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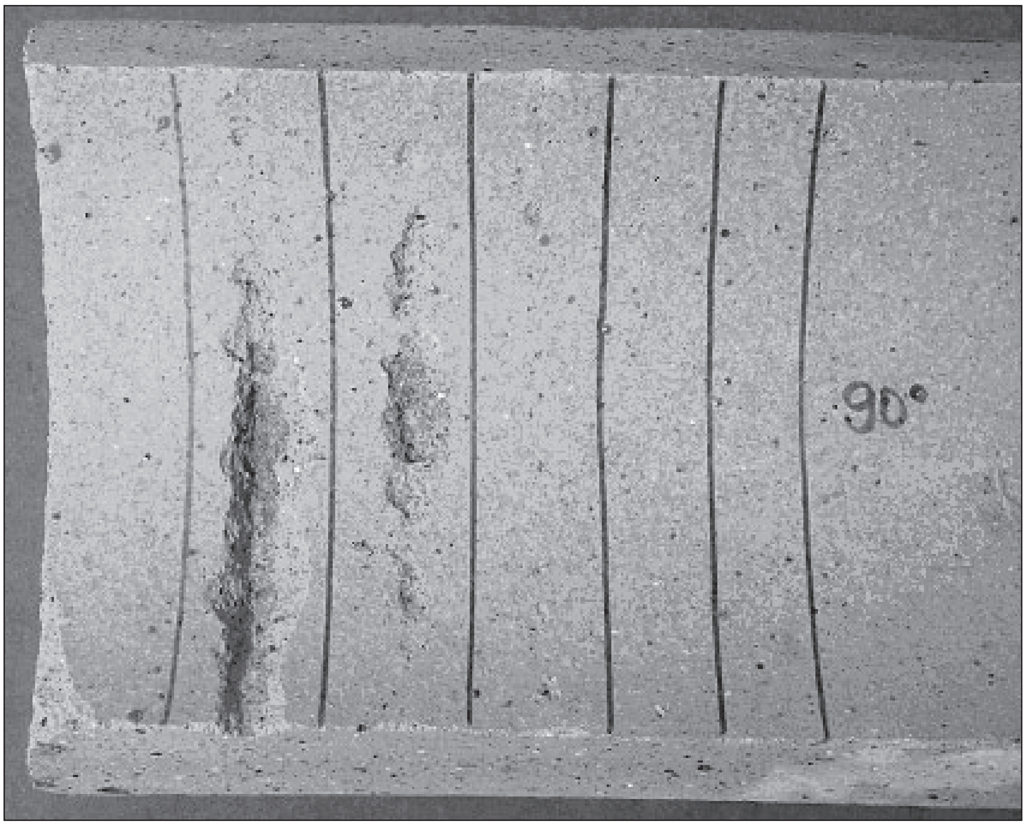
Waterjet Cleaning Of Vitrified Clay, PVC And HDPE Sewer Pipe Without Damage To The Pipe Wall

by: D. Wright, J. Wolgamott, G. Zink, StoneAge, Inc., Durango, Colorado, U.S.A.



Vitrified Clay Pipe With Waterjet Damage

On the inside

ABSTRACT

Sewer lines are commonly cleaned using waterjet systems with pressures up to 70 Mpa (10,000 psi). There is a risk of damaging these lines depending on operating parameters and pipe material. Sewer and drain line systems can be composed of vitrified clay, PVC, cast iron, or concrete. Vitrified clay pipe has been in use for sewer and storm drains since before 1900. PVC plastic pipe came into widespread use in the late 1960's and early 1970's, and is being used for many current installations. Other materials such as fiberglass/epoxy resins and HDPE are being used in rehabilitation of old lines. The purpose of these tests was to determine waterjet operating parameters below which no damage would be caused to vitrified clay pipe or PVC pipe, the two most common materials, as well as HDPE, a material used for slip lining of existing pipes.

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Waterjet Cleaning Of Vitrified Clay, PVC And HDPE Sewer Pipe Without Damage To The Pipe Wall, from page 1

1. INTRODUCTION

Tests were conducted to determine safe operating parameters to prevent damage to sewer and drain pipe materials. Variables such as rotation, jet angle, and time affect the minimum pressure that will damage these materials.

Waterjet cleaning of sewer and drain piping is most commonly performed at operating pressures between 10.5 and 28 MPa (1500 and 4000 psi), with flow rates varying from 30 to 300 lpm (8 to 80 gpm). Typical sewer jetting arrangements have hose lengths that result in pressure losses of 2 to 10.5 MPa (300 to 1500 psi), meaning that the pressure at the nozzle is 2 to 10.5 MPa (300 to 1500 psi) less than the pressure shown on the gage at the pump. All pressures reported in these tests are pressures at the nozzle.

2. TESTING

Two basic types of tests were performed, one set with a stationary jet and the other with rotating jets. For the stationary jet testing, a single nozzle with flow straightener, 1.6 mm (.063 in.) diameter was mounted at 135 degrees to the pipe surface with a 25.4 mm (1 in.) standoff distance. For the rotating jet tests, a self-rotating swivel was mounted within an inch of the inner pipe surface, illustrated in Figure 1. Rotation speeds varied from 150 to 300 rpm. Two nozzles with flow straighteners, 1.6 mm (.063 in.) diameter, were used in these tests. Ports in the head provided jet angles of 90, 135 and 150 degrees, illustrated in Figure 2. The rotating jets were left in the same location for time periods of 10, 30, 60 and 120 seconds. One section of new 200 mm (8 in.) clay pipe was cut into quarters and used for all of the clay pipe tests except the comparison of three additional samples. One section of new 200 mm (8 in.) PVC pipe was used for all of the PVC tests.

The damage caused by the rotating jets was measured in terms of volume of material removed. This produces a value that can be expressed on a chart to show a relative comparison between tests and rates of increase. Figures 3 and 4 show a vitrified clay pipe sample and a PVC pipe sample used for the tests.

3. RESULTS

3.1 Stationary Jet Minimum Pressures

3.1.1 Vitrified Clay Pipe

The static jet tests in the vitrified clay pipe resulted in slightly better minimum pressure results than the rotary jet tests. The minimum pressure to damage the pipe was dependent on local weaknesses; the rotating jets had a better chance of finding weak spots because they covered more area. The stationary jet at a pressure of 17.5 MPa (2500 psi) produced no damage after 120 seconds,

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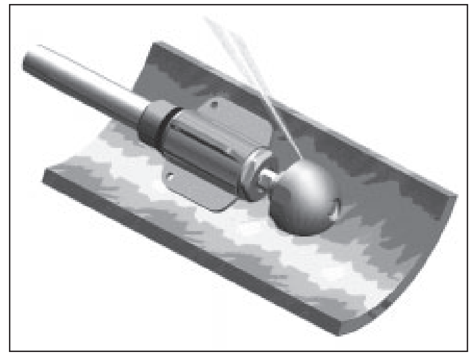


Figure 1. Rotary Nozzle and Quarter Section of Pipe as Tested

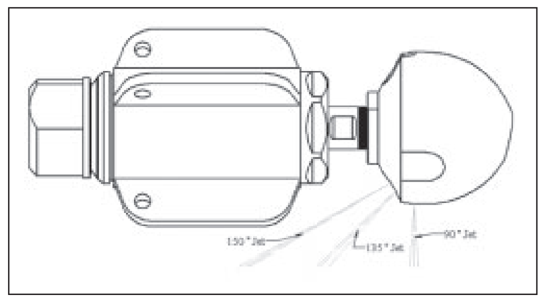


Figure 2. Illustration of Jet Angles

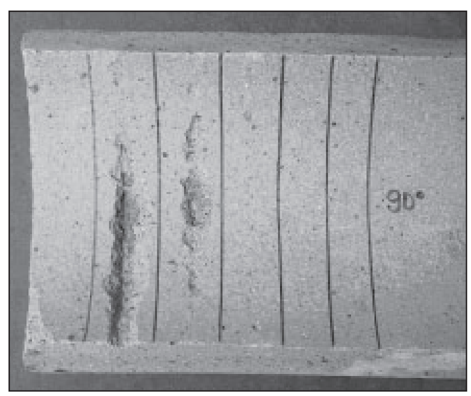


Figure 3. Vitrified Clay Pipe.
Also pictured on the cover.

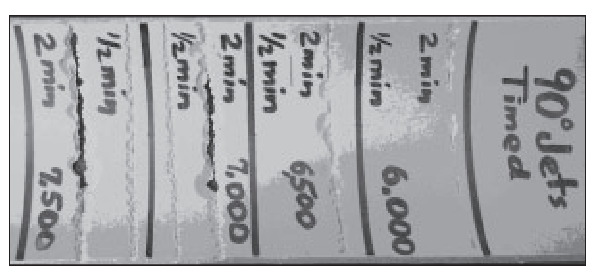
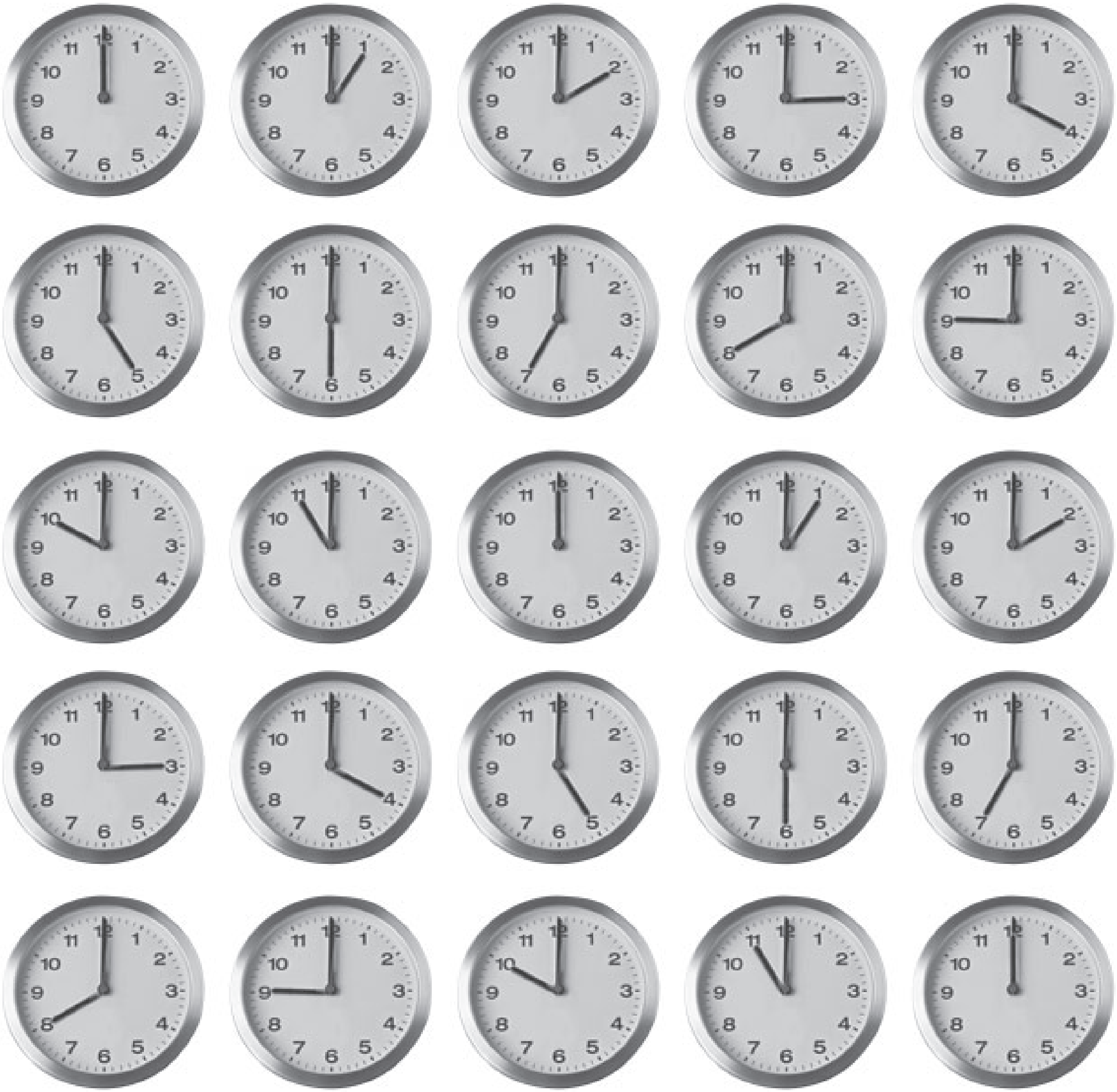


Figure 4. PVC Plastic Pipe



KMT Acquires Aqua-Dyne

KMT Waterjet Systems has acquired Aqua-Dyne, a U.S. based company with annual sales of about $8 million USD. The acquisition gives KMT access to a new growing market segment with significant potential and will create synergies with KMT Waterjet Systems.

Privately owned Aqua-Dyne, based in Houston, Texas, has manufactured high pressure waterjetting systems and accessories mainly for the U.S. market since the late 1960's. Its products are used in surface preparation, cleaning and concrete removal (hydro-demolition). These processes are more environmentally friendly alternatives to traditional sand blasting and grinding methods. The served market segments include shipbuilding, petro-chemical and construction industries. The global market size is estimated to $330 million USD with an annual growth rate of 7 percent.

Aqua-Dyne has a staff of 35 employees and sales of $8 million USD, with an operating margin of approximately 12 percent. More than half of the sales are derived from the aftermarket, and the business has an installed base of approximately 5,000 pumps.

"The acquisition of Aqua-Dyne significantly increases our market potential in the Waterjet area. By combining KMT Waterjet Systems' existing organization, international experience and distribution channels with Aqua-Dyne's strong brand, we see considerable growth opportunities world-wide," said Lars Bergström, President and CEO of KMT.

Aqua-Dyne will be a part of the Waterjet Cutting Product Area and was consolidated in the Group as of April 7, 2006. The agreed purchase price of $10 million USD will primarily be financed through bank loans. An acquisition analysis will be reported in the interim report for the second quarter, scheduled for release on August 21.

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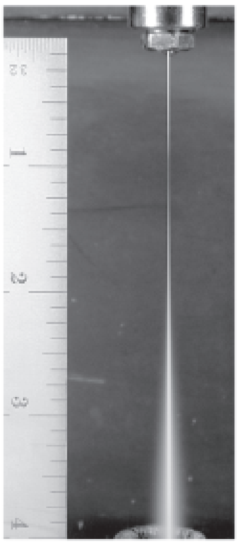
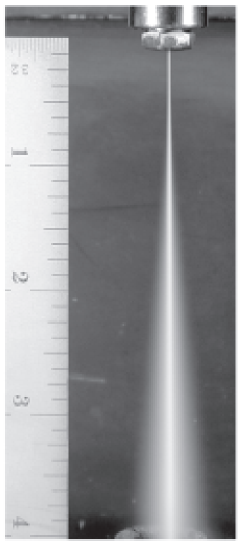
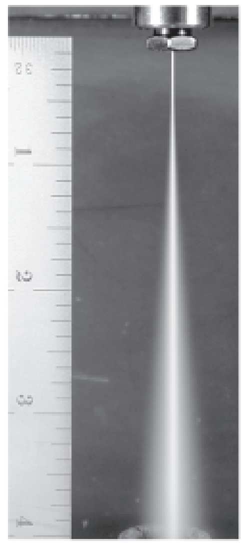
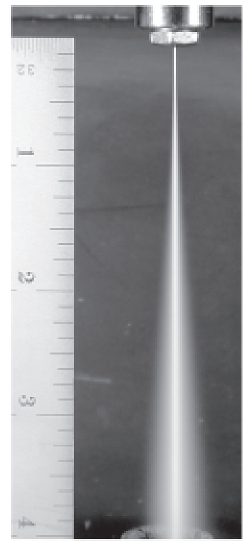

GATTI High-Cohesive


Competitor "A"


Competitor "B"


Competitor "C"

All nozzles are .012" sapphire orifices tested at 50,000psi. All photos are unedited originals. It's easy to see that GATTI High-Cohesive orifices deliver more of your pump's energy to the work, as compared to those whose efficiency is lost in a turbulent mist. GATTI High-Cohesive nozzles are the only true low-turbulence, long life, ultra-high performance sapphire orifices on the market.

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Safety Committee Solicits Comments On Improvements To *Recommended Practices*

The WJTA Safety Committee hereby solicits comments regarding improvements to the publication, *Recommended Practices for the Use of Manually Operated High Pressure Waterjetting Equipment*. While *Recommended Practices* is reviewed periodically at the biennial conferences of the WaterJet Technology Association, your comments and suggestions for improving the publication are invited and welcome anytime.

Please address your comments and suggestions to: Safety Committee, c/o WJTA, 906 Olive Street, Suite 1200, St. Louis, MO 63101-1434, phone: (314)241-1445, fax: (314)241-1449, e-mail: wjta@wjta.org, web site: www.wjta.org.

Waterjet Dismantling Of Automobile Tires

In 2002 Cornier et al.* reported a study of an interesting waterjet application – dismantling of automobile tires with high pressure waterjets. The main ideas will be highlighted here.

Some statistics about automobile tires:

- >10,000,000 tons of tires are produced every year around the world
- Only < 10% are recycled
- Only < 1% are recycled in an economical way

Their study is to use waterjets to separate rubber from the metallic structure while producing a very fine rubber powder that can be used for pavement, sport ground, or schoolyards. Their exploratory experiments include these parameters:

- The part of the tires (tread, sidewall, heel)
- The structure of the tires (number and nature and layers)
- Nozzle stand-off distance (5 – 50 mm)
- Slant angle of jet/matter (90 to 30°)
- Type of nozzle (rotary, flat, etc)
- Nozzle diameter (0.1 – 0.5 mm)
- Number of nozzles (single and multiple)
- Water pressure (1000 to 4000 bars)
- Water flow
- Traverse speed (50 – 500 mm/min)
- Rotational speed (up to 1300 rpm)
- Jet direction relative to traverse direction (same or opposite)
- Traverse direction relative to thread or cable

Their findings include the following:

- The feasibility of the principle (separate rubber from metals and turn it into a fine powder) is proven.
- However the jet failed to strip some of the rubber that is shielded by the metallic structure.
- The optimum traverse speed for a 4-jet rotary head (0.2 mm nozzle diameter) at 2500 bar of pressure is about 100 mm/min.
- The jet traverse direction should be parallel to the tread.
- Rotation speed of nozzle head has no significant impact.
- The direction of traverse speed should be opposite to that of jet velocity.
- The use of intersecting jets is helpful in removal of the rubber.

* *Cornier, A., Cornier, S., and Froelich, D. (2002) Automobile tyres dismantling by high pressure water jet, Proceedings of the 16th International Conference on Water Jetting, Aix-en-Provence, France, October 16-18, pp 567-581.*

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The WJTA leadership requests that members respect the contact information of fellow members and not use that information for the dissemination of spam or junk email. Membership information is not meant to be circulated beyond the WJTA membership.

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while 21 MPa (3000 psi) began to damage the material after exposure beyond 60 seconds.

3.1.2 PVC Pipe

The static jet tests conducted in PVC pipe produced a much lower minimum pressure result than the rotary jet tests. The static jet was placed at the 135 degree position in the head. A pressure of 14 MPa (2000 psi) produced a small hole when left in the same location for 10 seconds; when the pressure was reduced to 10.5 MPa (1500 psi) no damage was present after 120 seconds.

3.2 Effect of Pressure and Angle with Rotary Jets

3.2.1 Vitrified Clay Pipe

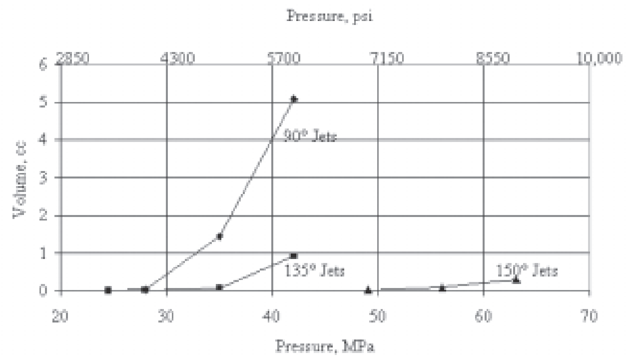

Figure 5. Effect of Pressure and Jet Angle on Vitrified Clay Pipe

A series of rotary jet tests were conducted to determine the effect of jet angle on the maximum safe pressure in new vitrified clay pipe. Each of these tests was run for 10 seconds, after which the samples were measured for volume of material removed. Results are shown in Figure 5. The 90 degree and 135 degree jets both began removing slight amounts of material at 24.5 MPa (3500 psi), but as pressure was increased, the amount of damage caused by the 90 degree jets grew at a much higher rate than that of the 135 degree jets. The 150 degree jets began to damage the pipe at 49 MPa (7000 psi), with a still lower rate of increase with increasing pressure.

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These tests show that reducing the angle of impingement can allow higher operating pressures without damage to the vitrified clay pipe.

Three other samples of vitrified clay pipe were tested using the 90 degree rotating jets for 10 seconds. These samples came from different sections of a storm drain line that had been in place for over 50 years. They were in relatively good condition, however. The results are shown in Figure 6; two of the three pieces had the same minimum pressure as the primary test sample material that had never been used. There possibly exist clay pipe installations, particularly in sanitary sewers where the pipe has been submerged for many years, where the material has degraded to a softer condition and might be more susceptible to jet damage.

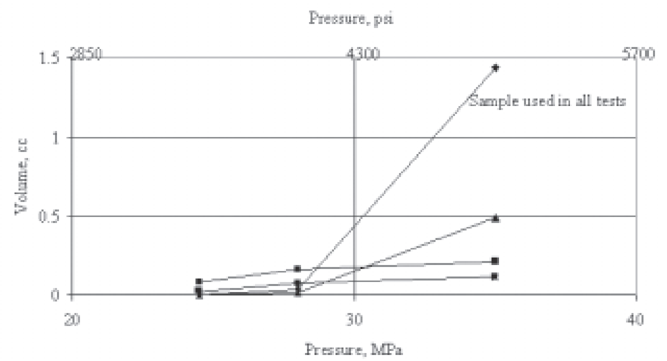

Figure 6. Comparison of Four Vitrified Clay Pipe Samples, with 90° Jets for 10 Seconds

3.2.2 PVC Pipe

These rotary jet tests were conducted on PVC pipe to determine the effect of jet angle on the maximum safe pressure. Each of these tests was run for 10 seconds, after which the samples were measured for volume of material removed. Results are shown

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Federal Signal Publishes Vactor/Guzzler Safety Manual

New Handbook Provides Safety Information for Operators of Multiple Vehicles

Federal Signal Environmental Products Group has published a combined *Vactor/Guzzler Safety Manual* that serves as a single source of safety training information for a variety of Vactor sewer and catch basin cleaners and Guzzler industrial vacuum loaders. The new handbook is an updated version of two previous safety handbooks published separately by Vactor Manufacturing and Guzzler Manufacturing. Vactor and Guzzler are subsidiaries of Federal Signal Environmental Products Group.

"The best way to talk about safety is to provide a clear, consistent message across the board, which is the approach we took with the new *Vactor/Guzzler Safety Manual*," said Andy Current, project manager at Vactor.

The safety manual begins by addressing basic safety information on the high-pressure water systems found on most Vactor trucks. Pressurized water can inject debris and bacteria deep into the skin. Even injuries that may appear to be minor can lead to serious infection and require prompt medical attention.

The *Vactor/Guzzler Safety Manual* includes a series of common sense tips, general warnings and safety standards, such as wearing protective clothing, ensuring good footing and visibility around the work area, shutting down before making repairs, working in teams of two or more and draining water in cold weather to keep ice from cracking valves and fittings. The handbook also covers a range of potential hazards, from equipment issues such as operating around electrical power cables and safe vacuum valve operation and relief, to general issues such as working safely in confined spaces and coping with static electricity.

Also included in the safety manual is a list of the typical labels and decals found on current Vactor equipment.

The Label section of the manual begins with an explanation of Vactor's five label categories, which range from "Danger" (a red label that warns of imminent hazard of serious injury or death) and "Warning" (an orange label that notes potential for serious injury or death) to less threatening cautions and notices.

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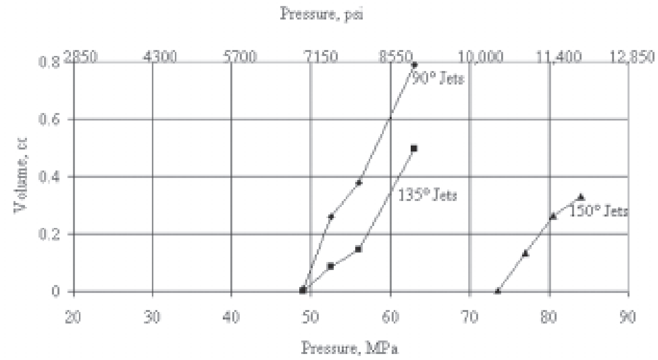

Figure 7. Effect of Pressure and Jet Angle on PVC Pipe

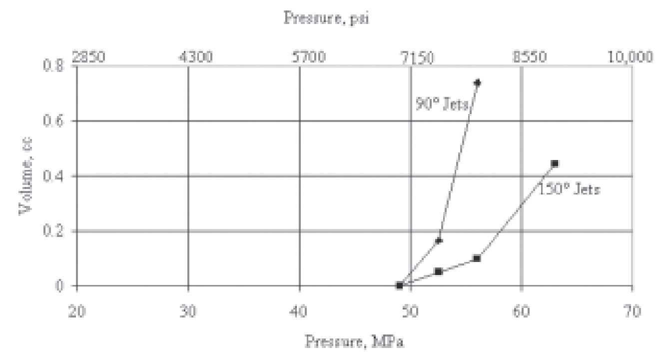

Figure 8. Effect of Pressure and Jet Angle on HDPE Pipe

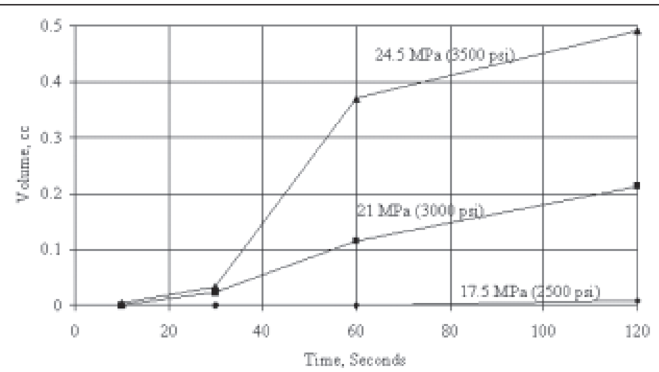

Figure 9. Effect of Time and Pressure with 90 Degree Jets on Vitrified Clay Pipe

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

in Figure 7. The 90 degree and 135 degree jets both began removing material at 49 MPa (7000 psi), while the 150 degree jets first created damage at 73.5 MPa (10,500 psi). All three conditions increased at nearly equal rates once the minimum pressure to create damage was reached. Just as in the vitrified clay pipe, a reduced angle of impingement allows higher operating pressures without damage to the PVC material.

3.2.3 HDPE Pipe

The HDPE pipe did not respond in the same manner as the other two materials, likely because the HDPE material is more plastic in behavior and a little bit softer than the PVC material. The minimum pressure for initial damage for jet angles of 90 to 150 degrees occurred at the same pressure of 49 MPa (7000 psi), although the amount of material removed increased at a greater rate with increasing pressure with the 90 degree jets. Figure 8 illustrates this data.

3.3 Time of Exposure with Rotary Jets

These tests were conducted to determine if pressures below the values determined in the previous tests would create damage if the jets were left rotating in the same place for long periods of time. The results show that if higher operating pressures are used, the tool should be kept moving through the line to avoid damage. However, if the tool is deliberately or accidentally left in place for an extended period of time, lower operating pressures should be used.

3.3.1 Vitrified Clay Pipe

Material removal in the vitrified clay pipe at pressures less than the 10 second maximum values occurred by exploitation of tiny pits in the material, which would grow with each successive pass of the jets. The 90 degree jets produced damage at 17.5 MPa (2500 psi) when left in place for longer than 60 seconds, while 21 MPa (3000 psi) resulted in damage after 10 seconds. These results are shown in Figure 9. Figure 10 shows results for the 135 degree jets, which did not produce any damage at 17.5 MPa (2500 psi) after 120 seconds, while 21 MPa (3000 psi) resulted in damage after 30 seconds. The 150 degree jets were tested at 28 MPa (4000 psi) with essentially no damage after 120 seconds, while 35 MPa (5000 psi)

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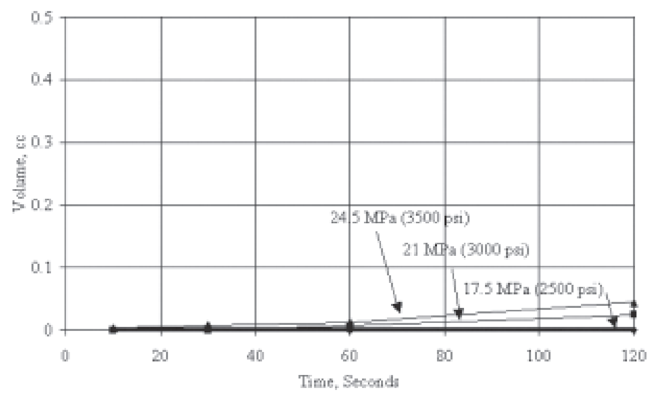

Figure 10. Effect of Time and Pressure with 135 Degree Jets on Vitrified Clay Pipe

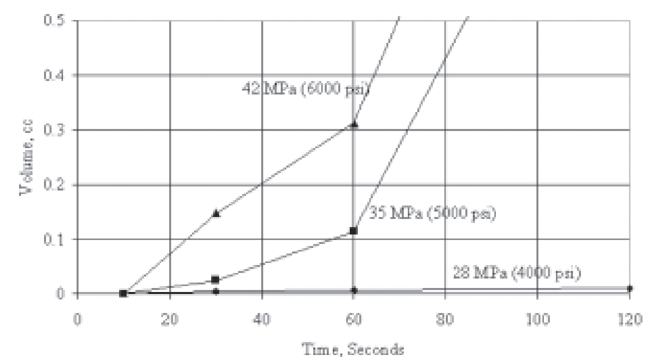

Figure 11. Effect of Time and Pressure with 150 Degree Jets on Vitrified Clay Pipe

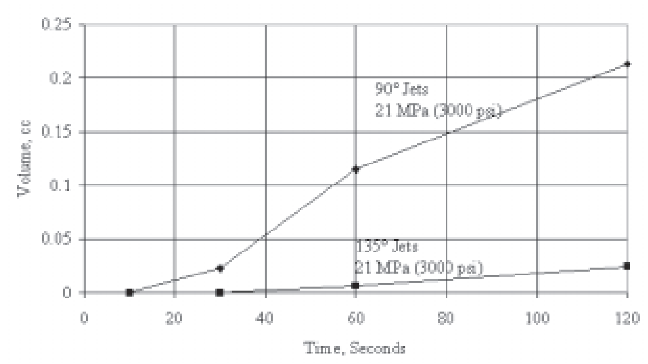

Figure 12. Effect of Angle and Time on Vitrified Clay Pipe

resulted in damage after 10 seconds and rapidly increasing damage thereafter; these results are shown in Figure 11. Figure 12 shows the increasing rate of material removal by the 90 degree jets compared to the 135 degree jets. Both created damage at the same pressure, but when compared after 120 seconds, the damage caused by the 90 degree jets was 10 times as great.

3.3.2 PVC Pipe

The mechanism by which PVC pipe was damaged over time at lower pressures was probably due to fatigue of the material, quite different than the vitrified clay pipe. No material removal would occur up to a point in time, and then suddenly a groove would appear and grow. Spalling of the material from the groove occurred once the cut depth resulted in confinement of the jet.

Figure 13 shows the results for PVC with the 90 degree jets, where 42 MPa (6000 psi) did not remove any material up to 30 seconds, but did after exposure for longer time periods. While 90 degree jets at 49 MPa (7000 psi) for 10 seconds or less produced no damage, a pressure of 42 MPa (6000 psi) or less would be required for extended periods of exposure. Material removal occurred at the same pressures and time periods with the 135 degree jets, as shown in Figure 14, but Figure 15 illustrates the relative magnitude of damage done by the 90 degree jets compared to that caused by the 135 degree jets. Figure 16 shows that it would be possible to operate up to 66.5 MPa (9500 psi) with 150 degree jets if exposure did not exceed 30 seconds.

3.3.3 HDPE Pipe

The HDPE material did not show much difference between the 10 second maximum pressure and pressures that would damage it over time; this was likely due to the greater plasticity of the material compared to the clay and PVC. 49 MPa (7000 psi) did not damage the material over a 30 second time period, and produced only slight damage after 120 seconds.

4.0 CONCLUSIONS

Tests were conducted in vitrified clay pipe, PVC pipe and HDPE pipe to determine safe operating parameters for waterjet cleaning without damage to the pipe material. The

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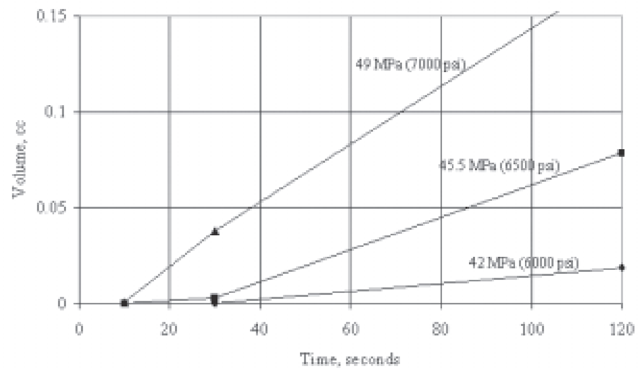

Figure 13. Effect of Time and Pressure with 90 Degree Jets on PVC Pipe

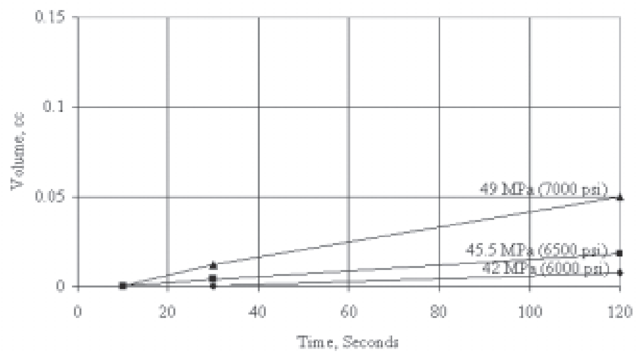

Figure 14. Effect of Time and Pressure with 135 Degree Jets on PVC Pipe

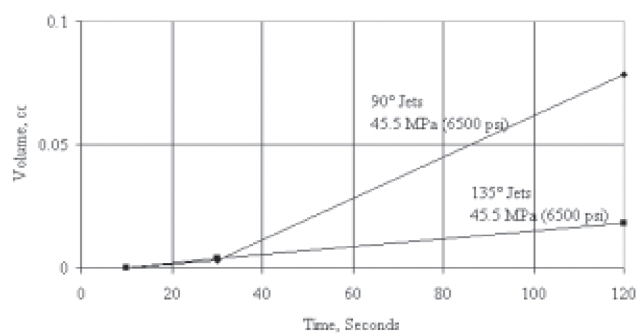

Figure 15. Effect of Angle and Time on PVC Pipe

Flow International Releases FlowMaster® 6.02 Upgrade

Free Upgrade Available to FlowMaster 6.0 and 6.01 Users

Flow International Corporation has announced the availability of FlowMaster 6.02, an upgrade to FlowMaster 6.0 and 6.01, Flow's innovative Windows®-based waterjet control system.

FlowMaster 6.02 gives users unparalleled flexibility to automatically program and path a part or select easy to use tools to quickly customize advanced designs and tolerances. Additional features include innovative cutting models for the highest waterjet pressure available – 87,000 psi – available only from Flow.

"Flow's software is one of the most innovative, feature-rich software packages found in manufacturing today," said Robert Peterson, market manager, Flow International. "Our strategy of continually improving our software to keep pace with waterjet innovations such as speed improvements, the ability to customize taper on arcs, 87,000 psi cutting and semi-auto pathing are helping customers stay competitive by improving productivity."

The FlowMaster 6.02 upgrade is free to all FlowMaster 6.0 and 6.01 users. For a free download, log onto www.flowparts.com, click on Product Support from the menu, then select Downloads and click on the "FlowMaster 6.0 to 6.02" or "FlowMaster 6.01 to 6.02" link.

For more information, visit www.flowcorp.com or contact info@flowcorp.com.

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minimum safe operating pressure typically occurs with a non-rotating, non-moving (static) jet. Rotating the jets increases this minimum pressure, as will reducing the angle of impingement of the jet on the pipe wall. However, longer time spent on one area will tend to exploit weaker portions of the material or create fatigue, reducing the maximum safe operating pressure to prevent damage to the pipe. Through the use of a rotating nozzle head, reducing the angle of the jets and keeping the tool moving down the line, pressures at the nozzles may approach 49 to 70 MPa (7000 to 10,000 psi) without damage to the pipe. However, if the tool is deliberately or accidentally left in place for an extended period of time, lower operating pressures should be used.

For vitrified clay pipe, the maximum safe nozzle pressure with an exposure time of 120 seconds with rotating 90 degree jets was found to be 17.5 MPa (2500 psi). However, if the exposure time was kept at 10 seconds or less and a jet angle of 150 degrees was used, operating pressures up to 42 MPa (6000 psi) could be used.

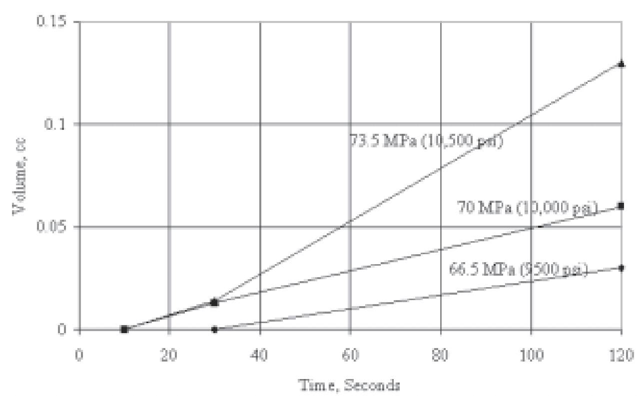


Figure 16. Effect of Pressure and Time with 150 Degree Jets on PVC Pipe

Maximum nozzle pressures for PVC pipe vary from 10.5 MPa (1500 psi) for a stationary jet to 38.5 MPa (5500 psi) for the 120 second exposure time with 90 degree rotating jets, to as high as 70 MPa (10,000 psi) with rotating jets, exposure times less than 10 seconds and a jet angle of 150 degrees.

The HDPE pipe did not have as wide of a range dependent on exposure time and jet angle; the safe nozzle pressures varied from 45.5 to 49 MPa (6500 to 7000 psi).

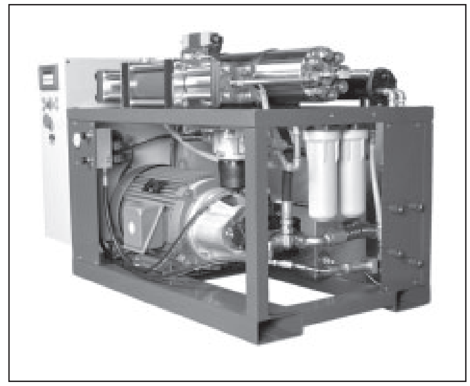
New Accustream Intensifier

Accustream is pleased to announce the release of the AS-6030™. It's the smallest intensifier-based pump manufactured by Accustream. It is designed for light-duty applications requiring a dependable and efficient supply of high pressure water. The unit is ideally suited for many water-only and some abrasive waterjet cutting applications.

The AS-6030 intensifier features the companies Advanced Intensifier Technology (AIT Technology). With a consistent output pressure of 60,000 psi, users are guaranteed optimal piercing and cutting performance and cut quality. Higher overall processing efficiency makes it possible to operate the system at exceptionally low production cost, ensuring and excellent price-to-performance ratio.

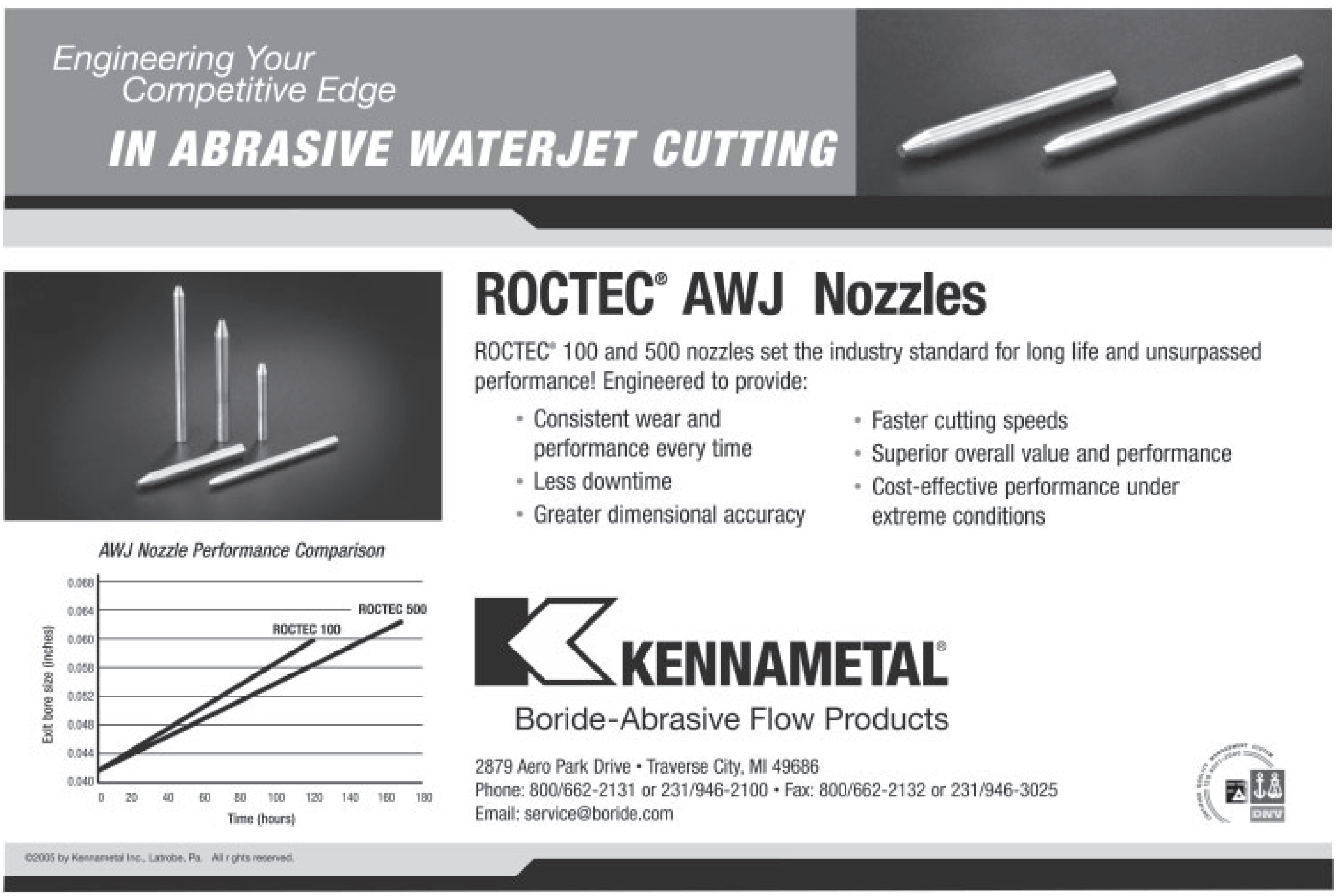
Standard features include electronically shifted intensifier, TEFC electric motor (30 hp), a frame mounted water filtration bank (.5 micron filters), a large 1-liter maintenance free attenuator, and an automatic high-pressure bleed down system. Accustream's AIT Technology combines innovative design, quality manufacturing, and carefully selected materials to maximize intensifier maintenance intervals, simplify component replacement and minimize cost of operation.

For complete process integration, every Accustream intensifier offers users advanced synchronization to a full range of CNC controlled motion systems. A control switch allows operation and monitoring of the system from a remote source.



AS 6030, 30 HP 60,000 PSI, Intensifier Pump

For more information please contact: Eric Chalmers or John Hennessey, Accustream Inc., 4757 Mustang Circle, St. Paul, MN 55112, telephone 888-566-7099, fax 763-717-7099, email info@accustream.com, online www.accustream.com.



WJTA To Participate In FABTECH

The differences between abrasive waterjets and traditional methods for cutting and machining will be the topic of a presentation by WJTA Board Member David A. Summers, Ph.D., at the October 31-November 2, 2006, FABTECH International & AWS Welding Show to be held at the Georgia World Congress Center in Atlanta, Georgia. Dr. Summers' presentation will be held at the Innovation Theatre in the Exhibition Hall.

Dr. Summers will present an overview on abrasive waterjet technology and the benefits of using abrasive waterjets for cutting and machining. Dr. Summers is the director of the University of Missouri-Rolla High Pressure Waterjet Laboratory and Rock Mechanics & Explosives Research Center.

If your company is involved in abrasive waterjet cutting and machining and an exhibitor at FABTECH, we encourage you to participate in this program. Representatives of WJTA corporate members OMAX Corporation and KMT Waterjet Systems, Inc., will be making presentations, and spaces are available for additional companies to participate.

The FABTECH Show is one of the largest events in North America that showcases a broad spectrum of metal forming, fabricating, tube & pipe, and welding equipment and technology.

Don't miss this opportunity to share with FABTECH attendees how productive and economical high pressure waterjets can be in comparison to some traditional cutting and machining methods for fabricating metal. Contact Ken Carroll at the WJTA office for more information.

Visit WJTA Booth #6145

Visit the WJTA exhibit booth #6145 located in the "Fabricator" section of the FABTECH Exhibition Hall.

Federal Signal Publishes Vactor/Guzzler Safety Manual, from page 9

"The new handbook is not meant to serve as a substitute for hands-on training, but it does provide current best practices, a listing of key safety decals and warnings and references for additional safety information," said Current.

The new *Vactor/Guzzler Safety Manual* is included with the purchase of each new Vactor and Guzzler truck. Customers who already own a Vactor or Guzzler truck can also request a copy of the handbook by contacting their Vactor/Guzzler sales representative or calling Babette Austin at 800/627-3171.

Visit Vactor, maker of sewer and catch basin cleaners, online at www.vactor.com. Visit Guzzler, supplier of industrial vacuum loaders, online at www.guzzler.com.

Flow International Signs Second Multi-Million Dollar Contract With Airbus UK

Flow International Corporation, a supplier of ultrahigh-pressure waterjet products, today announced it has been awarded a second multi-million dollar contract to manufacture and install a multi-axis Composite Machining Center (CMC), abrasive waterjet and routing machine tool system for Airbus UK's use on the recently launched Airbus A350 program. Flow was awarded its first multi-million dollar contract with Airbus UK in December 2005.

Under this latest contract, Airbus UK's Filton plant will use this Flow waterjet system to machine composite spars for the wing structures of the A350 when the system is delivered in approximately 12 months. Under the prior contract, Flow's waterjet system will machine the wing structures. Within Airbus, the UK is responsible for design and manufacture of the wings and fuel systems - a role it will continue to play in the all-new Airbus A350 aircraft, of which approximately 60 percent will be comprised of advanced materials.

The use of waterjet cutting of composite materials provides many distinct benefits. Waterjets are a clean non-contact cutting and trimming technology that allows the use of flexible, programmable tooling, in lieu of expensive hard tooling for each individual part. As a result, this system dramatically reduces set up time and saves money. Waterjets eliminate the potential for the delamination of composite materials, which can occur with conventional cutting techniques.

WJTA Welcomes New Members

Corporate

Bystronic Inc.
Jeffrey Day
Joe Cisar
Michael Zakrzewski
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Fax: (631)231-1040

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West Waterjet
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Fax: (419)574-4173

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PTS Technology Oy
Sumeliuksenkatu 18 B
Tampere 33100 Finland
Telephone: [358](3)2722771
Fax: [358](3)2722760

New High Output Pumps For Waterjet Cutting

KMT Waterjet Systems, manufacturer of extreme-pressure waterjet equipment, has announced the latest addition to their growing line of advanced high pressure waterjet equipment: the SRP intensifier. KMT offers the new SRP pump for those companies that need a stronger, more reliable source of high pressure water in higher volumes.

The new hydraulic-driven SRP pump, with a 10-minute seal change design, is much easier to maintain and is designed for very long production runs. It delivers up to 2.8 gallons per minute at 35,000 psi with a 100 hp motor and a single intensifier. The operating cost is far lower than other types of pumps because the hydraulic design reduces component wear.

These waterjet pumps, like the others in the Streamline™ series, have exclusive options including room for a redundant intensifier and the Equalizer multi-pump balancing system.

KMT Waterjet delivers hyper-pressure waterjet systems that have great reliability and ease of use at pressures up to 60,000 psi. The result is a system that delivers better efficiency at lower costs, in a machine that is easy to use.

KMT Waterjet Systems is part of the KMT Group, which markets, develops and manufactures advanced production solutions for precision grinding, sheet metal working, tube forming, and waterjet cutting. The KMT holding company, Karolin Machine Tool AB, is quoted on the "O" list of the Stockholm Stock Exchange.

For more information, visit www.kmtwaterjet.com, email: sales@kmtwaterjet.com, phone: 620-856-2151, or fax: 620-856-5050.

WaterJet Technology Association's Order Form for Publications/Products

Name ______________________ Member # ______

Company ______________________

Address ______________________

City ______________________ State ______

Country ______________________ Postal Code ______

Phone # [ ]( ) __________ Fax # [ ]( ) __________

Email ______________________

(to receive shipping confirmation)

Billing Address (if different from above):

Address ______________________

City ______________________ State ______

Country ______________________ Postal Code ______

Payment Method

❑ Check or Money Order payable to **WJTA** (U.S. DOLLARS ONLY)

❑ PO # __________ (Enclose PO)

❑ Please charge my ❑ MC ❑ VISA ❑ American Express ❑ Discover

Credit Card # ______________________

Exp. Date ______ / ______

____
Print name as it appears on card

____
Cardholder's signature

THREE EASY WAYS TO ORDER

By Phone: Just call **(314)241-1445** and have your credit card information ready. (MC/VISA/Am. Exp./ Discover ONLY).

By Fax: Fill out the order form with your credit card information and call our 24-hour fax number at: **(314)241-1449**.

By Mail: Fill out the order form and mail with applicable payment to: **WJTA, 906 Olive Street, Ste. 1200, St. Louis, MO 63101-1434.**

Item		WJTA Member Price	Non Member Price	Shipping & Handling	
____ **Proceedings CD-ROM of The 2005 WJTA American Waterjet Conference** (2005)	@	$ 109.00	$ 129.00	$ 8.00	= $________
____ **Proceedings CD-ROM of The 2003 WJTA American Waterjet Conference** (2003)	@	$ 35.00	$ 55.00	$ 8.00	= $________
____ **Proceedings CD-ROM of The 2001 WJTA American Waterjet Conference** (2001)	@	$ 10.00	$ 30.00	$ 8.00	= $________
____ **Proceedings Book & CD-ROM of The 10th American Waterjet Conference** (1999)	@	$ 10.00	$ 30.00	$ 8.00	= $________
____ **Proceedings Of The 9th American Waterjet Conference** (1997)	@	$ 10.00	$ 25.00	$ 8.00	= $________
____ **Proceedings Of The 8th American Waterjet Conference** (1995)	@	$ 0.00	$ 0.00	$ 8.00	= $________
____ **Proceedings Of The 7th American Waterjet Conference** (1993)	@	$ 0.00	$ 0.00	$ 8.00	= $________
____ **Waterjet Technology: Basics and Beyond** 8/21/05 PowerPoint presentations in printed format	@	$ 20.00	$ 25.00	$ 8.00	= $________
____ **An Overview of Waterjet Fundamentals And Applications,** Fifth Edition (2001)	@	$ 55.00	$ 70.00	$ 8.00	= $________
____ **An Overview of Waterjet Fundamentals And Applications** 8/17/03 PowerPoint presentations in printed format	@	$ 30.00	$ 35.00	$ 8.00	= $________

Minimum charge of $8 per order. $8 for 1-3 items purchased; $16 for 4-7 items purchased; for 8 or more items purchased, contact the WJTA office.

Recommended Safety Practices, English Edition

1 - 10 copies	______ # of copies	x	$ 5.00 ea.	$ 10.00 ea.	= $_______
11 - 99 copies	______ # of copies	x	$ 4.00 ea.	$ 8.00 ea.	= $_______
100 - or more copies	______ # of copies	x	$ 3.00 ea.	$ 6.00 ea.	= $_______

Recommended Safety Practices, Spanish Edition

1 - 10 copies	______ # of copies	x	$ 7.00 ea.	$ 12.00 ea.	= $_______
11 - 99 copies	______ # of copies	x	$ 6.00 ea.	$ 10.00 ea.	= $_______
100 - or more copies	______ # of copies	x	$ 5.00 ea.	$ 8.00 ea.	= $_______

Shipping and Handling

1 - 10 copies ..... $0.50 per book, 11 - 99 copies .... $0.40 per book, 100 - or more copies .... $0.25 per book   # of copies x $_______   = $_______

Recommended Practices Safety Video, Available In VHS Video or CD-ROM.

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***Contact the WJTA office for the shipping and handling charge of more than one Safety Video.**

Baseball Cap		______ # of caps	x	$ 7.95 each	$ 7.95 each	$ 6.00 ea.	= $________
WJTA Navy Blue Polo Shirt	Size ______ (S, M, L, XL, 2X)	______ # of shirts	x	$ 30.00 each	$ 35.00 each	$ 7.00 ea.	= $________

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Safety Cards: 1-50 cards .... FREE (**For the purchase of more than 50 safety cards, call the WJTA office for the shipping and handling charge.)**   = $______

For shipping and handling charges outside the USA, contact the WJTA Office.

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