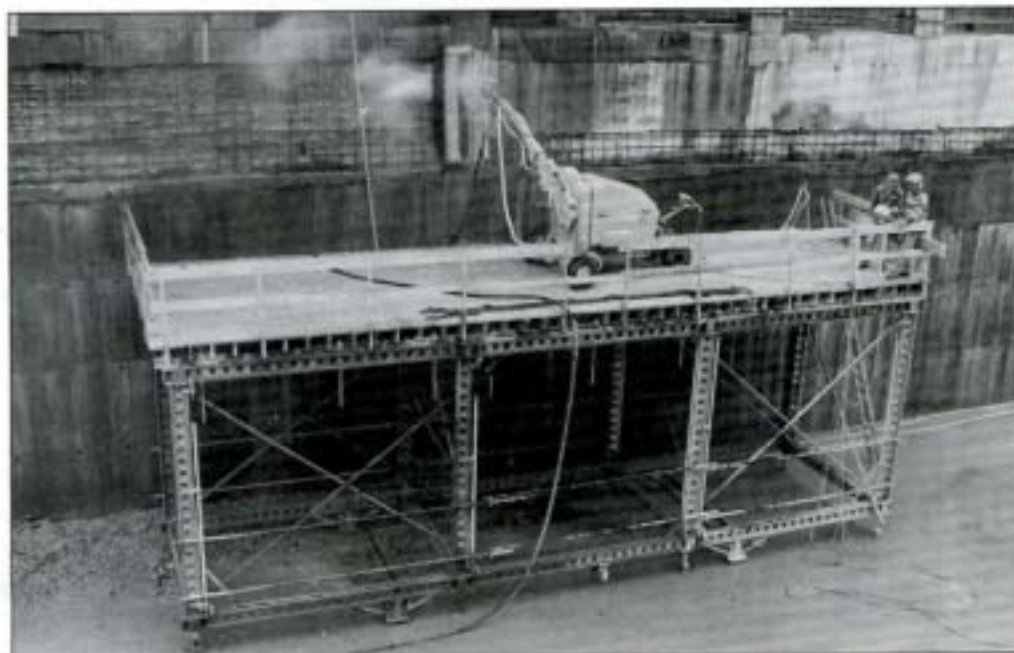




## Hydrodemolition In A Portuguese Dry Dock



About 730m<sup>3</sup> of weak, porous concrete has to be removed from about 5600m<sup>2</sup> of the Lisnave dock's high vertical walls.



Contractor Belbetões is using its Conjet Robot 362 at Lisnave to selectively remove damaged concrete to a depth of 120mm to 140mm and below the reinforcement at an average rate of 1.5m<sup>3</sup>/h.

*See related article  
on page 2*

## Conjet Robot 362 Assists In Repair Of A Dry Dock In Lisbon, Portugal

The Portuguese contractor Belbetões, a subsidiary of Portugal's leading civil engineering contractor Teixeira Duarte SA, has chosen one of the latest Swedish Conjet Robot 362 hydrodemolition machines to assist with extensive and major concrete repairs to the vast Lisnave reinforced concrete dry dock at Mitrena in the Portuguese capital Lisbon. The entire concrete surface on the dock walls and in the high level galleries has to be removed to below the steel reinforcements because they have been corroded by salty seawater seeping into the porous concrete.

Belbetões, working for the dock's main repair contractor Teixeira Duarte, is using the high pressure waterjetting system with the Conjet Robot 362 to remove the weakened concrete and clean the reinforcement in the walls. This is done in a series of 1.5m high strips round the periphery of the dry dock. Much of the concrete removal can be reached from the dock floor, but for the high level Beletoes has placed the Robot 362 on a temporary and easily moveable working platform. The Robot 362 is selectively removing the damaged concrete to a depth of about 120mm to 140mm and below the reinforcement, which is also cleaned of rust. Approximately 730m<sup>3</sup> of weak, porous concrete has to be removed from about 5600m<sup>2</sup> of the dock's high vertical walls. Belbetões is covering about 12.5m<sup>2</sup>/h, removing an average 1.5m<sup>3</sup>/h of the weak concrete.

"The job for Lisnave is the first we have used hydrodemolition," says Teixeira Duarte engineer Rui Câmara. "We didn't want to take any risks and as Conjet is the leading manufacturer of hydrodemolition equipment we bought a complete Conjet system, including powerpack and Robot 362. It has proved to be a good, reliable machine and is doing a very good job.

Hydrodemolition is a very good method as it takes off concrete to a pre-set depth either above or below reinforcement, which is also cleaned and left undamaged. It also provides a rough surface to give a good bond for the new replacement concrete."

The steel reinforcement in Lisnave's 350m long, 50m wide and 11m deep dry dock has suffered from extensive chloride attack since it was built in 1973. Salt in the seawater has penetrated the concrete through

(continued on page 5)

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# Choosing A Handline Nozzle For Firefighting

By: Akron Brass Company, Wooster, Ohio

**T**he nozzle is an important part of the firefighting system. The selection of the nozzle to be used by a fire department should depend upon the tactics and performance required. You should decide what you want your nozzle to do before making your decision.

## What Nozzles Do

Firefighting nozzles are designed to help put out fires by getting the right amount of water, in the right form, in the right place.

## Nozzles have three main functions

### 1. Control flow

The size of the orifice in the outlet of the nozzle controls the flow.

### 2. Provide reach

The nozzle creates a restriction at the end of the waterway which changes water pressure to velocity. Velocity provides the reach which is necessary to get the water to where it is needed.

### 3. Create shape

Different situations require different methods of applying water or foam. Some situations require the reach and penetration of a straight stream, while others require the heat absorption capability or radiant heat protection of a fog stream.

## Nozzle Options

There are four basic nozzle types: 1) the solid bore; 2) the single gallonage (sometimes called variable pressure/variable flow); 3) the adjustable gallonage and; 4) the automatic or constant pressure. Of the four, the latter three make up a group of nozzles commonly called combination nozzles because they produce both a straight



and a fog stream.

### Solid Bore Nozzle:

The solid or smooth bore nozzle is the most basic of the four nozzle types, both in design and function. Its purpose is to produce a steady stream, which provides maximum reach and penetration.

### Single (Fixed, or Variable Pressure/ Variable Flow)

#### Gallonge Nozzle:

The single gallonage nozzle, the simplest form of the combination or fog nozzle, provides flow at a predetermined rate that cannot be altered significantly while in use. However, when the nozzle pressure is varied the flow varies. Some of today's single gallonage nozzles can provide quality patterns even at reduced nozzle pressures.

### Adjustable Gallonge Nozzle:

Today's adjustable gallonage nozzles allow the nozzle operator to manually select a desired gallonage without shutting down. Like the single gallonage nozzle, some of today's adjustable gallonage nozzles can provide quality patterns even at reduced nozzle pressures.

### Automatic (Constant Pressure) Nozzle:

An automatic nozzle is designed to maintain a relatively constant pressure over a wide range of flows. This is accomplished by a mechanism in the nozzle that automatically adjusts to an increase or decrease in flow to maintain pressure, and thus reach, fairly consistent.

## Selecting a Nozzle

When selecting a nozzle it is important to choose the type that is best suited for your applications. The following guidelines will help you determine which type and size of nozzle is best for you.

### What flow range is required?

A nozzle cannot create flow. The available water, pump capacity, hose lays, etc., determine what a nozzle can achieve. The system needs to be analyzed to determine what flow range can be achieved. Determine the maximum flow rate that can be achieved with normal engine pressures and hose lays. Determine the minimum flow that


(continued on page 16)

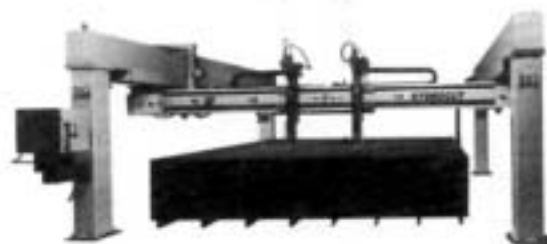


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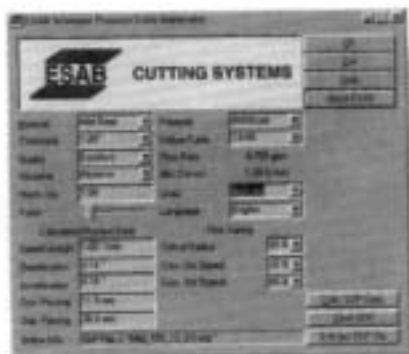
 ESAB's **Vision PC** CNC controller for waterjet cutting combines remarkable ease of operation with powerful software tools like real-time tool path display and kerf-on-the-fly with kerf-override to offer the most technologically advanced control in the industry. This Windows-based controller features menu-driven operation, color LCD display, 8-position joystick, hand wheel, hard drive, 3.5" floppy drive, and speed potentiometer for easy operator use. Station and process control are integrated in a single ergonomic



*Rugged gantry design and AC brushless digital motors on ESAB's HydroCut provide precise motion control and positioning accuracy.*


operator's panel. A 333 mHz processor and advanced features such as multi-level return, zoom while running, and program continue after power failure further add to the power of this control.

ESAB's exclusive Process Parameter Programming features the unique **Data Generator Program** that automatically optimizes cutting



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Telefax 52-83-50-5920

## Conjet Robot 362 Assists In Repair Of A Dry Dock In Lisbon, Portugal, from page 2

surface cracks, porosity and capillary attraction. The ingress of salt has accelerated corrosion of the interior steel reinforcement, which has expanded as it corroded causing cracking and bursting of the surrounding concrete structure.

Conjet's hydrodemolition equipment, which has been used on the repairs to other dry docks and numerous other concrete structures world-wide, does not generate any new cracks in the concrete left behind. The efficient technique is also about 25 to 50 times faster than cutting with hand held breakers, which can hit and vibrate the rebar and do a lot of extra damage by breaking the bond between the reinforcement and good concrete.

Teixeira Duarte's remotely operated, computer controlled Conjet Robot 362 relies on a jet of high pressure water exiting from a special nozzle at supersonic speed and forcing its way into the concrete's porous surface. The water creates a hydraulic over pressure in the concrete which breaks away when this pressure rises above the tensile strength of the concrete. The high pressure water for the Conjet Robot 362 is provided by a diesel-driven Powerpack housed in a silenced 20-foot-long ISO container. Water at a pressure of 1000 bar and a flow rate of 187 liters per minute is fed from the Powerpack through a flexible hose to the Conjet Robot's nozzle from a Hammelmann HDP 352 high pressure pump driven by a 373kW (500 horsepower) Caterpillar diesel engine.

The nozzle, set at a predetermined angle of attack to the concrete, is mounted on an oscillating cassette. This is attached to a traversing cradle running back and forth along a feed beam, which is mounted on the Conjet Robot's 3.6m long rotating arm. When the cradle reaches the end of its travel the nozzle swivels over to maintain the

same angle, which enables the jet to operate with a sweeping action to cut away concrete behind reinforcement. At the same time the machine moves back along the platform a predetermined distance ready to make the next adjacent cut.

After removing the old concrete from the high vertical dock walls and exposing and cleaning the reinforcement Teixeira Duarte follows on to complete the restoration with a new cast in-situ in-fill layer of high strength concrete. This in-fill 60 Mpa strength concrete contains silica powder to reduce porosity to prevent similar chloride corrosion of the rebar re-occurring. Teixeira Duarte started on the restoration to Lisnave's dry dock at Mitrena and other associated repairs just before Christmas 1998 and is on schedule to complete the entire PTE500 million contract in the fall of 1999.

For further information please contact:

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OR

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5643 Warner Road  
Fowlerville, MI 48836  
USA  
Tel: (517)223-0915  
Fax: (517)223-9525

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## Updated NLB Website

NLB Corp. has expanded its web site to make it easier for waterjet users to get information about high-pressure and ultra-high pressure waterjetting.

For example, details of more than 500 NLB waterjet accessories can be downloaded directly from the site, or visitors may request literature or videos via e-mail. All NLB pump and applications brochures and videos are also available for the 100-page-plus site, which also showcases company news and capabilities.

The news section gives visitors access to current and archived NLB news releases, a trade show calendar, and a downloadable version of its "High-Pressure Highlights" newsletter.

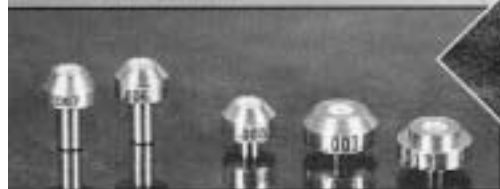


The NLB website, accessible at <http://www.nlbcorp.com>, has proven a valuable source of waterjetting information since it began in 1996, with over 62,000 files viewed in the past two years alone.

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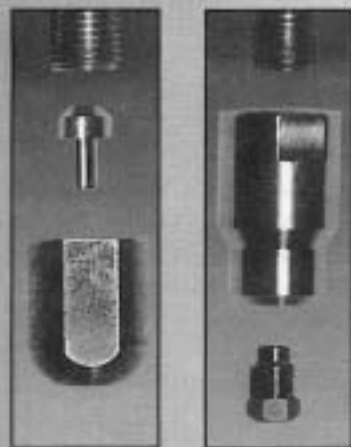
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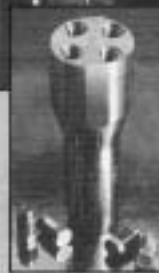
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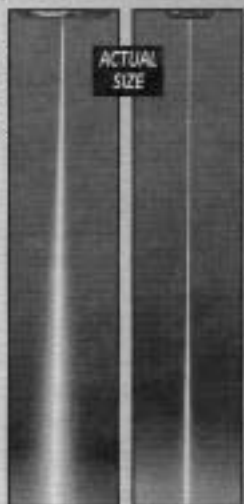
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# WJTA's 10<sup>th</sup> American Waterjet Conference

The 10<sup>th</sup> American Waterjet Conference was held August 14-17, 1999, at the JW Marriott Hotel in Houston, Texas. Participants attending the Conference totaled 750. They learned the latest advances in waterjet technology as described in seminars and prepared papers. They also attended an exhibit of waterjet equipment and supplies and witnessed live demonstrations of equipment.

The Conference began on Saturday, August 14, with three concurrent workshops: the WJTA Safety Practices Seminar based on the WaterJet Technology Association's *Recommended Practices for the Use of Manually Operated High Pressure WaterJetting Equipment*; Advanced Topics in Surface Preparation With Waterjets; and the WJTA short course, Fluid Jet Technology—Fundamentals and Applications.

The Exhibit Hall opened on Saturday evening, August 14, with a reception sponsored by Flow International Corporation. The exhibit was filled with 70 booths where the latest waterjet equipment, supplies and services were displayed by 44 companies.

Concurrent sessions dealing with research and practical applications were held on August 15 and 16. A total of 65 papers were presented. These papers were published in the *Proceedings of the 10<sup>th</sup> American Waterjet Conference*.

On Tuesday, August 17, the Conference concluded with a technical tour and field demonstrations hosted by HydroChem Industrial Services at their new facility in Deer Park, Texas. Related Conference news and photographs can be found throughout this issue of *Jet News*.

(continued on page 8)

## ***Congratulations to the 1999 WJTA Award Recipients!***

Dr. Andrew Conn presents the 1999 Pioneer Award to Dr. Mohamed Hashish of Flow International Corporation, Kent, Washington.



President Savanick presents the Safety Award to Bruce Wood of MPW Industrial Services, Inc., Hebron, Ohio.



President Savanick presents retiring board member Dr. Thomas Kim a plaque in appreciation for his years of service to WJTA.



President Savanick presents the Service Award to John Wolgamott of StoneAge, Inc., Durango, Colorado.



Dr. Mohamed Hashish presents an award for the best applications paper, "Fluid Jet Ignition Hazards Safety Analysis," to Paul Miller of Teledyne Brown Engineering, Huntsville, Alabama.



Dr. Mohamed Hashish presents an award for the best research paper, "Simulation of Displacement Fields Associated with Abrasive Waterjet Drilled Hole," to Zihong Guo and Mamidala Ramulu.

## WJTA's 10th American Waterjet Conference, *from page 7*

### Field Demonstrations at HydroChem Industrial Services in Deer Park, Texas



Conference attendees arriving at HydroChem



(l. to r.) Pat DeBusk, Tom Carter and Gary Noto.



Pat DeBusk demonstrates HydroChem equipment.

### Field trip attendees witness the demonstration of waterjetting equipment



(Conference news continued on page 10)



#### Calendar Of Events

##### OCTOBER 9-11, 2000

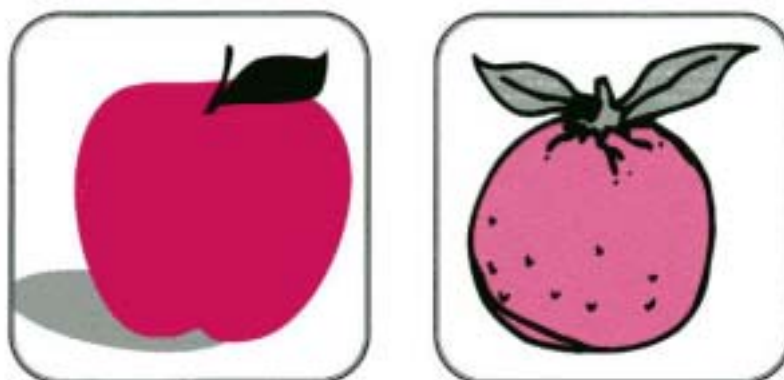
The CMTE with its co-hosts the Australian High Pressure Water Jetting Association (AUSJET) and The Water Jet Technology Society of Japan (WJTSJ) are hosting the 6th Pacific Rim International Conference on Water Jetting Technology in Sydney, Australia.

The Conference will focus on the development and implementation of new technologies that contribute to improved productivity, health and safety in the waterjetting industry.

For more information contact: Water Jetting Technology Conference, c/o CMTE, PO Box 883, Kenmore Q 4069, telephone: +61 7 3212 4420, fax: +61 7 3212 4683, email: [cmte@cat.csiro.au](mailto:cmte@cat.csiro.au), web site: [www.cmte.org.au/news/waterjet.html](http://www.cmte.org.au/news/waterjet.html)



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## WJTA's 10th American Waterjet Conference, from page 8



The WJTA thanks the staff of Birenbaum & Associates which was responsible for the efficient functioning of the 10th American Waterjet Conference. Shown (l to r.) are Laura Garner, Ken Carroll, Deborah Sites, LeAnn Hampton, Denise Hurt, Mark Birenbaum, Ph.D. and Jan Tubbs (staff member Wendy Courtney is not pictured).

Conference participants gather at the WJTA Saloon in the J.W. Marriott Hotel to enjoy a Texas barbecue dinner, games of chance and prizes.



Rolling the dice for chances on prizes.

### Letter Of Congratulations

WaterJet Technology Association:

On the occasion of this opening ceremony, the China Waterjet Technology Association would like to express our sincere congratulations to the organizing committee of the Conference and WaterJet Technology Association on the successful opening of the 10th American Waterjet Conference.

Meanwhile, China Waterjet Technology Association would like to convey to all the representatives at the Conference the warm greetings and sincere good wishes of the scholars and experts in the field of waterjet technology in China.

The convening of the 10th American Waterjet Conference will provide a very valuable arena for the academic exchanges. This will promote the development and application of the waterjet technology worldwide.

Following the 10th American Waterjet Conference, the 10th China Waterjet Conference will be held in November of this year. On this occasion, the China Waterjet Technology Association would like to cordially invite the scholars and experts in the field of waterjet technology, both from the United States and all over the world, to attend the China Waterjet Conference that will be held every two years and make academic exchanges in China.

China WaterJet Technology Association

### Many Thanks To The WJTA 10<sup>th</sup> American Waterjet Conference Sponsors

AQUA-DYNE, INC.: Saturday, Sunday Coffee Breaks

CLEANER TIMES MAGAZINE: Sunday Coffee Break

FLOW INTERNATIONAL CORPORATION: Saturday Welcoming Reception

HIGH PRESSURE EQUIPMENT COMPANY: Gifts/Prizes for Monday Awards Presentation/Party

HYDROCHEM INDUSTRIAL SERVICES, INC.: Tuesday Technical Tour/Luncheon

JETECH, INC.: Monday Coffee Break

JETSTREAM OF HOUSTON, INC.: Co-sponsor, Technical Tour Lunch

NLB CORPORATION: Sunday Exhibit Hall Luncheon

PARKER POLYFLEX: Monday Coffee Break

SPRINTANK: Co-sponsor, Technical Tour Lunch

WHEATLEY GASO: Bottled Water at HydroChem

WILCO: Bottled Water at HydroChem

*(Conference news continued on page 11)*

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*Over 700 industry professionals visited the WJTA Exhibition Hall to learn about the latest in waterjet equipment and supplies. Forty-four companies exhibited their wares. The following are scenes in the exhibition hall.*



## Thank You To The Advisory Council!

The WaterJet Technology Association (WJTA) hereby expresses its gratitude to the Advisory Council for the presentation on August 14, 1999, of the tutorial session, "Advanced Topics in Surface Preparation," as part of the WJTA program of workshops offered at the 10<sup>th</sup> American Waterjet Conference in Houston. The availability of this course enhanced the pre-conference program. In previous conferences the WJTA had offered only one course on the fundamentals of waterjet technology. This year, with the addition of the Surface Preparation Workshop and a course on safety, WJTA was able to offer a more diverse program and thereby attract students who otherwise might not be attending the pre-conference workshops.

Members of the Advisory Council who generously made the presentation of the Surface Preparation workshop possible include:

**George Rankin**

Aqua-Dyne, Inc.

**Rick Schmid**

Flow International Corporation

**Forrest Shook**

NLB Corporation

**Larry Fulmer**

Carolina Equipment and Supply

**Pat DeBusk & Frank Moll**

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Industrial Pressure, Inc.

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**Tom Higgins**

**Doug & June Koppang**

A-1 Able Services, Inc.

**Leo & Steve Kosowan**

**Luis Ortega Trotter**

Superjet Services

Dear President Dr. Savanick

It is a great honor for me to receive the Technology Award of the WaterJet Technology Association for 1999. This award is highly valued by specialists in jetting technology. The WaterJet Technology Association is greatly respected in the world because of its effective management, careful service to members and worldwide vision.

I regret that I was absent at the ceremony of the award on August 16 and could not receive it personally due to my official business in Japan. I have received the award with heartfelt thanks on September 8 at our University.

I expect that your Association will continue to be prosperous for the development of the jetting technology.

Sincerely yours,  
Ryoji Kobayashi



# Pittsburgh's Point State Park Fountain

One of the prominent features of the Pittsburgh, Pennsylvania area – the Fountain at Point State Park was restarted and lit up during the July 4, 1997, celebration in Pittsburgh. The Pennsylvania Department of Conservation and Natural Resources Secretary John C. Oliver threw the ceremonial switch before the fireworks display.

"We are pleased to be returning a signature landmark to Pittsburgh," Oliver said. "This project is just one of hundreds of improvements the Ridge Administration is making statewide to Pennsylvania's wonderful state parks."

Oliver said the \$800,000 in repairs replaced all parts in the fountain, including a new floor slab in the fountain pool; replacement of the lighting system; pump and motor rehabilitation and replacement; and new lighting and pump control systems.

The fountain project is part of Project Stewardship, the State of Pennsylvania's \$100 million effort to repair and upgrade the infrastructure of Pennsylvania's state parks and forests. Project Stewardship calls for the repair or replacement of roads, bridges, water and sewer treatment plants, and other park and forest facilities. Priority is given to projects that impact visitor health and safety.

Project Stewardship is funded through the Keystone Recreation, Park and Conservation Fund; fees collected at state parks; liquid fuels tax dedicated to forestry bridge repairs and replacements; and the state's capital budget.

The repairs to the fountain were funded by the state's capital budget.

The Point Fountain was dedicated in 1974, marking the completion of Point State Park, which required 29 years of planning and construction.

Six pumps operate the fountain: three force the water into a 275-foot plume (when there's no wind). The main column pumps incorporate a control, which automatically adjusts the column height based on actual wind speed, to avoid wasting water and drenching park visitors. Three smaller pumps create a



*Photograph provided courtesy of Commonwealth Media Services.*

fan design symbolic of the three rivers: the Ohio, the Allegheny, and the Monongahela, which converge at the Point in Pittsburgh. The fountain is lit to enhance its grandeur. In operation, over 400,000 gallons of water are recycled in the system. Water lost during operation is gotten from an underground aquifer in the sand and gravel beneath the park – often called Pittsburgh's "fourth river."

Oliver said since the early 1980s, there have been many problems with the lighting system and pump controls. The older equipment became increasingly difficult to repair and find replacement parts. This diminished the lighting and height of the fountain. The fountain limped along until the flood of 1996 when waters inundated the "watertight" doors and windows in the pumphouse, submerging all pumps, motors and electrical systems.

The fountain was shut off for repairs in the fall of 1996.

DCNR engineers, the city of Pittsburgh and Entech Inc. of Reading designed the new lighting, electrical and concrete repairs. Costa Contracting of Pittsburgh, Mitsch Mechanical Inc. of Verona, and Lighthouse Electrical of Canonsburg completed the repairs. The Pennsylvania State Department of General Services administered the contract.

The Fountain at Point State Park is a

famous symbol of the city and is featured in all of the city's promotional tourist photos. It operates 7 a.m. to midnight during the spring, summer and fall.

## WJTA Administration

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Fut-Den Wang, Ph.D.  
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### Association Managers

Mark S. Birenbaum, Ph.D. • Kenneth C. Carroll  
(314)241-1445

## New WaterArmor™ Gaiters Protect Feet And Shins

NLB Corp. has added foot and shin protection to the WaterArmor™ line of protective apparel with the introduction of WaterArmor™ gaiters.

Each one-size-fits-all gaiter covers the shin and metatarsal area of the foot, and can be worn over a boot of any style. A hinged design lets the user kneel and move comfortably. The gaiters are durable and easy to clean, and can be left on boots.

Like the rest of the WaterArmor™ protective apparel, which is manufactured by Warwick Mills and available through NLB, the gaiters are tough, yet lightweight. They are specially designed for high-pressure waterjet operators using hand-held, 10,000 psi (700 bar) waterjet equipment.



The gaiters are designed to work with WaterArmor™, which consists of replaceable sections made of tough, flexible TurtleSkin®. This patent-pending, multi-layered fabric features a grade of DuPont's KEVLAR® fiber commonly used in bullet-proof vests. The five-pound (2.3 kg) apparel, covered by a waterproof, abrasion-resistant outer shell, allows air circulation that keeps operators cool.

WaterArmor™ gaiters have a polypropylene outer cover, for easy cleaning with just a hose and mild soap and water.

In laboratory tests, TurtleSkin® WaterArmor™ was not penetrated by waterjets operating at pressures of 10,000 psi (700 bar) with a flow rate of 16 gpm (60 lpm). The velocity was 8.2 feet per second (2.5 m/sec.) at a nozzle stand-off of 1.25 inches (32 mm). WaterArmor™ is not intended for use above 10,000 psi (700 bar).

NLB, a leader in high-pressure and ultra-high waterjet technology, manufactures a full line of waterjetting systems and accessories for contractor and industrial uses. These include surface preparation, paint booth cleaning, tank cleaning, descaling, concrete demolition, concrete and pipe cutting, and more.

## Introducing a new generation of protective apparel: WaterArmor™

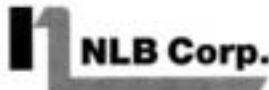


Nothing protects operators from the impact of water jets like new WaterArmor™. Available from NLB Corporation, this advanced apparel makes an ordinary wet suit extraordinary.

### Key features include:

- Tough, flexible TurtleSkin®, a patented technology from Warwick Mills featuring ballistic-grade KEVLAR®
- Increased protection up to 10,000 psi (700 bar)
  - In tests, WaterArmor was not penetrated by water jets at 10,000 psi and 16 gpm (velocity 8.2 fps, nozzle stand-off 1-1/4")
- Lightweight (5 lbs. or 2.3 kg), comfortable and cool
- Adjustable panel system allows one-size-fits-all outfitting
- Fits comfortably under any standard wet suit

WaterArmor™: the new standard in water jet protection. Don't let your operators wear anything less.



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WaterArmor™ and TurtleSkin® are trademarks of Warwick Mills. KEVLAR® is a DuPont trademark.

## Recovery Of Platinum From Abrasive Jet Cuttings

**T**he WARD 24, typically used for the recovery and recycling of abrasive for reuse in abrasive waterjet cutting, has found a novel use.

In fact, the client is not so interested in the dry, recycled abrasive, as they are in the recovery of the platinum being cut with the waterjet. Heraeus Metals operates several waterjets, one of which is set aside to cut precious metals, and in this case, platinum.

In order to reduce the kerf and subsequent loss of the precious metal, a fine orifice nozzle combination is used with Barton 150 garnet. At the time of writing, platinum is valued at \$400 per ounce. It is hence vital that all the sludge, consisting of platinum and abrasive, is sent to be processed in Germany to recover the precious metal.

Generally, the processing fee to extract precious metals is based on the weight of the total mixture of abrasive and platinum, not on the amount of platinum recovered from the mixture. It would hence be of great value if the bulk of the weight, which is abrasive, is removed from the mixture/sludge prior to processing.

"It was strange to have a customer only interested in the 'waste product', and not the dry, ready to use abrasive," says Richard Ward, president of EasiJet. "Basically everything seemed to be backwards!"

Once the tests were done, with the sludge being passed over a 250 mesh screen, the platinum (sludge mixture) and recycled abrasive were sent off for evaluation. Of particular interest

## A Safe, Innovative Way to Use Multiple Water-Jetting Guns.

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was the determination that only 0.007% platinum was found in the dry, ready to use recycled abrasive.

The implication of the results are quite significant. Firstly, the amount of impurities being passed from the washing and screening process when recycling abrasive with the WARD 24 are insignificant and as low as 0.007%. Secondly, the basis of recycling abrasive can be reversed and used to

recover precious metals from the sludge.

Of course, the added bonus in this case, is the abrasive could be used again, substantially reducing the operating cost of running the waterjet.

For Heraeus, using the WARD 24 is a case of hitting two birds with one stone!



**Flow International Corporation Introduces A  
Waterjet Machine Tool**

## **Waterjet Machining Center Slashes Operating Costs**



**F**low International Corporation is introducing the Waterjet Machining Center, designed to increase productivity and performance and reduce operating costs.

The Waterjet Machining Center was designed to allow operators to run the machine with little human intervention to increase uptime and improve productivity. It offers unparalleled levels of performance and was designed through collaborative efforts with global partners.

Among the many features of Flow International's latest technological breakthrough, the Waterjet Machining Center features: a completely integrated, energy-efficient garnet-removal-and-recycling system that dries only recyclable abrasive and reuses waste heat and water to reduce operating costs by 50 percent; Flow International's cutting performance monitoring system; a fully integrated cutting head height and collision sensor; the world's first 60,000 psi operating pressure pump; up to four multi-position cutting heads; and a utility cabinet to centralize utility hookups.

"Through the global design, purchasing, and collaborative design efforts with world-class partners and suppliers, we're pleased to be able to offer our customers a completely integrated machine with an extremely high level of value," said Michael Ruppenthal, market manager for Flow International.

## **Stefan Nilsson Appointed President Of ABB I-R Waterjet Systems L.L.C.**

**T**he appointment of Stefan Nilsson as the new president of ABB I-R Waterjet Systems L.L.C. is announced by Joseph Carney, president of the ABB Automotive Systems Group of ABB Flexible Automation Inc.



**Stefan Nilsson**

Mr. Nilsson moves to this position from vice president and general manager of the Material Handling Division of ABB Flexible Automation Inc. Prior to that, he was general manager of automotive operations of the Robotic Products Group.

Mr. Nilsson brings to ABB I-R over 20 years of experience with ABB and has lived and worked for ABB divisions here in the United States since 1985. He holds Masters of Engineering and a Masters of Business degrees from Universities in Sweden. He is a member of the Society of Automotive Engineers, the Society of Manufacturing Engineers and the Material Handling Association. Mr. Nilsson and his family reside in Troy, Michigan.



### **SLASHING ABRASIVE WATERJET OPERATING COSTS!**



To date, all abrasive has been thrown away, but with the WARD 24 it is possible to recycle and reuse this abrasive. As a result, the drastically lower prices of waterjet cutting allow waterjet to be a more competitive player in the cutting industry.

### **REVOLUTIONIZE YOUR WATERJET OPERATIONS WITH THE WARD 24**

#### **EasiJet**

200 Northeast Ave., Tallmadge, OH 44278  
phone: 330 633-7698 fax: 330 633-7670 email: ward24@easijet.com  
www.easijet.com

## Choosing A Handline Nozzle For Firefighting, from page 3

will be required. Consider whether the nozzle will always be used on the same hose or whether it will be used in other applications which might require different flows.

Remember — Fire is extinguished by the rate of application, which depends on the discharge of the nozzle at normal pressures. It is not extinguished by nozzle pressure.

### **How much flow can be controlled by the available manpower?**

Reaction force is determined by the gpm flow, nozzle pressure and pattern.

First determine the maximum flow that can be controlled by the available manpower.

Remember — A typical firefighter can handle approximately 125 gpm flow (at normal pressure) and still advance the line. Usually, two firefighters are needed to handle 150 gpm flow and still advance the line.

### **Are different patterns required?**

Decide whether a solid bore nozzle or fog/straight stream nozzle is required. Quality fog nozzles produce almost as good a straight stream as a solid bore nozzle but do require a higher inlet pressure. The reach of a quality fog nozzle at 100 psi is about the same as that of a solid bore nozzle at 80 psi. If the lower pressure performance of a solid bore nozzle combined with the patterns of a fog/straight stream nozzle would accommodate your needs best, consider a break apart fog nozzle with the compact solid bore tip.

Fog nozzles are designed to provide a dispersed stream to protect personnel. Teeth are provided to break up the water into smaller droplets for better heat absorption and steam effect. A quality fog pattern will throw some

of the water towards the center of the cone to provide better protection. Spinning teeth provide excellent breakup of water for heat absorption and steam conversion, due to the elimination of fingering, which is especially important in LPG type fires.

### **Who should control the flow - the nozzle operator or the pump operator?**

Determine whether it is necessary to change the flow rate while operating. If so, decide whether the nozzle operator or the pump operator should control the flow. If the nozzle operator should control the flow, an adjustable gallonage nozzle could be the best choice. If the pump operator is to control the flow, a single gallonage (fixed, or variable pressure/variable flow) or an automatic nozzle would probably be the best.

### **How durable should the nozzle be?**

Nozzles are designed to withstand reasonably tough service, but some nozzles will withstand more abuse than others. If durability is crucial and maintenance and repair opportunities are limited, a less complex nozzle design might be the best choice because the simplest nozzles are usually the toughest.

### **What is the level of training?**

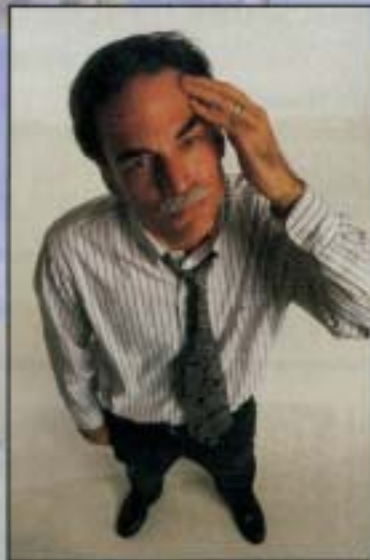
Fire departments provide various amounts of training for the pump operator and the nozzle operator. The nozzle should complement the training. Solid bore nozzles require the least amount of training for the pump operator and the nozzle operator. The engine pressure depends mainly on the length and size of hose. Single gallonage or variable pressure/variable flow nozzles require somewhat more training than the solid bore nozzle. Adjustable gallonage fog nozzles require additional training of the pump operator and the nozzle operator because different engine pressures will be required for each of the flow settings with different lengths and sizes of hose. Automatic/constant pressure fog nozzles also require additional training of the pump operator and the nozzle operator. The pump operator must be trained to accurately control the engine pressure and flow with different lengths and sizes of hoses and different operating conditions. After analyzing a department's needs and considering the strengths and purposes of each nozzle, decision makers will be better prepared to choose how to spend their limited resources on the right combination of nozzles.





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Curt Montgomery  
Jay Rowan  
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Phone: (713)675-7421  
Fax: (713)675-1515

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Ruben Saldivar  
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Al Klaser  
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Walter Hall  
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Pasadena, TX 77506  
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Fax: (713)920-5230

### Omega Pump Operations

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Phone: (915)337-4718  
Fax: (915)337-7582

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Travis Kainer  
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Bill Aurich  
9600 N. Loop East  
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Houston, TX 77029-4397  
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## Individual

### Dwight Bieberich

Fort Wayne Wire Die Inc.  
2424 American Way  
Fort Wayne, IN 46809  
Phone: (219)747-1687  
Fax: (219)747-4269

### Dr. Folker Borchardt

URACA  
Postfach 1260  
Bad Urach, Germany D72563  
Phone: [49](7125)133-0  
Fax: [49](7125)133-202

### Steve P. Brown

Rockline Industries Inc.  
PO Box 962  
Springdale, AR 72765  
Phone: (501)756-9251  
Fax: (501)927-4345

### Richard A. Burgess

KTA Tators Inc.  
2105 Wilson Road  
Humble, TX 77396  
Phone: (281)540-1177  
Fax: (281)540-1724

### Chris Cantrell

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Chester, SC 29706  
Phone: (803)581-2781  
Fax: (803)581-1730

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Chester, SC 29706  
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### Andrew De Vries

Nannaco dba Surface Pro  
2935 Thousand Oaks #6-261  
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Fax: (210)545-1831

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Huntington Beach, CA 92648  
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Fax: (562)927-1168

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Polymer Systems Inc.  
11417 Sunset Hills Road #103  
Reston, VA 20190  
Phone: (703)736-0082  
Fax: (703)736-9852

### Aquiles Guadarrama

Hidrojet S A De C V  
Zotitla 44  
Mexico, Mexico 05500  
Phone: [52](5)813-0084  
Fax: [52](5)813-0089

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(continued on page 19)

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## Sure Seal Sealant/Lubricant Available From Spir Star, Inc.

**S**pir Star, Inc., manufacturer of high pressure thermoplastic hose, announced that it now offers a new lubricant sealant called Sure Seal.

This new sealant is designed to lower torque requirements and is an excellent lubricant. Sure Seal is also designed to eliminate wear and galling on stainless threaded connections.

Sure Seal is equally effective on exotic materials as well as non ferrous alloys and may also be used on more

common types of carbon steel. Sure Seal is recommended for use as a thread compound in applications such as bolted joints, pipe and fittings, thus eliminating the need for Teflon tape.

In demonstrations, a variety of threads have been pressed into distorted shapes, flattened by hammering and otherwise ruined. In each case Sure Seal reformed the threads to their original shape and made the mating surfaces smooth and even. In one instance, a 316 stainless

bolt was used to chase new threads in an aluminum block!

Sure Seal is available in an easily dispensed tube applicator. For more information, contact:

**Spir Star, Inc.**  
11983 FM 529  
Houston, TX 77041  
Toll Free Phone: (800)890-7827

## Welcome WJTA New Members, from page 18

### Jon Kirby

Dwyer Aluminum Mast Co.  
2 Commerce Drive  
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Phone: (203)484-0419  
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### Sunny Li

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Kowloon, Hong Kong  
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Phone: (562)755-3697  
Fax: (562)927-1168

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Napan, NB E1N 4W5 Canada  
Phone: (506)773-5845  
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### Tamara Merriman

Hydrotech Cutting Inc.  
RR 15 Box 685  
Bedford, IN 47421  
Phone: (812)849-9538  
Fax: (812)849-6333

### Dr. Alexandros Michaelides

Cyprus Institute of Tech  
PO Box 20783  
Lefkosia, Cyprus 1663  
Phone: [357](2)317288  
Fax: [357](2)318087

### Francisco Parga

Martin Pump & Equipment Co.  
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### Mark Robertson

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### Joseph Ryan

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Fax: (281)398-0564

### Frank Smith

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Fax: (714)546-8017

### Patrick J. Spence

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25940 Northline Road  
Taylor, MI 48180  
Phone: (734)946-7880  
Fax: (734)946-6304

### James T. Sumner

Arcadia Supply  
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Albany, NY 12204  
Phone: (518)434-6213  
Fax: (518)434-2527

### Chuck Thompson

SF Phosphates  
515 S. Hwy 430  
PO Box 1789  
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### Matthew Tonnaer

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### Dieter Volk

Mike Volk Inc.  
PO Box 1607  
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Fax: (419)529-2287

### Chris Wetherall

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### Lyle Wilson

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### Student

### Tanya Sadlo

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Fax: (604)882-8852

### Kurt Volk

Mike Volk Inc.  
PO Box 1607  
Mansfield, OH 44901

# ABB I-R Waterjet Cutting Systems

**A**BB I-R Waterjet Systems, the joint venture of ABB Flexible Automation Inc. and Ingersoll-Rand Company, will be exhibiting the advanced *Cut Wizard™* waterjet cutting software, an Acculine™ RP two-dimensional waterjet cutting system and a Cutting Box™ in Booth No. 8092, McCormick Place North, at the 1999 FABTECH Show, November 14-18 in Chicago.

The Acculine™ RP line of machines is a cost-effective, high precision flexible solution for waterjet and Hydroabrasive™ cutting operations. The basic RP design features a high-accuracy moving gantry. The RP series of machines can use 50 or 100 horsepower Ingersoll-Rand Streamline™ SL-IV series intensifiers, depending on the application. The waterjet cutting machines are offered in two standard work envelopes: 12 feet x 6 feet and 8 feet x 4 feet. The 12 x 6 version will be on exhibit as well as both intensifiers.

The gantry-style waterjet systems use a PC based CNC controller that is specifically configured for waterjet cutting machines, providing excellent contouring accuracy and full throttle control of water and abrasive functions. The ABB I-R *Cut Wizard™* waterjet cutting software helps to optimize the cutting process and provides the necessary tool path generation and feedrate requirements. Designed and developed by ABB I-R Waterjet Systems, *Cut Wizard™* is a user-friendly Windows® based integrated CAD/CAM/Waterjet software program that is especially tailored to waterjet technology and waterjet cutting processes. The software allows a user to go from a drawing to cutting in a couple of steps and short time period. The integration and ease of use reduces the time required from going from an image to the actual cutting process.

Also on display will be the ABB I-R Cutting Box™. It is a robotic workcell designed to trim small parts like automotive door and instrument panels. Parts to be trimmed are mounted in vertical fixtures on an index table that permits one part to be loaded/unloaded while the other is being cut. An ABB robot mounted inside the box is equipped with a waterjet-cutting head. This enclosed, watertight design maintains a clean work environment by containing all water and cutting scrap.

ABB I-R will also be discussing their complete capability for 2D and 3D advanced waterjet cutting technology using pure water or abrasive and water for high production or batch processing of parts for the automotive, aerospace, food, architectural,

furniture and paper industries as well as fabricators and job shops.

ABB I-R Waterjet Systems L.L.C., located in Farmington Hills, Michigan, combines Ingersoll-Rand's high-pressure intensifier and two-dimensional waterjet cutting technology with ABB's expertise in robotics and motion equipment to provide "world-class" automated waterjet cutting systems.



## SUPER-WATER® — Testimonial #2

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Vince L. Imlay, Water Jet Inc., Seymour, Indiana  
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Dear Dr. Howells:

Complete results on cutting EPDM closed-celled rubber sponge are given. The client (who requests anonymity) uses plain water with a 0.008-inch sapphire orifice while my results — shown in bold, underlined and in brackets — are for 0.3% SUPER-WATER® with a 0.007-inch sapphire orifice.

Substrate	Kpsi	# in Stack	Nozzle	Cut rate (inches/min)	
0.413-inch sponge	40 (40)	4 (5)	0.008" (0.007")	500 (500)	Equal cut quality
0.551-inch sponge	40 (40)	3 (5)	0.008" (0.007")	500 (500)	Equal cut quality
0.236-inch sponge	40 (40)	5 (8)	0.008" (0.007")	600 (500)	Equal cut quality
0.876-inch dense sponge	40 (40)	1 (1)	0.008" (0.007")	200 (500)	Better cut
0.866-inch 5-layer	45 (45)	1 (1)	0.008" (0.007")	300 (300)	Better cut

The client wishes to reduce the required horsepower and increase the number of layers in the stack being cut. The horsepower required in using a 0.007-inch nozzle instead of a 0.008-inch decreases from 10.1 to 7.0 (i.e. a 31% reduction).

SUPER-WATER® concentrated industrial water blasting additive is a product of: **Berkeley Chemical Research, Inc.**, PO Box 9264, Berkeley, CA 94709, telephone: (510)526-6272, fax: (510)525-2375, web site: [www.berkchem.qpg.com](http://www.berkchem.qpg.com)



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## NLB Crawler For Surface Preparation

A new SPIN JET® crawler from NLB Corp. automates the preparation of tanks, ship hulls and other large, vertical surfaces with ultra-high pressure waterjets. The easy-to-manuever SRT-10 unit systematically removes coatings with rotating waterjets, saving operators the effort of hand lancing.

The SRT-10 enhances the productivity and labor-saving advantages of waterjetting, which has been shown to leave a cleaner surface than grit blasting without the noise, dust and disposal problems. The unit easily removes epoxies, anti-skid and rubberized paints, rust, and other build-up.

NLB's SRT-10 works with a vacuum recovery system, which collects water and debris as it works.

This greatly simplifies disposal, significantly reducing time and expense.

The unit's unique design combines the vacuum recovery with NLB's patented rotating SPIN JET® technology in a way that prevents hoses from kinking. The SRT-10 is therefore more maneuverable than other crawler units, and therefore requires less manual touch-up.

The SRT-10 operates at a maximum pressure of 40,000 psi (2,800 bar), with a maximum flow of just 6 gpm (23 lpm). The water is supplied by an NLB ULTRA-CLEAN 40® ultra-high pressure pump unit. The system includes winches (which position the unit and act as a safety brake) and a full-function remote control.



NLB, a global leader in waterjet technology, manufactures a full line of quality high-pressure and ultra-high pressure waterjetting systems and accessories for many uses. These include surface preparation, tank cleaning, descaling, concrete demolition, paint booth cleaning, concrete and pipe cutting, and more.

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Patent  
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# NEEDLE VALVE FEATURES & OPTIONS

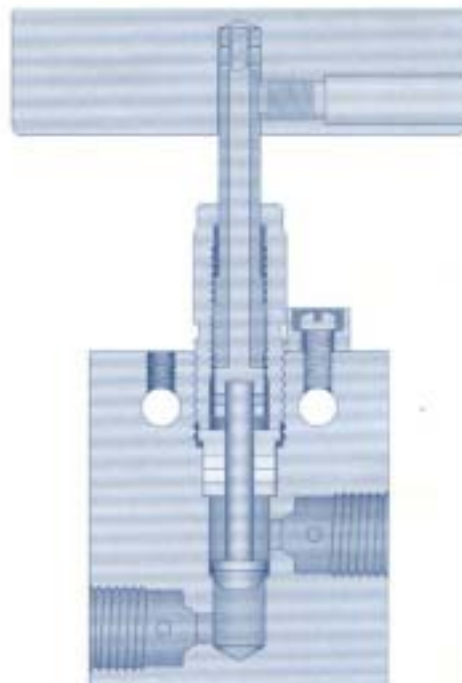
## Needle Valve Features:

- Non-rotating stem prevents galling and scoring
- Four stem styles:
  - Vee
  - Metering
  - Regulating
  - Micro-Metering
- 17-4PH Stem for longer service life. 316 wetted parts are also available by specifying option **-316WP**
- Glass-filled packing for temperatures to 600°F (315°C)
- Integral through holes for bracket mounting, a panel-mounting option is also available
- Wide range of options allow customizing of valve
- Positive gland locking device

## Materials of Construction

Standard materials of construction include 316 cold-worked stainless steel, 17-4PH, and glass-filled teflon. All BuTech equipment may also be produced in any machinable metal. Some of the more common exotic materials used are:

Hastelloy™  
Inconel™  
Titanium  
Monel 400™



## **Packing and Stem Materials**

- GR Grafoil packings for service to 800°F (426°C)
- TFE Virgin Teflon packing
- 316WP 316 wetted parts
- STS Stellite tipped stem
- SRS Stellite replaceable seat (Replaceable seat valves only)

## **Handle Options**

- PH Round plastic handle in place of aluminum (available on 1/4" through 9/16" sizes)
- SS Stainless steel handle in place of aluminum (available on 1/4" through 9/16" sizes, on 3/4" and 1" SS is standard)
- EXT\_ Handle extended above valve body, specify number of inches of extra height desired (Ex: **EXT6** is a 6" extension)

## **Security Options**

- HLD Handle locking device (prevents unauthorized opening/closing of valve)
- SLD Stem locking device (prevents stem from turning due to vibration)

## **Extreme Service**

- AVG Anti-vibration glands instead of standard glands for applications with excessive vibration or shock
- O2 Cleaned for oxygen service
- HT Extended stuffing box, graphite packing, and materials for high-temperature service to 1200°F (648°C)
- HTF Finned extended stuffing box, graphite packing, and materials for high-temperature service to 1200°F (648°C)
- LT Extended stuffing box, teflon packing, and materials for cryogenic service to -423°F (-251°C)
- LTF Finned extended stuffing box, teflon packing, and materials for cryogenic service to -423°F (-251°C)

## **Panel Mount**

- PM Panel-mount packing gland for single-hole mounting



All dimensions are for reference only and are subject to change.  
Dimensions in parentheses are millimeters (mm).

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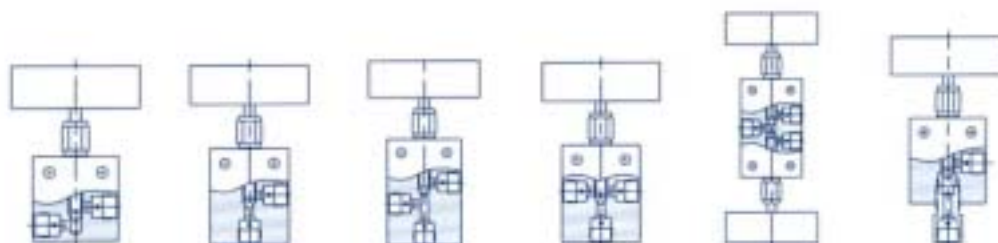
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# NEEDLE VALVES



Tube OD	MAWP+	Cv*	Stem Style	2-way Straight	2-way Angle	3-way Two on Pressure	3-way One on Pressure	2-stem Manifold	2-way Angle Replaceable Seat
1/4"	20,000 PSI 1,380 bar	0.31	Vee Reg	20UV41V 20UV41R	20UV42V 20UV42R	20UV43V 20UV43R	20UV44V 20UV44R	20UV45V 20UV45R	20UV46V 20UV46R
3/8"	20,000 PSI 1,380 bar	0.75	Vee Reg	20UV61V 20UV61R	20UV62V 20UV62R	20UV63V 20UV63R	20UV64V 20UV64R	20UV65V 20UV65R	20UV66V 20UV66R
9/16"	20,000 PSI 1,380 bar	1.75	Vee Reg	20UV91V 20UV91R	20UV92V 20UV92R	20UV93V 20UV93R	20UV94V 20UV94R	20UV95V 20UV95R	20UV96V 20UV96R
3/4"	20,000 PSI 1,380 bar	2.80	Vee Reg	20V121V 20V121R	20V122V 20V122R	20V123V 20V123R	20V124V 20V124R	20V125V 20V125R	20V126V 20V126R
1"	20,000 PSI 1,380 bar	5.20	Vee Reg	20V161V 20V161R	20V162V 20V162R	20V163V 20V163R	20V164V 20V164R	20V165V 20V165R	20V166V 20V166R
1/4"	30,000 PSI 2,070 bar	0.12	Vee Reg	30UV41V 30UV41R	30UV42V 30UV42R	30UV43V 30UV43R	30UV44V 30UV44R	30UV45V 30UV45R	30UV46V 30UV46R
3/8"	30,000 PSI 2,070 bar	0.23	Vee Reg	30UV61V 30UV61R	30UV62V 30UV62R	30UV63V 30UV63R	30UV64V 30UV64R	30UV65V 30UV65R	30UV66V 30UV66R
9/16"	30,000 PSI 2,070 bar	0.33	Vee Reg	30UV91V 30UV91R	30UV92V 30UV92R	30UV93V 30UV93R	30UV94V 30UV94R	30UV95V 30UV95R	30UV96V 30UV96R
1"	30,000 PSI 2,070 bar	2.80	Vee Reg	30V161V 30V161R	30V162V 30V162R	30V163V 30V163R	30V164V 30V164R	30V165V 30V165R	30V166V 30V166R
9/16"	40,000 PSI 2,760 bar	0.31	Vee Reg	40UV91V 40UV91R	40UV92V 40UV92R	40UV93V 40UV93R	40UV94V 40UV94R	40UV95V 40UV95R	40UV96V 40UV96R
1/4"	60,000 PSI 4,140 bar	0.09	Vee Reg	60UV41V 60UV41R	60UV42V 60UV42R	60UV43V 60UV43R	60UV44V 60UV44R	60UV45V 60UV45R	60UV46V 60UV46R
3/8"	60,000 PSI 4,140 bar	0.14	Vee Reg	60UV61V 60UV61R	60UV62V 60UV62R	60UV63V 60UV63R	60UV64V 60UV64R	60UV65V 60UV65R	60UV66V 60UV66R
9/16"	60,000 PSI 4,140 bar	0.27	Vee Reg	60UV91V 60UV91R	60UV92V 60UV92R	60UV93V 60UV93R	60UV94V 60UV94R	60UV95V 60UV95R	60UV96V 60UV96R
3/4"	60,000 PSI 4,140 bar	0.50	Vee Reg	60V121V 60V121R	60V122V 60V122R	60V123V 60V123R	60V124V 60V124R	60V125V 60V125R	60V126V 60V126R

\*Cv values listed are for 2-way straight pattern valves. For 2-way angle valves, increase Cv value by 50%.

+Maximum allowable working pressure at 72°F (22°C).



# AIR AND HYDRAULIC ACTUATORS

BuTech actuators are designed for remote control of tough-to-handle fluid and gas systems, such as corrosive processes, high temperature test loops, cryogenic systems, sampling of steam generators, and hazardous environments. Since BuTech air and hydraulic operators are virtually maintenance-free, they are ideally suited for service in limited access areas. The compact size and weight of these units permits installation where space or weight is at a premium.

The single-acting actuators have a *fail-safe feature*: The Air-to-Open actuator closes the valve on loss of operating pressure, while the Air-to-Close actuator opens the valve on loss of operating pressure. These very desirable safety features are necessary in critical systems.

BuTech offers both 5" and 8" air actuators for the valves shown in this catalog. Also available are the compact hydraulic actuators. See chart below for proper selection.



Valve Model		Normally Open, Air-to-Close Actuators ATC5 ATC8		Normally Closed, Air-to-Open Actuators ATO5 ATO8		Double-Acting Pneumatic Actuators DA5 DA8		Double-Acting Hydraulic Actuators DAH DAH2	
20UV4 20UV6	MAWP	20,000 PSI 1380 bar		20,000 PSI 1380 bar	20,000 PSI 1380 bar	20,000 PSI 1380 bar		20,000 PSI 1380 bar	
	Req'd Air Pressure	74 PSI 5 bar		82 PSI 10 bar	55 PSI 4 bar	63 PSI 4 bar		592 PSI 41 bar	
20UV9	MAWP	18,000 PSI 1240 bar	20,000 PSI 1380 bar	14,000 PSI 970 bar	20,000 PSI 1380 bar	20,000 PSI 1380 bar		20,000 PSI 1380 bar	
	Req'd Air Pressure	100 PSI 7 bar	49 PSI 3 bar	84 PSI 6 bar	58 PSI 4 bar	98 PSI 7 bar		925 PSI 64 bar	
20V12	MAWP		20,000 PSI 1380 bar		12,500 PSI 860 bar		20,000 PSI 1380 bar		20,000 PSI 1380 bar
	Req'd Air Pressure		101 PSI 7 bar		66 PSI 5 bar		90 PSI 6 bar		1,134 PSI 78 bar
20V16	MAWP		12,000 PSI 830 bar		7,500 PSI 520 bar		12,000 PSI 830 bar		16,000 PSI 1100 bar
	Req'd Air Pressure		100 PSI 7 bar		66 PSI 5 bar		89 PSI 6 bar		1,500 PSI 103 bar
30UV	MAWP	30,000 PSI 2070 bar		30,000 PSI 2070 bar		30,000 PSI 2070 bar		30,000 PSI 2070 bar	
	Req'd Air Pressure	35 PSI 2 bar		78 PSI 10 bar		23 PSI 2 bar		222 PSI 15 bar	
30V	MAWP		18,000 PSI 1240 bar		12,500 PSI 860 bar		22,000 PSI 1520 bar		26,000 PSI 1790 bar
	Req'd Air Pressure		92 PSI 6 bar		66 PSI 5 bar		99 PSI 7 bar		1,475 PSI 102 bar
40UV	MAWP	40,000 PSI 2760 bar		40,000 PSI 2760 bar		40,000 PSI 2760 bar		40,000 PSI 2760 bar	
	Req'd Air Pressure	36 PSI 2 bar		78 PSI 10 bar		24 PSI 2 bar		227 PSI 16 bar	
60UV	MAWP	60,000 PSI 4140 bar		60,000 PSI 4140 bar		60,000 PSI 4140 bar		60,000 PSI 4140 bar	
	Req'd Air Pressure	23 PSI 2 bar		88 PSI 6 bar		12 PSI 1 bar		111 PSI 8 bar	
60V	MAWP	60,000 PSI 4140 bar	60,000 PSI 4140 bar		60,000 PSI 4140 bar	60,000 PSI 4140 bar		60,000 PSI 4140 bar	
	Req'd Air Pressure	100 PSI 7 bar	45 PSI 3 bar		61 PSI 4 bar	88 PSI 6 bar		830 PSI 57 bar	



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# NIPPLES, TUBING AND MANIFOLDS

BuTech stocks pre-cut coned and threaded nipples in lengths up to 12" (305mm). In addition, nipples can be purchased to any custom length.



Tube OD	MAWP	2.75"	3.00"	4.00"	Length 6.00"	8.00"	10.00"	12.00"
1/4"	20,000 PSI 1,380 bar	20N442-316	20N443-316	20N444-316	20N446-316	20N448-316	20N4410-316	20N4412-316
3/8"	20,000 PSI 1,380 bar		20N663-316	20N664-316	20N666-316	20N668-316	20N6610-316	20N6612-316
9/16"	20,000 PSI 1,380 bar			20N994-316	20N996-316	20N998-316	20N9910-316	20N9912-316
3/4"	20,000 PSI 1,380 bar				20N126-316	20N128-316	20N1210-316	20N1212-316
1"	20,000 PSI 1,380 bar				20N166-316	20N168-316	20N1610-316	20N1612-316
1"	30,000 PSI 2,070 bar				30N166-316	30N168-316	30N1610-316	30N1612-316
9/16"	40,000 PSI 2,760 bar			40N994-316	40N996-316	40N998-316	40N9910-316	40N9912-316
1/4"	60,000 PSI 4,140 bar	60N442-316	60N443-316	60N444-316	60N446-316	60N448-316	60N4410-316	60N4412-316
3/8"	60,000 PSI 4,140 bar		60N663-316	60N664-316	60N666-316	60N668-316	60N6610-316	60N6612-316
9/16"	60,000 PSI 4,140 bar			60N994-316	60N996-316	60N998-316	60N9910-316	60N9912-316
3/4"	60,000 PSI 4,140 bar				60N126-316	60N128-316	60N1210-316	60N1212-316

Tube OD	MAWP	LD.	Catalog Number	
			316SS	304SS
1/4"	20,000 PSI 1,380 bar	0.109" (2.8 mm)	20-109-316	20-109-304
3/8"	20,000 PSI 1,380 bar	0.203" (5.2 mm)	20-203-316	20-203-304
9/16"	20,000 PSI 1,380 bar	0.312" (7.9 mm)	20-312-316	20-312-304
3/4"	20,000 PSI 1,380 bar	0.438" (11.1 mm)	20-438-316	20-438-304
1"	20,000 PSI 1,380 bar	0.562" (14.3 mm)	20-562-316	20-562-304
1"	30,000 PSI 2,070 bar	0.438" (11.1 mm)	30-438-316	30-438-304
9/16"	40,000 PSI 2,760 bar	0.250" (6.4 mm)	40-250-316	40-250-304
1/4"	60,000 PSI 4,140 bar	0.083" (2.1 mm)	60-083-316	60-083-304
3/8"	60,000 PSI 4,140 bar	0.125" (3.2 mm)	60-125-316	60-125-304
9/16"	60,000 PSI 4,140 bar	0.188" (4.8 mm)	60-188-316	60-188-304
3/4"	60,000 PSI 4,140 bar	0.250" (6.4 mm)	60-250-316	60-250-304

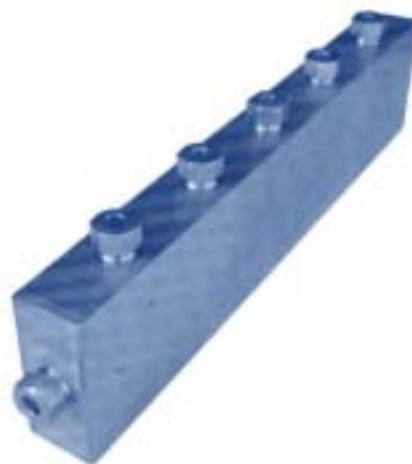
BuTech Pressure Systems offers a complete selection of austenitic seamless cold-drawn stainless steel tubing for high pressure applications where both high strength and corrosion resistance are desired. Tubing is available in standard 20-24 foot length (6-7 meters), however, longer lengths are available on request.



## Manifolds

Specialty pressure manifolds minimize space requirements and reduce installation time necessary to plumb a pressure system. In addition, by reducing the number of components used in a system, manifolds reduce the number of potential leak joints.

BuTech Pressure Systems will design and build pressure manifolds to meet specific installation, layout and pressure requirements. These manifolds are capable of withstanding pressures from vacuum to 60,000 PSI (4140 bar), and are available in a variety of materials and sizes. Among the pressure connections that can be incorporated are low pressure compression, medium and high pressure cone-and-thread, NPT, SAE, BSP and others. Transitions in system line sizes and tubing pressure series can be accomplished through a specialty manifold. These manifolds are appropriate wherever pressure tubing systems are utilized.





# FITTINGS AND CONNECTION COMPONENTS



Tube OD	MAWP	Elbow	Tee	Cross	Coupling	Replacable Seat Coupling	Bulkhead Coupling
1/4"	20,000 PSI 1,380 bar	20L4	20T4	20X4	20F4	20UF4	20BF4
3/8"	20,000 PSI 1,380 bar	20L6	20T6	20X6	20F6	20UF6	20BF6
9/16"	20,000 PSI 1,380 bar	20L9	20T9	20X9	20F9	20UF9	20BF9
3/4"	20,000 PSI 1,380 bar	20L12	20T12	20X12	20F12	20UF12	20BF12
1"	20,000 PSI 1,380 bar	20L16	20T16	20X16	20F16	20UF16	20BF16
1"	30,000 PSI 2,070 bar	30L16	30T16	30X16	30F16	30UF16	30BF16
9/16"	40,000 PSI 2,760 bar	40L9	40T9	40X9	40F9	40UF9	40BF9
1/4"	60,000 PSI 4,140 bar	60L4	60T4	60X4	60F4	60UF4	60BF4
3/8"	60,000 PSI 4,140 bar	60L6	60T6	60X6	60F6	60UF6	60BF6
9/16"	60,000 PSI 4,140 bar	60L9	60T9	60X9	60F9	60UF9	60BF9
3/4"	60,000 PSI 4,140 bar	60L12	60T12	60X12	60F12	60UF12	60BF12



Tube OD	MAWP	Gland	Collar	Plug	Anti-Vibration Collet Gland	Cup	Safety Heads
1/4"	20,000 PSI 1,380 bar	20G4	20C4	20P4	20AVCG4	20CA4	20SH4
3/8"	20,000 PSI 1,380 bar	20G6	20C6	20P6	20AVCG6	20CA6	20SH6
9/16"	20,000 PSI 1,380 bar	20G9	20C9	20P9	20AVCG9	20CA9	20SH9
3/4"	20,000 PSI 1,380 bar	20G12	20C12	20P12	20AVCG12	20CA12	20SH12
1"	20,000 PSI 1,380 bar	20G16	20C16	20P16	20AVCG16	20CA16	20SH16
1"	30,000 PSI 2,070 bar	20G16	20C16	30P16	20AVCG16	30CA16	30SH16
9/16"	40,000 PSI 2,760 bar	60G9	60C9	40P9	60AVG9	40CA9	40SH9
1/4"	60,000 PSI 4,140 bar	60G4	60C4	60P4	60AVG4	60CA4	60SH4
3/8"	60,000 PSI 4,140 bar	60G6	60C6	60P6	60AVG6	60CA6	60SH6
9/16"	60,000 PSI 4,140 bar	60G9	60C9	60P9	60AVG9	60CA9	60SH9
3/4"	60,000 PSI 4,140 bar	60G12	60C12	60P12	60AVG12	60CA12	60SH12



Tube OD	Check Valves				Filters	
	MAWP		Ball Type	O-ring Type	Line	Cup
1/4"	20,000 PSI	1,380 bar	20BC4	20SC4	20LF4	20SCF4
3/8"	20,000 PSI	1,380 bar	20BC6	20SC6	20LP6	20SCF6
9/16"	20,000 PSI	1,380 bar	20BC9	20SC9	20LP9	20SCF9
3/4"	20,000 PSI	1,380 bar	20BC12	20SC12	20LF12	20SCF12
1"	20,000 PSI	1,380 bar	20BC16	20SC16	20LF16	20SCF16
1"	30,000 PSI	2,070 bar	30BC16	30SC16	30LF16	30SCF16
9/16"	40,000 PSI	2,760 bar	40BC9	40SC9	40LP9	40SCF9
1/4"	60,000 PSI	4,140 bar	60BC4	60SC4	60LF4	60SCF4
3/8"	60,000 PSI	4,140 bar	60BC6	60SC6	60LP6	60SCF6
9/16"	60,000 PSI	4,140 bar	60BC9	60SC9	60LP9	60SCF9
3/4"	60,000 PSI	4,140 bar	60BC12	60SC12	60LF12	60SCF12



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WJ-99



# ADAPTERS AND COUPLINGS

BuTech Pressure Systems stocks a wide variety of male-female adapters and female-female couplings. The charts below show some of the possible combinations. Other connections and sizes are available. Please consult the BuTech sales staff.



## Adapters

		FEMALE END									
		MAWP: 20,000 PSI (1380 bar)					MAWP: 60,000 PSI (4140 bar)				
MALE END	Tube OD	MAWP	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"
	1/4"	20,000 PSI 1,380 bar	20A4M4M	20A4M6M	20A4M9M	20A4M12M	20A4M16M	20A4M4H	20A4M6H	20A4M9H	20A4M12H
	3/8"	20,000 PSI 1,380 bar	20A6M4M	20A6M6M	20A6M9M	20A6M12M	20A6M16M	20A6M4H	20A6M6H	20A6M9H	20A6M12H
	1/2"	20,000 PSI 1,380 bar	20A9M4M	20A9M6M	20A9M9M	20A9M12M	20A9M16M	20A9M4H	20A9M6H	20A9M9H	20A9M12H
	3/4"	20,000 PSI 1,380 bar	20A12M4M	20A12M6M	20A12M9M	20A12M12M	20A12M16M	20A12M4H	20A12M6H	20A12M9H	20A12M12H
	1"	20,000 PSI 1,380 bar	20A16M4M	20A16M6M	20A16M9M	20A16M12M	20A16M16M	20A16M4H	20A16M6H	20A16M9H	20A16M12H
	1 1/4"	60,000 PSI 4,140 bar	20A4H4M	20A4H6M	20A4H9M	20A4H12M	20A4H16M	60A4H4H	60A4H6H	60A4H9H	60A4H12H
	1 1/2"	60,000 PSI 4,140 bar	20A6H4M	20A6H6M	20A6H9M	20A6H12M	20A6H16M	60A6H4H	60A6H6H	60A6H9H	60A6H12H
	2"	60,000 PSI 4,140 bar	20A9H4M	20A9H6M	20A9H9M	20A9H12M	20A9H16M	60A9H4H	60A9H6H	60A9H9H	60A9H12H
	3"	60,000 PSI 4,140 bar	20A12H4M	20A12H6M	20A12H9M	20A12H12M	20A12H16M	60A12H4H	60A12H6H	60A12H9H	60A12H12H



## Couplings

		MAWP: 20,000 PSI (1380 bar)					MAWP: 60,000 PSI (4140 bar)				
		Tube OD	MAWP	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
1/4"	20,000 PSI 1,380 bar	20F4	20F4M6M	20F4M9M	20F4M12M	20F4M16M	20F4M4H	20F4M6H	20F4M9H	20F4M12H	20F4M16H
3/8"	20,000 PSI 1,380 bar	20F6	20F6M9M	20F6M12M	20F6M16M	20F6M4H	20F6M6H	20F6M9H	20F6M12H	20F6M16H	20F6M20H
1/2"	20,000 PSI 1,380 bar	20F9	20F9M12M	20F9M16M	20F9M4H	20F9M6H	20F9M9H	20F9M12H	20F9M16H	20F9M20H	20F9M24H
3/4"	20,000 PSI 1,380 bar	20F12	20F12M16M	20F12M4H	20F12M6H	20F12M9H	20F12M12H	20F12M16H	20F12M20H	20F12M24H	20F12M30H
1"	20,000 PSI 1,380 bar	20F16	20F16M20H	20F16M4H	20F16M6H	20F16M9H	20F16M12H	20F16M16H	20F16M20H	20F16M24H	20F16M30H
1 1/4"	60,000 PSI 4,140 bar	60F4	60F4H6H	60F4H9H	60F4H12H	60F4H16H	60F4H20H	60F4H24H	60F4H30H	60F4H36H	60F4H42H
1 1/2"	60,000 PSI 4,140 bar	60F6	60F6H9H	60F6H12H	60F6H16H	60F6H20H	60F6H24H	60F6H30H	60F6H36H	60F6H42H	60F6H48H
2"	60,000 PSI 4,140 bar	60F9	60F9H12H	60F9H16H	60F9H20H	60F9H24H	60F9H30H	60F9H36H	60F9H42H	60F9H48H	60F9H54H
3"	60,000 PSI 4,140 bar	60F12	60F12H16H	60F12H20H	60F12H24H	60F12H30H	60F12H36H	60F12H42H	60F12H48H	60F12H54H	60F12H60H

**Note:** The Maximum Allowable Working Pressure of an adapter or coupling shall not exceed the MAWP of the selected connection.

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**BuTech**  
PRESSURE SYSTEMS

# QUICK DISCONNECT COUPLINGS AND HOSE



- Pressures to 60,000 PSI (4140 bar)
- Multiple port and seal options available
- Unique, self-locking design -- will not disconnect under pressure
- Low pressure drop valved design or full-flow non-valved version available
- Stainless steel construction for long, trouble-free service

**QD**  **MAWP**  - **Valve Code**  - **Size**  - **Connection**  - **Port Type**

<b>20</b> 20,000 PSI	<b>01</b> Coupling, Non-valved	<b>2</b> 1/8"	<b>HP</b> H/P Coned-and-threaded	<b>M</b> Male (Omit for female)
<b>30</b> 30,000 PSI	<b>02</b> Coupling, Valved	<b>4</b> 1/4"	<b>MP</b> M/P Coned-and-threaded	
<b>60</b> 60,000 PSI	<b>03</b> Nipple, Non-valved	<b>6</b> 3/8"	<b>NPT</b> NPT	
	<b>04</b> Nipple, Valved	<b>8</b> 1/2"		
		<b>9</b> 9/16"		
		<b>12</b> 3/4"		
		<b>16</b> 1"		

BuTech offers a variety of high pressure hose for waterjet cutting, high pressure testing and hydraulics.

All hose assemblies available with choice of female or male NPT end connections in 1/8", 1/4", 3/8", 1/2", 3/4", and 1" sizes. Operating temperature range is -40° to +140°F (-40° to 60°C).

Hose Series	Working Pressure		Hose I.D.		Hose O.D.		Insert I.D.	
	PSI	bar	Inches	MM	Inches	MM	Inches	MM
20.3H-.80	20,300	1400	0.80	20.3	1.30	33.0	0.53	13.5
20.4H-.50	20,400	1410	0.50	12.7	0.88	22.4	0.30	7.6
22.5H-.25	22,500	1550	0.25	6.4	0.50	12.7	0.13	3.3
23H-.33	23,000	1590	0.33	8.4	0.61	15.5	0.18	4.6
26H-.20	26,000	1790	0.20	5.1	0.43	10.9	0.07	1.8
26H-.50	26,000	1790	0.50	12.7	0.97	24.6	0.31	7.9
30H-.15	30,000	2070	0.15	3.8	0.37	9.4	0.10	2.5
36H-.33	36,000	2480	0.33	8.4	0.68	17.3	0.18	4.6
36.25H-.20	36,250	2500	0.20	5.1	0.50	12.7	0.09	2.3
40H-.20	40,000	2760	0.20	5.1	0.50	12.7	0.09	2.3
40.6H-.15	40,600	2800	0.15	3.8	0.42	10.7	0.08	2.0
48H-.20	48,000	3310	0.20	5.1	0.57	14.5	0.08	2.0
60H-.20	60,000	4140	0.20	5.1	1.57	39.9	0.08	2.0

**Hose Series**  - **Length**  - **Size**  - **Connection Type**  - **Style**

<b>From chart above</b>	<b>Specify in inches</b>	<b>2</b> 1/8" <b>4</b> 1/4" <b>6</b> 3/8" <b>8</b> 1/2" <b>9</b> 9/16" <b>12</b> 3/4" <b>16</b> 1"	<b>H</b> H/P Coned-and-threaded <b>M</b> M/P Coned-and-threaded <b>P</b> NPT <b>T</b> Tube Nipple	<b>M</b> Male, non-swivel <b>MS</b> Male, swivel (A limited selection of female connections are available. Please consult factory.)
-------------------------	--------------------------	--	--	---

Example:

**40.6H-.15-120-8P (M x MS)** specifies a 0.15" ID Hose rated 40,600 PSI, 120" long, with 1/2" NPT connections, one end swivel.



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# PRESSURE GAUGES AND BALL VALVES



BuTech offers a line of gauges for indication of system pressure. All gauges are supplied with 1/4" H/P Coned and Threaded connections. Various adapters are available for use with medium and high pressure component systems.

Pressure Range	Pressure Divisions	Bottom Connected Gauges		Back Connected Gauges	
		Wall Mount	Flush Mount	Wall Mount	Flush Mount
1,000 PSI 70 bar	10 PSI 1 bar	1MG	1MG-PM	1MGB	1MGB-PM
2,000 PSI 140 bar	20 PSI 1 bar	2MG	2MG-PM	2MGB	2MGB-PM
3,000 PSI 210 bar	25 PSI 2 bar	3MG	3MG-PM	3MGB	3MGB-PM
5,000 PSI 340 bar	50 PSI 3 bar	5MG	5MG-PM	5MGB	5MGB-PM
7,500 PSI 520 bar	50 PSI 3 bar	7.5MG	7.5MG-PM	7.5MGB	7.5MGB-PM
10,000 PSI 690 bar	100 PSI 7 bar	10MG	10MG-PM	10MGB	10MGB-PM
15,000 PSI 1030 bar	100 PSI 7 bar	15AG	15AG-PM	15AGB	15AGB-PM
20,000 PSI 1380 bar	200 PSI 14 bar	20AG	20AG-PM	20AGB	20AGB-PM
30,000 PSI 2070 bar	250 PSI 17 bar	30AG	30AG-PM	30AGB	30AGB-PM
50,000 PSI 3450 bar	500 PSI 34 bar	50AG	50AG-PM	50AGB	50AGB-PM
75,000 PSI 5170 bar	500 PSI 34 bar	75AG	75AG-PM	75AGB	75AGB-PM
100,000 PSI 6890 bar	1,000 PSI 69 bar	100AG	100AG-PM	100AGB	100AGB-PM



BuTech Ball Valves are available in 2-, 3-, 4- and 5-way designs in pressures to 20,000 PSI (1380 bar). The valves offer an infinite combination of connections including male and female NPT, low-pressure compression fittings, medium- and high-pressure tube ends, medium- and high-pressure female, JIC 37° flare, SAE O-ring boss, socket-weld, butt-weld, and metric connections. They are available with special seal materials or manufactured from any machinable metal for extreme applications. They can also be fitted with pneumatic or electric actuators for remote control.



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# TOOLS

## Tube Bender

The BuTech tube bender is designed to provide fast, accurate and reliable bending of heavy wall tubing with only one setup.



Tube OD	Catalog Number
1/4"	MTB4
3/8"	MTB6
9/16"	MTB9
1/4", 3/8", 9/16"	MTB469

## Tube Vises

BuTech tube vises are the lightweight and inexpensive way to hold tubing tightly during coning and threading operations.



Tube OD	Catalog Number
1/4"	TV4
3/8"	TV6
9/16"	TV9
3/4"	TV12
1"	TV16

## Hand Tools

BuTech hand tools are designed to permit on-site end preparation for tubing. The coning tool uses a precision collet to maintain concentricity between the tube and the cutter blades. The threading tool uses an adjustable split die and a precision guide bushing to cut a perfect thread.



Tube OD	Series	Coning Tool	Threading Tool
1/4"	20,000 PSI	20HCT4	THT4-H
3/8"	20,000 PSI	20HCT6	THT6-H
9/16"	20,000 PSI	20HCT9	THT9-H
3/4"	20,000 PSI	20HCT12	THT12-H
1"	20,000 PSI	20HCT16	THT16-H

1/4"	60,000 PSI	60HCT4	THT4-H
3/8"	60,000 PSI	60HCT6	THT6-H
9/16"	60,000 PSI	60HCT9	THT9-H
3/4"	60,000 PSI	60HCT12	THT12-H
1"	60,000 PSI	60HCT16	THT16-H

## Power Tools

BuTech power tools are designed to be used with any variable speed power hand drill. This unique feature makes them perfect for fast machining of several tube ends.



Tube OD	Series	Coning Tool	Threading Tool
1/4"	20,000 PSI	20CT4	THT4-P
3/8"	20,000 PSI	20CT6	THT6-P
9/16"	20,000 PSI	20CT9	THT9-P
3/4"	20,000 PSI	20CT12	THT12-P
1"	20,000 PSI	20CT16	THT16-P

1/4"	60,000 PSI	60CT4	THT4-P
3/8"	60,000 PSI	60CT6	THT6-P
9/16"	60,000 PSI	60CT9	THT9-P
3/4"	60,000 PSI	60CT12	THT12-P
1"	60,000 PSI	60CT16	THT16-P

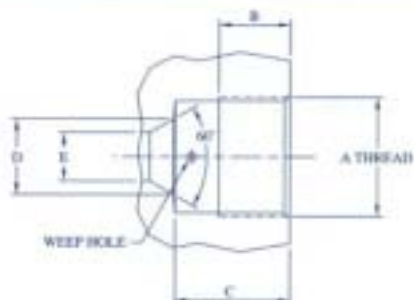


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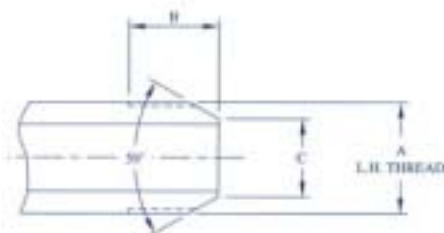
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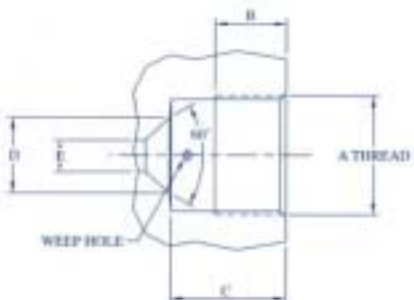
# CONNECTION DIMENSIONS



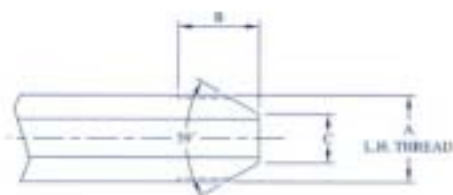
Connection	A Thread	B	C	D	E
1/4" M/P	7/16"-20	0.28" (7.1)	0.50" (12.7)	0.19" (4.8)	0.109" (2.8)
3/8" M/P	9/16"-18	0.38" (9.7)	0.62" (15.7)	0.31" (7.9)	0.203" (5.2)
9/16" M/P	13/16"-16	0.44" (11.2)	0.75" (19.1)	0.50" (12.7)	0.312" (7.9)
3/4" M/P	3/4"-14 NPSM	0.50" (12.7)	0.94" (23.9)	0.62" (15.7)	0.437" (11.1)
1" M/P	1-3/8"-12	0.81" (20.6)	1.31" (33.3)	0.88" (22.4)	0.562" (14.3)



Connection	A Thread*	B	C
1/4" M/P	1/4"-28	0.34" (8.6)	0.140" (3.6)
3/8" M/P	3/8"-24	0.44" (11.2)	0.250" (6.4)
9/16" M/P	9/16"-18	0.50" (12.7)	0.406" (10.3)
3/4" M/P	3/4"-16	0.62" (15.7)	0.562" (14.3)
1" M/P	1"-14	0.78" (19.8)	0.718" (18.2)



Connection	A Thread	B	C	D	E
1/4" H/P	9/16"-18	0.38" (9.7)	0.44" (11.2)	0.17" (4.3)	0.093" (2.4)
3/8" H/P	3/4"-16	0.53" (13.5)	0.62" (15.7)	0.26" (6.4)	0.125" (3.2)
9/16" H/P	1-1/8"-12	0.62" (15.7)	0.75" (19.1)	0.38" (9.7)	0.188" (4.8)
3/4" H/P	1-7/16"-12	0.88" (22.4)	1.03" (26.2)	0.63" (15.9)	0.250" (6.4)
1" H/P	1-3/8"-12	0.81" (20.6)	1.31" (33.3)	0.88" (22.2)	0.438" (11.1)



Connection	A Thread	B	C
1/4" H/P	1/4"-28	0.56" (14.2)	0.125" (3.2)
3/8" H/P	3/8"-24	0.75" (19.1)	0.219" (5.6)
9/16" H/P	9/16"-18	0.94" (23.9)	0.281" (7.1)
3/4" H/P	3/4"-16	1.16" (29.5)	0.375" (9.5)
1" H/P	1"-14	0.92" (23.2)	0.562" (14.3)



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Catalog WJ, May 1999



# WJTA Committees

## Conference Committee, 11<sup>th</sup> (2001) American Waterjet Conference

*George Savanick, Ph.D., Chairman*  
*Mohamed Hashish, Ph.D.*  
*Bruce Wood*

## Conference Site Selection Committee, 12th (2003) American Waterjet Conference

*John Wolgamott, Chairman*  
*Pat DeBusk*  
*Mohamed Hashish, Ph.D.*  
*Tom Labuz*  
*Larry Loper*  
*Forrest Shook*  
*Mohan Vijay, Ph.D.*  
*Bruce Wood*

## Investment Committee (formerly Finance Committee)

Consists of chairman, president, treasurer and Mark Birenbaum, Ph.D.  
*John Wolgamott, Chairman*  
*George Savanick, Ph.D., President*  
*Bruce Wood, Treasurer*  
*Mark Birenbaum, Ph.D.*

## Membership Brochure Advisory Committee

Provides guidance for the preparation of WJTA membership brochures.  
*Lydia Frenzel, Ph.D.*  
*Mohamed Hashish, Ph.D.*  
*George A. Savanick, Ph.D.*  
*Bruce Wood*

## Membership Brochure Advisory Subcommittee

Assists in preparing membership brochures for targeted interest groups.  
*Bruce Wood, Pat DeBusk: Contractors*  
*George Savanick, Ph.D., Thomas Kim, Ph.D.: Academicians/Researchers*  
*Mohamed Hashish, Ph.D., John Wolgamott: Manufacturers*

## Monograph Committee

*John Wolgamott*  
*Thomas Kim, Ph.D.*  
*Lydia Frenzel, Ph.D.*  
*Mohamed Hashish, Ph.D.*

## Nominating Committee

(formerly the Nominations and Elections Committee)

*Andrew Conn, Ph.D., Chairman*  
*Brian Roach*  
*Lydia Frenzel, Ph.D.*

## Policy/Procedures Manual, Standing Committee to Review and Update the Policy/Procedures Manual

To review and update the Policy/Procedures Manual for board approval and to monitor policies and procedures.  
*Bruce Wood*  
*George Savanick, Ph.D.*  
*John Wolgamott*

## Recommended Practices, Committee to Develop Recommended Practices for the Hydrodemolition Industry

*Dan Bernard*  
*David Summers, Ph.D.*  
*Forrest Shook*  
*Fred Boas*

## Recommended Practices, Committee to Develop Recommended Practices for Machine-Operated Waterjets

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*George Savanick, Ph.D.*  
*David Summers, Ph.D.*  
*John Olsen*

## Safety Committee

(formerly the Standards Committee)

Recommends changes to safety manual.  
*George Savanick, Ph.D., Chairman*  
*Craig Anderson*  
*Tony Bessette*  
*Pat DeBusk*  
*Andrew Conn, Ph.D.*  
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*David Summers, Ph.D.*  
*Mohan Vijay, Ph.D.*  
*Fun-Den Wang, Ph.D.*

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Committee's task is to develop a proposal on scholarships.

*Lydia Frenzel, Ph.D.*  
*Mohamed Hashish, Ph.D.*  
*Mohan Vijay, Ph.D.*  
*Fun-Den Wang, Ph.D.*

## Short Course Committee

Plans and oversees the course, Fluid Jet Technology — Fundamentals and Applications  
*Mohan Vijay, Ph.D. and George Savanick, Ph.D., Co-Chairmen*  
*Andrew Conn, Ph.D.*  
*Lydia Frenzel, Ph.D.*  
*Mohamed Hashish, Ph.D.*  
*David Summers, Ph.D.*  
*Bruce Wood*

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Committee to discuss enhancements to WJTA's web page.  
*Mohamed Hashish, Ph.D.*  
*David Summers, Ph.D.*  
*Thomas Labuz*

## International Journal of Waterjet Technology

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