edge waterjets, visit www.jetedge.com, call 1-800-JET-EDGE (538-3343), 763-497-8700 or e-mail sales@jetedge.com.

distance increases, the maximum surface speed decreases to 13.7 m/s (45 ft/s) before showing deterioration. This becomes a very important consideration in very large pipes, tanks, and stack cleaning, where diameters of 3 m (10 ft) or more are common. With a 3 m (10 ft) diameter vessel, the rotation speed should be no more than 80 rpm to maintain a surface speed of 12 m/s (40 ft/s) or less. The surface speed in a round pipe or vessel is calculated using equation 3.

(3) Surface Speed (m/s) = RPM x Diameter (m) / 19.1

(3) Surface Speed (ft/s) = RPM x Diameter (ft) / 19.1

3.2 Tube Cleaning

Tube cleaning may be done by hand held flex lancing, machines that feed flex lances, or rigid lances mounted on a machine, with rotation provided by a motor. There exists two basic tube cleaning jobs, those with scale on the walls of the tubes but tubes are otherwise open, and completely plugged tubes. Cleaning of scaled tubes is often referred to as polishing. Because of the small sizes of hoses or lances used, the flow rate may need to be limited to minimize pressure losses.

3.2.1 Nozzle Selection

Tube nozzles are typically either non-rotating tips with as many as 20 orifices, self-rotary nozzles with 2 to 7 orifices that are installed on the end of a non rotating flex or rigid lance, or tips with 2 to 7 orifices to be installed on the end of a rotating lance. As with pipe cleaning, the use of rotation allows complete coverage with fewer, larger jets. The tube size determines the maximum size of the lance tip and the lance. When cleaning plugged tubes, the nozzle used should be no larger than 2/3 to 3/4 of the tube diameter. The nozzle diameter should be larger than any couplings or hose ends to prevent material from catching on these.

3.2.2 Jetting Configurations

Flex lance nozzles are usually jetted to produce several pounds of pulling force; this is accomplished by the use of rearward facing jets. In unplugging patterns, this requires about 60% of the water to the back jets; this water is practically wasted, as the rearward facing jets are too poor in jet quality to do much effective material removal. They are only there to provide counterbalance to the forward facing jets, and when a rigid lance is used on a securely supported lancing machine, there is no need for backward facing jets. There is no extra flushing provided by the rearward facing jets; in a plugged tube, the water has nowhere else to go but out the clean end of the tube, carrying cuttings with it.

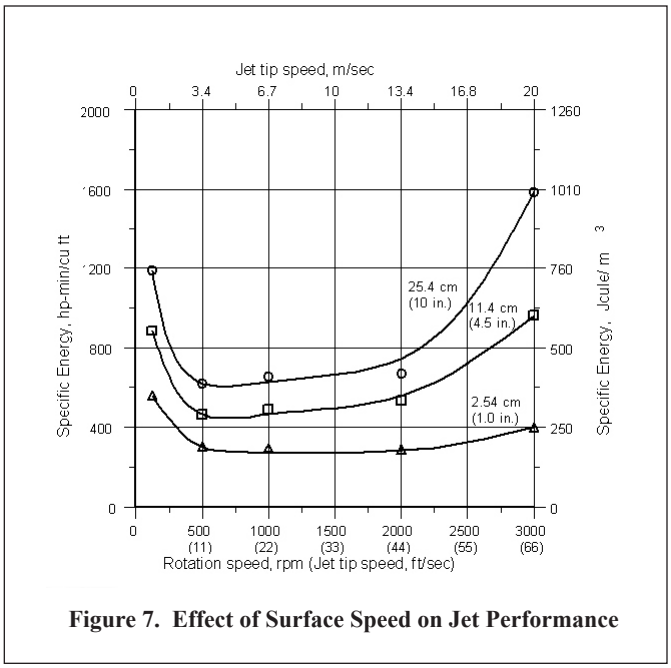


Figure 7. Effect of Surface Speed on Jet Performance

3.2.3 Rotation Speed

The same surface speed parameters apply in tube cleaning as in pipe cleaning; the biggest difference being the much smaller size of the tubes. In a 25 mm (1 in.) tube, the rotation speed to achieve the maximum recommended

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Precision System Components (PSC) From KMT Waterjet

Since 1971, the people of KMT have worked with extreme pressure products and have built a strong reputation for reliable products and excellent support. The line of PSC products, all manufactured by KMT, leverage the experience and deliver the performance KMT customers have grown to know and expect.

PSC for Pressures to 20K, 30K, 40K, 66K, 100K and 150K

PSC were developed on the basis of customer input and KMT's experience with extreme pressure systems. Key attributes identified as top needs before development began were durability, reliability and availability.

PSC parts are designed with features that make them durable and reliable even in the harshest environments. For example, the high-pressure valves were made with heavy-duty metal handles, machined with finger grips and given higher grade stainless steel valve stems.

The parts are stocked in large quantities to allow quick delivery by KMT Waterjet Systems and a growing network of leading distributors (OEM).

KMT Waterjet Systems has a strong reputation for responsiveness, service and reliable equipment. These attributes were carried over to the PSC line, where the new valves were deep cycle tested for performance.

The net result is a new line of valves, fittings and tubing that are made using precision production machines, better materials and new designs. Even in the toughest environments, PSC parts offer performance that is unmatched by other manufacturers.

For more information about PSC parts or to place an order, call (814)835-3600 or e-mail: pscsales@kmtwaterjet.com. Download a catalog at kmtwaterjet.com/multimedia page.

KMT Aqua-Dyne Launches New Website

KMT Aqua-Dyne's new website is now online. The new site has been redesigned with improved navigation functions to view Aqua-Dyne's extensive choices of water blasting products.

The new website provides information on water blasting solutions used in industrial cleaning, pipe cleaning, surface preparation, hydrostatic testing, hydro demolition, stripe removal, pumping units and for water blasting parts.

View the new KMT Aqua-Dyne website at www.aqua-dyne.com.

WJTAListServ - A Free Service To WJTA Members

The ***WJTA****ListServ* enables you to take advantage of prompt email interaction with your colleagues. ***WJTA****ListServ* is a **FREE** email broadcast system developed by WJTA to help you communicate and network with other waterjet professionals.

Participation is limited to WJTA members in good standing. You must sign up in order to participate. To sign up for the ***WJTA****ListServ*, contact Beth at the WJTA office by email: wjta@wjta.org, phone: 314-241-1445, or fax: 314-241-1449.

Configuring A Waterblast System, from page 17

surface speed of 16.8 m/s (55 ft/s) is 12,600 rpm, which is why the high speed self rotary nozzles can be effective in small tube cleaning. But with this high speed comes rapid deterioration with standoff distance, so a nozzle with a larger diameter should be used in larger tubes.

3.2.4 Feed Rate

In both tube and pipe cleaning, an estimated feed rate can be determined using the rotation speed and the number and size of the jets. This is only an estimation, as the material may need to be hit several times by the jet before being completely removed, but it does serve as a useful starting point. Equation 4 is used to calculate the feed rate. Typically a jet spreads and has an effective impact path greater than the orifice diameter; this factor may be included as a multiple in this equation.

(4) Feed Rate (mm/min) = RPM x Number of Jets x Orifice Diameter (mm) x Jet Spread

(4) Feed Rate (in./min) = RPM x Number of Jets x Orifice Diameter (in.) x Jet Spread

3.3 Vessel and Tank Cleaning

Large tanks and vessels can be among the most difficult cleaning challenges due to their large size, limited and confined space access and internal geometries. The simplest equipment to use is a 3-D type tool, although the most efficient means is a 2-D tool moved along the axis of the vessel. Unfortunately, in most tanks this is not possible due to central obstructions such as agitators. Standoff distances can be quite large; the effective cleaning range can be estimated as explained in Section 2.3 of this paper. Rotation speed and surface speed are also important considerations due to the large size of the vessels being cleaned.

The simplest method for using a 3-D tool is to hang it by the high pressure hose as shown in Figure 8. A 3-D tool is most effective if left in place to operate through a cleaning cycle, as opposed to continuously moving it as is done with a 2-D type tool. Several types of positioners for 3-D tools allow placing the tool closer to the surface to be cleaned, and to position the tool on the far side of obstructions, as shown in Figures 9 and 10.

Large diameter tanks, stacks and vessels that have an open center and a means of

(continued on page 20)

Hydrodemolition of Concrete Surfaces, from page 9

examination also indicated the presence of micro-cracks below the jackhammer prepared surface while none was found below the hydrodemolition prepared surface. A real test of bridge work was done on a freeway bridge in Seattle with a hydrodemolition unit operating at 25,000 psi and between 15 and 44 GPM. A volume removal rate from 12 and 24 cubic feet per hour was achieved by changing the nozzle diameter and therefore the flow rate and horsepower (from 260 to 580 HP) as well as by fixing the horsepower and changing the pressure (from 13,000 to 55,000 psi).

**Schmid, R.F. (1989) High pressure hydromilling of concrete surfaces, Proceedings of the 5th American Water Jet Conference, Toronto, Canada, August 29-31, Paper 15.*

Reprinted by permission from Quality Waterjet Newsletter, June 23, 2009.

Configuring A Waterblast System, from page 19

accessing the center can most effectively be cleaned using a 2-D rotating tool that is slowly raised or lowered to achieve complete coverage, as shown in Figure 11. In this fashion, the jets are always directly aimed at the wall with a relatively close and constant standoff distance.

4. SUMMARY

There are many variables in waterblast cleaning applications, from types of equipment to be cleaned to the deposits that must be removed. This paper covered the basics to methodically approach these tasks and the parameters that influence all applications.

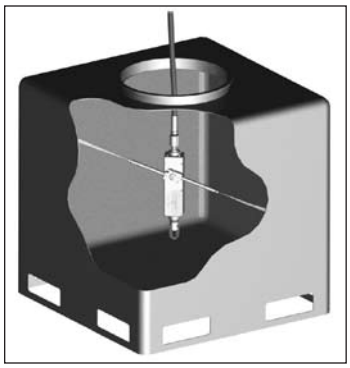


Figure 8. 3-D Cleaning Head Hanging from High Pressure Hose

Figure 9. Positioning of 3-D Cleaning Head Closer to Wall of Tank

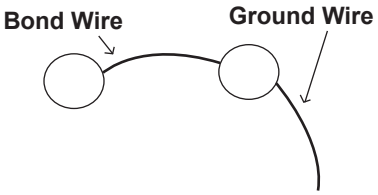
Figure 10. Positioning of 3-D Cleaning Head on Far Side of Obstruction

Figure 11. 2-D Head in Large Tank and Stack Cleaning

Static Electricity – The "Invisible Enemy" Of The Vacuum Truck Industry, from page 2

objects, joins them and gives them the same charge.

Grounding – eliminates the difference in electrical charge of a conductive body to the ground (earth) by a conductive wire.



What is the best method of controlling static charge buildup on your vacuum trucks? The proper installation and use of carefully designated rugged bonding and grounding equipment.

Several important features of good static grounding equipment are:

1. Grounding and bonding clamps should be equipped with rugged, sharp, spark-proof points to ensure metal to metal contact. Many times the metal surfaces have many coats of paint or rust that resist the proper contact
2. Plier type clamps must be made of corrosion and spark-proof material and have a rugged strong spring
3. Low resistant flexible cables are a must. The OSHA requirement of a 10 or less OHM resistance of the cable connection can be made with cables
4. Cables can come in a variety of types and lengths, including straight stainless steel and on retractable reels.

The use of weak alligator clips or flat surface wielding clamps offers a false sense of security and many times don't make proper ground connection.

The bonding of hoses, conductive pipe wands, and other pieces connected together for the vacuum process is essential to provide electrical continuity ensuring a safe path for the static electrical buildup. Hose connections should be tested with OHM meters on a periodic basis to ensure safe connections.

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Flow International Introduces JetPlex Pump, FlowConnex™

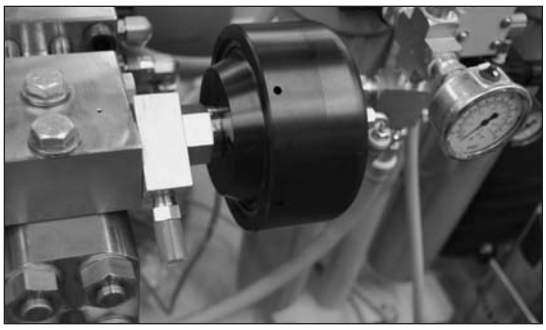
Flow International Corporation has introduced the JetPlex pump, designed to set the industry standard for performance and reliability.

Designed to run 24 hours a day, seven days a week, JetPlex pumps are based on field-proven technology with more than 10,000 pumps installed worldwide, logging more than 65 million working hours. The design ensures the highest pressure stability available in a pump, with optimal performance, reliability and easy, predictable maintenance.

JetPlex provides users with the following key benefits:

- Good edge quality on parts and faster cutting speeds.
- Lower utility bills. Less power and water consumed per horsepower of output, combined with lower maintenance costs, delivers the lowest overall operating pump costs in the industry.
- Reduced downtime as compared to other direct drive pumps. Flow's R&D staff and engineers design parts using sophisticated Finite Element Analysis (FEA) modeling software, where pressure-cycle fatigue life and structural characteristics can be predicted and analyzed on a computer.
- Increased pump reliability. With Flow's patented designs and high-quality materials, the JetPlex pump offers longer intervals between maintenance cycles than previous generations of direct drive pumps.
- Simpler maintenance. With no hydraulic system, JetPlex pumps are easier to maintain.

The JetPlex utilizes Flow's Patented Automatic Control Valve, or Pac-V, to ensure quick reaction when changing operating pressure or opening and closing the flow of water through the cutting nozzle. The Pac-V is also easier and more reliable to use than designs that utilize a bypass valve or dual orifice design to control water flow. Another benefit of Pac-V technology is that it allows the use of a wide range of orifice sizes, ensuring that you can tackle the most challenging and diverse applications.



Flow has also recently introduced FlowConnex, the company's next generation of interconnectivity for waterjet operations.

Using FlowConnex, operators, shop supervisors and managers can easily see the status of their Flow waterjet systems on the FlowConnex dashboard from the shop floor, in an office or at an offsite location. This includes waterjet machine productivity and machine utilization information, as well as pump pressure and other critical system parameters. FlowConnex also provides alerts to signal waterjet operators and management of waterjet machine and/or pump conditions that could shut down the waterjet machine. These customized alerts can be viewed from e-mail or any mobile device, such as a cell phone.

In addition to FlowConnex pinpointing potential issues, it links directly to Flow's expert knowledge database facilitating a fast and efficient resolution. Together, with Flow's exclusive 24 hour a day, 365 days-per-year phone support, downtime is minimized and production is maximized.

For more information, visit www.flowcorp.com.

Recommended Practices Under Review

A subcommittee of the WJTA Safety Committee has been formed to review and update the *Recommended Practices for the Use of Manually Operated High Pressure Waterjetting Equipment*. In addition to a review of the current content, the committee will also discuss a new section that will address recommended practices for the use of automated waterjetting equipment.

Please submit your comments or suggestions for revising the *Recommended Practices* to: WJTA Safety Committee, 906 Olive Street, Suite 1200, St. Louis, MO 63101-1448, phone: (314)241-1445, fax: (314)241-1449, email: wjta@wjta.org, website: www.wjta.org.

Hydrodemolition On The Rio Verde Viaduct In Italy, from page 6

four faces. SEI-Idrojet operations and site manager Enrico Mariotti was responsible for devising and controlling the hydrodemolition process.

On completion of concrete removal another team followed on fixing additional reinforcement in stages to all sides of the tapering pier. Shuttering panels 1.8m high were then fixed round all faces to support a new 220mm thick skin of self compacting concrete pumped into the formwork from ground level. After the concrete had set the formwork was removed and repositioned for the next 1.8m lift for the process to be repeated to the top of the pier.

On completion of repairing and strengthening a pier with an additional layer of concrete, the working platform was dismantled and re-erected on the next and then subsequent piers for the hydrodemolition and concrete repair process to be repeated.

For information, contact Lars Göran Nilsson, Conjet AB, P.O. Box 507, S-136 25 Haninge, Sweden, phone: +46-(0)8-5565-2240, fax: +46-(0)8-5565-2260, email: conjet@conjet.com, web: www.conjet.com.

The Conjet modified feedbeam and nozzle, travelling back and forth along the platform's rack, selectively removed damaged concrete to a depth of 70mm and below any exposed reinforcing.

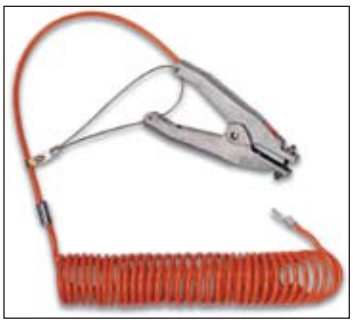
Index of Advertisers

Static Electricity – The "Invisible Enemy" Of The Vacuum Truck Industry, from page 21

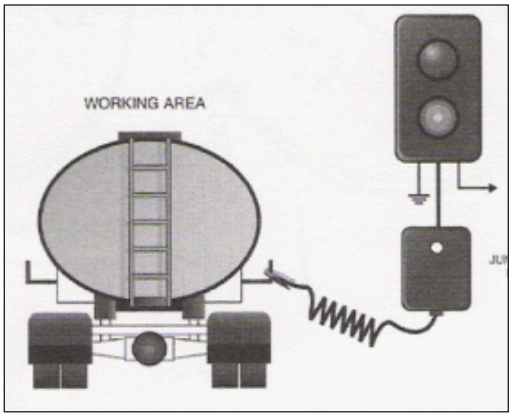
In addition to the mechanical static grounding clamps and assemblies, there are electrical-indicating static ground verification systems. These systems verify when proper ground connections are made and light signals show the operator when a ground connection is secured. Systems can be set up as ground indicators or can also be wired with the vacuum pump so that they will not allow a vacuum operation without a ground connection.

Ground monitoring devices offer safe, economical and easy-to-install solutions for applications where it is necessary to verify a good static ground connection onto containers, drums, road tankers, railcars, and other conductive objects.

"In bonding and grounding installations that are prone to corrosion, movement, or insulating surface coatings, self testing bonding clamps and systems can be used to continuously test the resistance to ground and verify acceptable levels." NFPA77 6.8.4



Prior to an operator vacuuming flammable liquids or powders from a vessel, the operator must connect a grounding clamp and cable to a known metal ground. This will ensure a pathway for the potential static electricity to be dissipated from the vacuum truck to the ground. With the use of conductive vacuum hoses, the vacuum operation will be bonded to the trucks. Now the cleaning operation can begin.

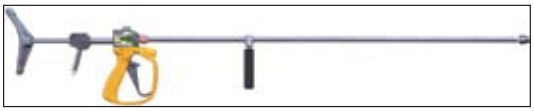


Another important part of a safer operating fleet is initial and period training of operators on static electrical safety.

Be safe and beat the "Invisible Enemy," Static Electricity.

Jetstream Creates Visual Safety System For Waterblasting Equipment, from page 11

Jetstream is widely recognized for several significant advancements in waterblast control gun design, most notably the introduction of cartridge-style valves for fast, easy field maintenance and



hydraulically-biased valving for safer, more positive operator control. The company has manufactured innovative control guns for nearly 30 years and launched production of the versatile DuraSafe series in 1998.

For more information on the visual safety system from Jetstream, call 1-800/231-8192, or visit Jetstream online at www.waterblast.com.

New features enhance learning & skills

WARDJet Updates Website

WARDJet has updated its website to include features that every waterjet operator will find valuable. Subscribe to a daily blog to stay informed about new waterjet applications. Participate in the "Waterjet University" to discover answers to waterjet cutting questions. Subject matter includes pump and gantry design, waterjet in comparison with other cutting technologies, waterjet software and controls, and the exploration of business opportunities in the waterjet field. Explore an extensive photo and video library that includes waterjet products to help visualize the benefits.

An inventory of used waterjet machines of various makes and models is constantly updated. Useful information about abrasive removal and the new WARD Pro abrasive recycling system is also included.

The website is easy to navigate and includes a section of free downloads (product catalog, feed-rate calculator, trial version of IGEMS® software and more).

Visit www.wardjet.com.

The *Jet News* is published by the WaterJet Technology Association (WJTA) and is a benefit of membership in the Association.

Aquajet "Open Day"

The latest Aquajet Systems 'open day' held at the company's production facility in Holsbybrunn, Sweden, proved highly successful attracting visitors from more than 12 countries.

New MaxHybrid

"Setting a record, the high number of guests, confirmed that international interest in hydrodemolition techniques is steadily growing, not only in Europe but globally," says Aquajet Systems Managing Director Stefan Hilmersson.

"We are committed to presenting new products and techniques that provide increased efficiency and quality to our customers," says Sales Manager Jan-Åke Petersson, "This year was no exception, and the latest version of the Aqua Cutter HVD Evolution attracted considerable attention."

Demonstrations were also given with the patented innovation producing geometric patterns such as triangles, parallelograms and circles.

Aquajet Systems robot program has been extended with the new concept robot, MaxHybrid. Powered by an electric engine, it also features an onboard diesel engine as an alterative source of power; according to the application.

The latest innovations were well received.

The new robot has an extended reach of 10 m (32 ft) plus all the features of other Aquajet robots to provide the operator with significant flexibility.

During the two day event, guests were also able to study and test Aquajet's complete product program. Products and accessories, developed to increase the safety and versatility using waterjetting in the construction industry, were also on display.

For more information, visit www.aquajet.se or email: aquajet@aquajet.se.

WJTA Welcomes New Members

Corporate

Allstate Power Vac.
Bob Lindenberger
Mark Wileczek
Lou Galasso
2527 Market Street
Aston, PA 19014
Telephone: (610)859-9000
Fax: (610)859-2000

Alta Tecnologia Industrial HP S.A. DE C.V.
Rosa Maria Pina Chacon
Tejocotes 10 3er Piso Colonia
Del Valle 3100
Mexico
Telephone: [52](55)55757492

Dunn Heat Exchangers, Inc.
Ryan Kirtley
Bret Bettison
Art Simmons
410 21st Street South
P.O. Box 3028-77592
Texas City, TX 77590
Telephone: (409)948-1704
Fax: (409)945-9873

International Flooring & Protective Coatings, Inc.
Jon Solomon
Robert Patrick
4675 E. Princess Anne Road
Norfolk, VA 23502
Telephone: (757)855-5286
Fax: (757)853-5980
Dean Holstein
236 Elon Court
Virginia Beach, VA 23454-4311
Telephone: (757)822-8511

World Wide Hose, Inc.
Shawn Smith
PO Box 514
New Philadelphia, Ohio 44663
Telephone: (330)602-4259
Fax: (330)602-4455

Corporate Individual

Jeffrey Lee Meyer
PSC
1806 Baker Way
Kelso, WA 98626
Telephone: (360)423-0260
Fax: (360)636-0493

Individuals

Gildardo D. Arcila
EMS
575 Swan Creek Court
Suwanee, GA 30024
Telephone: (770)277-8706

Derek Bade
Metco Industrial
640 South Road
Glandore, SA 5037
Australia
Telephone: [61](08)82972011
Fax: [61](08)83712610

Tony Bernard
Aqua Power
413 Grant Avenue
Eveleth, MN 55734-1310
Phone: (218)744-1144
Fax: (218)744-5555

Daphne Cameron
Ausjet Incorporated
PO Box 1426
Bibra Lake WA 6965
Australia
Telephone: [61](430)391166

Michel Deleris
JEDO Technologies
Rue Du Chene Vert BP 78204
haute Garonne 31682
France
Telephone: [33](0)561-000-450
Fax: [33](0)561-000-451

Dana M. Hicks
ENZ USA, Inc.
1585 Beverly Court, Unit 115
Aurora, IL 60502
Telephone: (630)692-7880
Fax: (630)692-7885

Masaki Hino
Fumie Guerrero
1362 Swallow Dr.
El Cajon, CA 92020
Telephone: (619)300-9099

Mike Ingham
CC EnviroKlean, Inc
6646 Berger Avenue
Kansas City, KS 66111
Telephone: (913)342-3372
Fax: (913)621-6885

John Koval
KR Surface Industries
P.O. Box 50520
Palo Alto, CA 94303
Telephone: (877)330-1584
Fax: (650)330-1589

Yiyu Lu
College of Resources and Environmental Science, Chongqing University
Shazhengjie St. 174
Shapingba Zone
Chongqing City 400044 China
Telephone: [86](23)65112372
Fax: [86](23)65106640

Lars Neff
University of Applied Sciences Northwestern Switzerland
Klosterzelgstrasse 2
Windisch 5210 Switzerland
Telephone: [41](56)462 44 97
Fax: [41](56)462 45 29

George T. Santin
Fluid Transfer Technology Corp
P.O. Box 4029
Copley, OH 44321
Telephone: (330)666-9646
Fax: (330)666-9656

Alexandre Sturlini
Marcelino Vieira de Faria,140
Mirandóplis 16800000 Brazil
Telephone: [55](18)37016163

Stephen J. Tarris
Southwest Aqueous Cleaning. LLC
PO Box 68892
Oro Valley, AZ 95737
Telephone: (530)219-7103
Fax: (520)797-1695

Robert Waryga
Madison Industrial Services Team, Ltd.
300 S. Pennell Road
Suite 310
Media, PA 19063
Telephone: (610)358-4006

Student

Amanuel T. Basha
Politecnico Di Milano
Via La Masa 1
Milan 1-20156
Italy
Telephone: [39](02)2399 8530
Fax: [39](02)2399 8585