



## Hydrodemolition On Swiss Railroad Near Gotthard



**Winding through the spectacular Swiss Alps the Gotthard rail tunnel is one of the world's most scenic railway tracks. Pictured here is the valley river under the tunnel bridge.**

*See article on page 4*



**A concrete 'tunnel bridge' was constructed 18 years ago crossing the 50m deep-sided valley which in 1998 was virtually filled with snow from avalanches.**

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# In Memoriam - Dr. Norman Charles Franz

**D**r. Norman Charles Franz, a WJTA Pioneer Award winner, died on September 25, 2007, in British Columbia. Dr. Franz was born in Newark, New Jersey on June 12, 1925 and grew up in Southbridge, Massachusetts. He served in the U.S. Army in World War II in Belgium, France, and Germany. After the war he graduated from Syracuse University and then went on to earn a Ph.D. from the University of Michigan where he became a member of the faculty of the School of Natural Resources. In 1968 he moved to Vancouver and joined the faculty of the University of British Columbia from which he retired in 1985.

Dr. Franz invented industrial waterjet cutting in the 1960s. This invention was a spin-off of a research program that Dr. Franz was conducting on the machining of wood. The use of waterjets to cut wood was inspired by the observation that broom handles used for testing for leaks from very high pressure boiler systems were cut off by the escaping steam. Later investigation showed that industrial cutting with steam jets was impractical because of the high gas pressures involved. However, this suggested the use of waterjets. Dr. Franz experimented with a single action intensifier, which developed over 50,000 psi waterjets, but the waterjets were discontinuous. He was thereby able to cut wood and other materials with ordinary water.

Dr. Franz then searched for a high pressure pump that would pump water continuously so as to produce a steady waterjet. He arranged a loan from McCartney Manufacturing, a subsidiary of Ingersoll Rand, of a high pressure intensifier pump used for catalyst injection in the manufacture of polyethylene. This proved to be a reliable system for the continuous

pumping of high pressure water. This pump and nozzle was duplicated and integrated with a system for obtaining relative motion

between the jet and the work piece. Such a system was installed at Alton Boxboard Company to cut large, complex parts used in the furniture industry. He thus solved the problem that could not be handled by conventional cutting tools. He had a




**Dr. Norman Charles Franz receiving the WJTA Pioneer Award in 1987.**

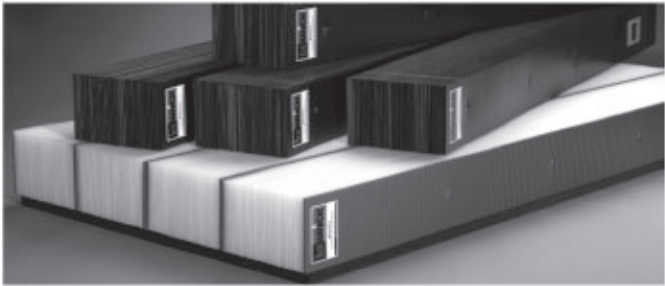
unique solution to a unique production problem. This jet cutting system was the first in industrial use and it operated successfully for many years. It was the precursor to the multibillion-dollar, worldwide waterjet cutting industry we see today.

Dr. Franz was also a leader in the improvement of waterjet cutting at long stand-off distance by the addition of long chain polymers to the water. He included an automated polymer mixing system in the Alton Boxboard installation, and therefore he was the first to apply long chain polymer additives in commercial waterjet cutting.

The WaterJet Technology Association made a donation to the Salvation Army in memory of Dr. Franz.



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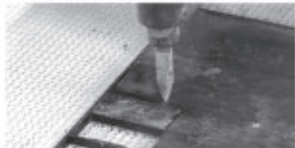
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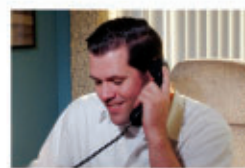
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# Hydrodemolition On Swiss Railroad Near Gotthard

**H**ydrodemolition techniques were successfully used on the world famous Swiss railway line close to Gotthard using an 11.5m high tower and a new Aquacutter Evolution robot from Sweden's Aquajet Systems to remove damaged concrete without affecting services on the twin rail track.

Opened in 1882, the Gotthard rail tunnel remains one of the world's spectacular railway tracks, winding through the Swiss Alps, but requires constant routine maintenance on its bridges and tunnels. To the north of St. Gotthard above the river Reuss, in addition to the twin rail track, the A2 motorway climbs at a gradient of 5°. The rail track, however, winds its way through a series of helical tunnels to

the entrance of the Gotthard tunnel. Enroute, a concrete "tunnel bridge" constructed 18 years ago crosses the 50m deep-sided valley. Formerly a steel bridge built in 1882 as an open bridge, it was exposed to avalanche.

In the winter of 1998, the avalanches filled the valley with snow virtually to the "bridge-tunnel." Recent tests have shown that the 88.50m long bridge could have been swept away with the next avalanche winds.

According to Executive Engineer, Mr. Bühlmann, the Swiss Federal Railway SBB commissioned a study to make the bridge safe. Its findings have opted to reinforce the bridge and tunnel, restore the bridge bearings, refurbish cracks up to 2m deep, and

connect the tunnel bridge with special wall anchors to the rocks. Together with reinforcement for avalanche-loads, the bridge will be maintained and damaged concrete replaced.

Swiss hydrodemolition specialist contractor Brugger was appointed to undertake the concrete removal – totalling 230m<sup>3</sup> - using the Aquacutter Evolution robot from Sweden's Aquajet Systems. The Aquacutter was used for the "lions share" of remedial work removing 180m<sup>3</sup>; with a hand held gun removing the remaining 40m<sup>3</sup>. The electric-powered robot uses 122 l/min of water at a pressure of 1900 bar to safely remove the

(continued on page 8)

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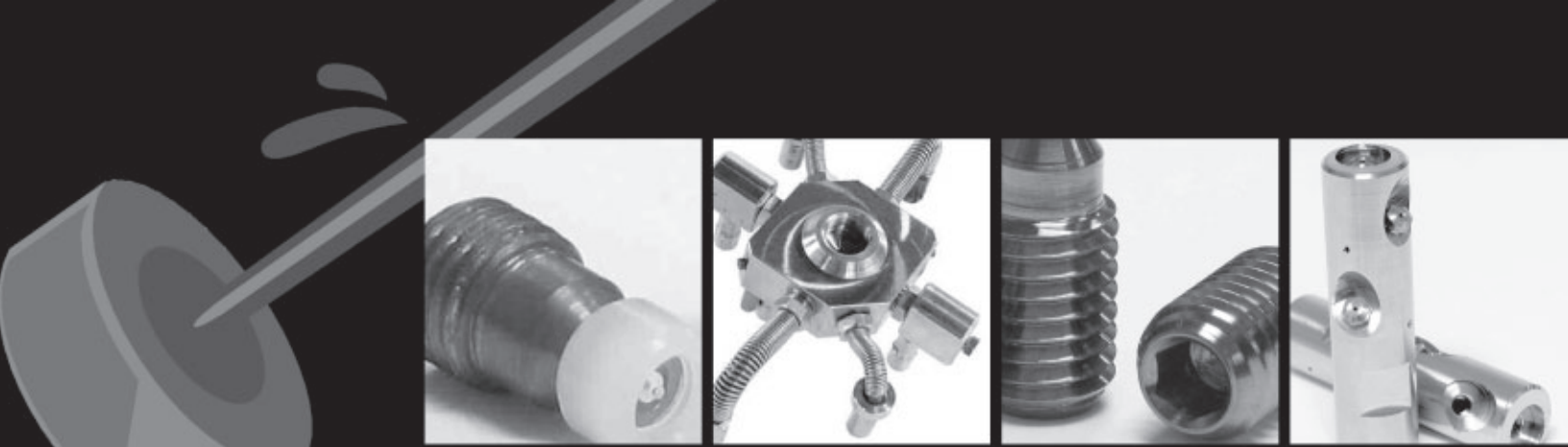
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# Coating Removal Parameters

**W**right et al.\* presented a paper on parameters that affect surface preparation at the 2007 American WJTA Conference and Expo. Highlights from the paper are presented below.

A series of coating removal tests were conducted on commercial grade coated steel siding trim sections at 240 MPa (35,000 psi) and flow rates of 11 to 22 lpm (3 to 6 gpm). Removal effectiveness was judged by visual estimation of the percentage removal of the top coating and the primer. Two different types of heads were used in these tests: bar head and bent arms (see photos). Several parameters were varied during the tests and the results are summarized here.

**Standoff Distance:** When the standoff distance is less than 18 to 42 times the orifice diameter for the bar heads and up to 67 times the orifice diameter for the bent arms, the jet is too close to be effective. The most effective removal with the bar head occurred with standoff distance to be 65 to 95 times the orifice diameter.

**Rotation Speed:** As a function of the jet path diameter and rpm, the linear velocity that the jet is moving has a direct impact to the removal effectiveness. The level of its impact also depends on four other parameters — standoff distance, orifice diameter, feed rate, and head design. As a general trend, the linear velocity of the nozzle should be no more than 20 m/sec (66 ft/sec).

**Feed Rate and Jet Path Diameter:** Feed rate is the most significant parameter affecting removal effectiveness. Obviously increasing feed rate caused decrease of removal effectiveness. Theoretically the feed rate can be

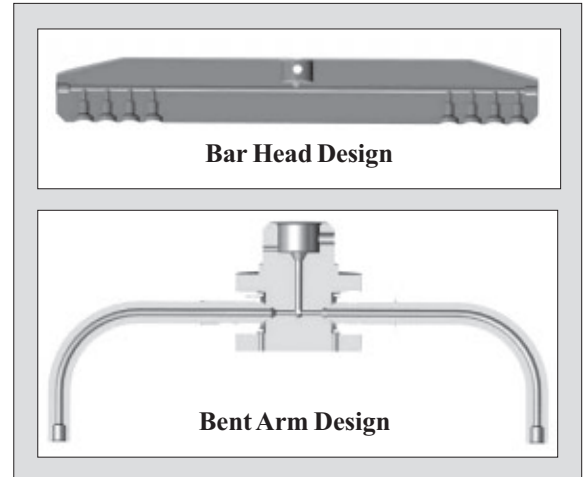
calculated with this formula:  
$$\text{Feed Rate} = \text{Orifice Diameter} \cdot \text{Number of Jets} \cdot \text{rpm}$$
  
But because the jet path diameter is not accounted for in this formula, a multiplication factor should be considered, with 1.5 for the largest bar head and 3 for the smallest.

**Jet Angle:** A 5 degree outward jet angle improved the coating removal by 15 to 20%.

**Head Design:** Compared to the bar head, the bent arm head improved the efficiency of coating removal by 25 to 30%.

\* Wright, D., Wolgamott, J., Zink, G. (2007) PARAMETERS AFFECTING SURFACE PREPARATION, Proceedings of the 2007 American WJTA Conference and Expo, edited by Mohamed Hashish, Ph.D., August 19-21, Houston, Texas, Paper 2-A.

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## Flow Signs Option Agreement To Acquire Omax Corporation

**F**low International Corporation announced that it has signed an exclusive option agreement to negotiate the acquisition of OMAX Corporation. OMAX is a Kent, WA-based privately held provider of precision-engineered, computer-controlled, abrasive waterjet systems. Under the terms of the agreement, Flow and OMAX will work to negotiate a definitive agreement for Flow to acquire OMAX. Upon closing, Flow would pay approximately \$109 million in cash and stock (including the amounts paid for the option agreement) with the potential for a contingent earn-out in two years of up to \$26 million in either stock or cash at Flow's option. A transaction to combine the two companies is subject to completion of all due diligence, execution of a definitive agreement, Hart-Scott-Rodino anti-trust clearance, and customary closing conditions.

"We believe a combination of the two companies presents a unique opportunity to enhance the global growth of waterjet solutions, which represent a relatively small but rapidly growing part of the overall market for cutting solutions," said Charley Brown, Flow's President and Chief Executive Officer. "While there are many synergies that make this merger a natural fit between waterjet pioneers, each company brings a unique set of intellectual property, engineering strength, and market focus, including OMAX's unique distribution channels worldwide, that makes this accretive combination so financially compelling and operationally attractive."

Dr. John Cheung, Chairman of OMAX, commented, "Our two companies share similar histories, passion, vision, and are quite literally neighbors in Kent. Together I

(continued on page 12)

## Nordstjernan Offers To Take Over KMT

**T**he shareholders of KMT Group AB received a press release from Nordstjernan containing a public tender offer (the Offer) concerning the acquisition of all of the shares in the company.

KMT's Board of Directors convened to evaluate the Offer and issued a

statement recommending that KMT stockholders not accept the Offer. The Board of Directors commissioned an independent party to formulate an opinion to consider the fairness of the Offer, which was published at the same time that the Board made its statement.

(continued on page 11)



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6125D	29	6,000
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## Hydrodemolition On Swiss Railroad Near Gotthard, from page 4

designated damaged concrete without causing any harm to the exposed steel rebar.

An important new feature of the new Aquacutter is the removal of all sensors and electric cables from the front of the machine eliminating ingress of water, grease and dust problems. The Aquajet EDS system allows for an optimal lance angle of "attack" without wasting energy from the jet of water. As much as + 45° on the Evolution model can be selected, ensuring full removal of concrete between and under the rebars.

Ordered through local distributed Atümat AG, the Aquacutter was chosen for its versatility, ease of operation, ease of transportation and its compact and lightweight build. The unit, operating at an altitude of 1300m was lifted into position by crane and installed on the opposite side of the valley.

(continued on page 9)



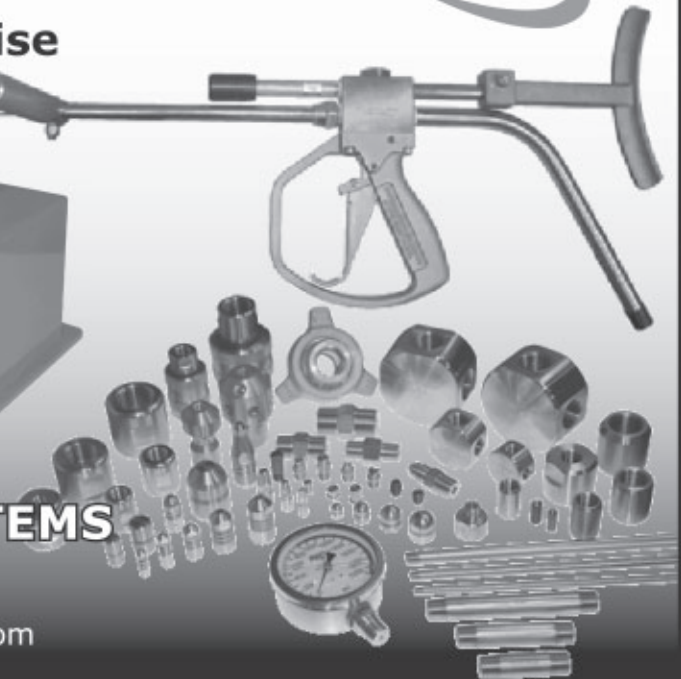
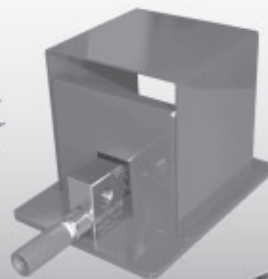
The 11-meter tower being lifted in place.

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## Hydrodemolition On Swiss Railroad Near Gotthard, from page 8

In order to cut 20mm of concrete on the outside of the tunnel bridge, Brugger opted to top the Aquacutter 6m standard tower with an additional 5.5m tower element to reach a maximum height of 11.5m. The robot tower was set to match the 10° inclination of the tunnel wall using a special support. The robots hydraulic pressure remained constant throughout operations on the 11.5m tower and long hydraulic hoses were not required. Even at its highest position the roller beam was reported to have remained very stable.

According to Daniel Rimle of Brugger, the company won the contract by proposing the best technical solution. "I am convinced that the Aquacutter robot will prove to be the best investment."



The robot tower was installed to match the 10° inclination of the tunnel wall.



The Aquacutter 6m standard tower was extended with an additional 5.5m tower element to reach a maximum height of 11.5m.

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## Flow Ranked Number 42 In Deloitte's Technology Fast 50 Program

**F**low International Corporation, a leading developer and manufacturer of ultrahigh-pressure (UHP) waterjet technology, has been named to Deloitte's prestigious Technology Fast 50 Program for Washington State, a ranking of the 50 fastest growing technology, media, telecommunications, and life sciences companies in the region by Deloitte & Touche USA LLP, one of the nation's leading professional services organizations. Rankings are based on the percentage revenue growth over five years from 2002–2006.

Flow's CEO Charley Brown credits increasing acceptance of ultrahigh-pressure waterjet cutting technology, demand for waterjet cutting of composites in the aerospace industry, and Flow's leadership and technological expertise in bringing 87,000 psi waterjet cutting to market with the company's 75 percent revenue growth from 2002–2006. Flow's revenue increase resulted in its ranking in the Technology Fast 50 for Washington State.

"We are pleased to be recognized by Deloitte for our hard work and resulting growth of waterjet cutting technology," said Brown. "Our growth over the past four years is testament to Flow's leadership position in the marketplace."

To qualify for the Technology Fast 50, companies must have had operating revenues of at least \$50,000 in 2002 and \$5,000,000 in 2006, be headquartered in North America, and be a company that owns proprietary technology or proprietary intellectual property that contributes to a significant portion of the company's operating revenues; or devotes a significant proportion of revenues to the research and development of technology. Using other companies' technology or intellectual property in a unique way does not qualify.

Companies from the 16 regional Technology Fast 50 programs in the United States and Canada are automatically entered in Deloitte's Technology Fast 500 program, which ranks North America's top 500 fastest growing technology, media, telecommunications and life sciences companies.

This year's Washington State Technology Fast 50 program is co-presented by Deloitte & Touche USA LLP and Perkins Coie, Citigroup Smith Barney, AH&T Insurance and the Puget Sound Business Journal.

## Nordstjernan Offers To Take Over KMT, from page 7

Chairman of the KMT Board Mats Heiman has announced that he is disqualified from taking part in the matter and will thus not participate in the Board's processing of the matter or in the statement concerning the Offering.

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## Jet Edge Appoints New Corporate Sales Manager



**Michael Metzger**

**J**et Edge, Inc., a leading manufacturer of ultra-high pressure waterjet and abrasivejet systems for precision cutting, coating removal and surface preparation, announced today that it has appointed Michael Metzger as its new corporate sales manager.

Metzger is responsible for Jet Edge's worldwide sales activities. He brings to Jet Edge more than 25 years experience in business development and production roles at all levels of the selling process. He is a graduate of the Georgia Institute of Technology.

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### Flow Signs Option Agreement To Acquire OMAX, from page 7

believe we will be better able to foster the innovation necessary to continue introducing the superiority of the waterjet to a large and growing marketplace."

Assuming that a definitive agreement is reached and regulatory approval is received, the transaction would be expected to close in approximately six months. Upon closing, all litigation between Flow and OMAX would be settled.

For more information, visit [www.flowcorp.com](http://www.flowcorp.com).

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## 40k psi Porta-Lance For Portable Rigid Lancing

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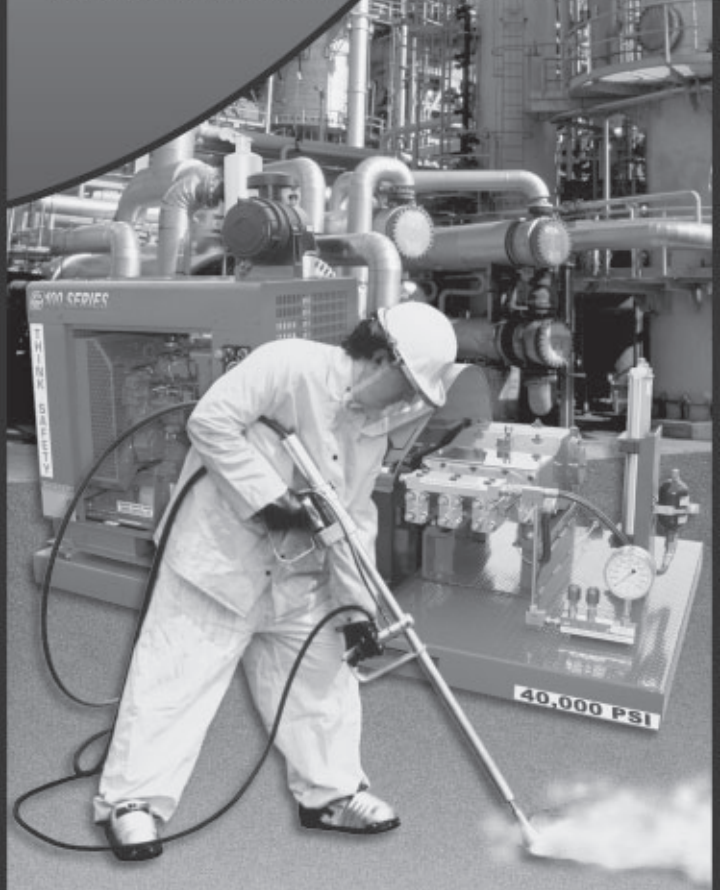
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### Recommended Practices

Effective January 1, 2008, prices for the *Recommended Practices for Waterjetting Equipment* and *Vacuum Equipment* will increase. Buy now and **SAVE 40%**. For your convenience, an order form is inserted with this *Jet News*.

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# Federal Signal Environmental Solutions Group Appoints Product Manager

**F**ederal Signal Environmental Solutions Group has appointed Tim Lee as product manager for the Guzzler Manufacturing and Jetstream of Houston subsidiaries. In this role, Lee will bring his industry expertise and product management leadership to the design and development of Guzzler's industrial vacuum loaders and Jetstream's industrial waterblasting equipment.

Lee joins the Environmental Solutions Group from Visteon Corporation, where he most recently served as program manager. Prior to that, he held numerous roles of increasing responsibility in engineering and manufacturing for Ford Motor Company. Lee will be based out of Jetstream's offices in Houston.

"Tim's addition to the team will help provide us with a better understanding of the environmental well-being needs of our customers and will further increase our lead in market knowledge and design applicability for the Guzzler and Jetstream brands," said James Han, Vice President of global marketing for the Environmental Solutions Group.

"It's exciting to join a company with such innovative products, a growing customer base, and significant market recognition," Lee said. "I look forward to working with the entire Environmental Solutions Group team to achieve our business goals."

For more information, visit [www.federalsignal.com](http://www.federalsignal.com).

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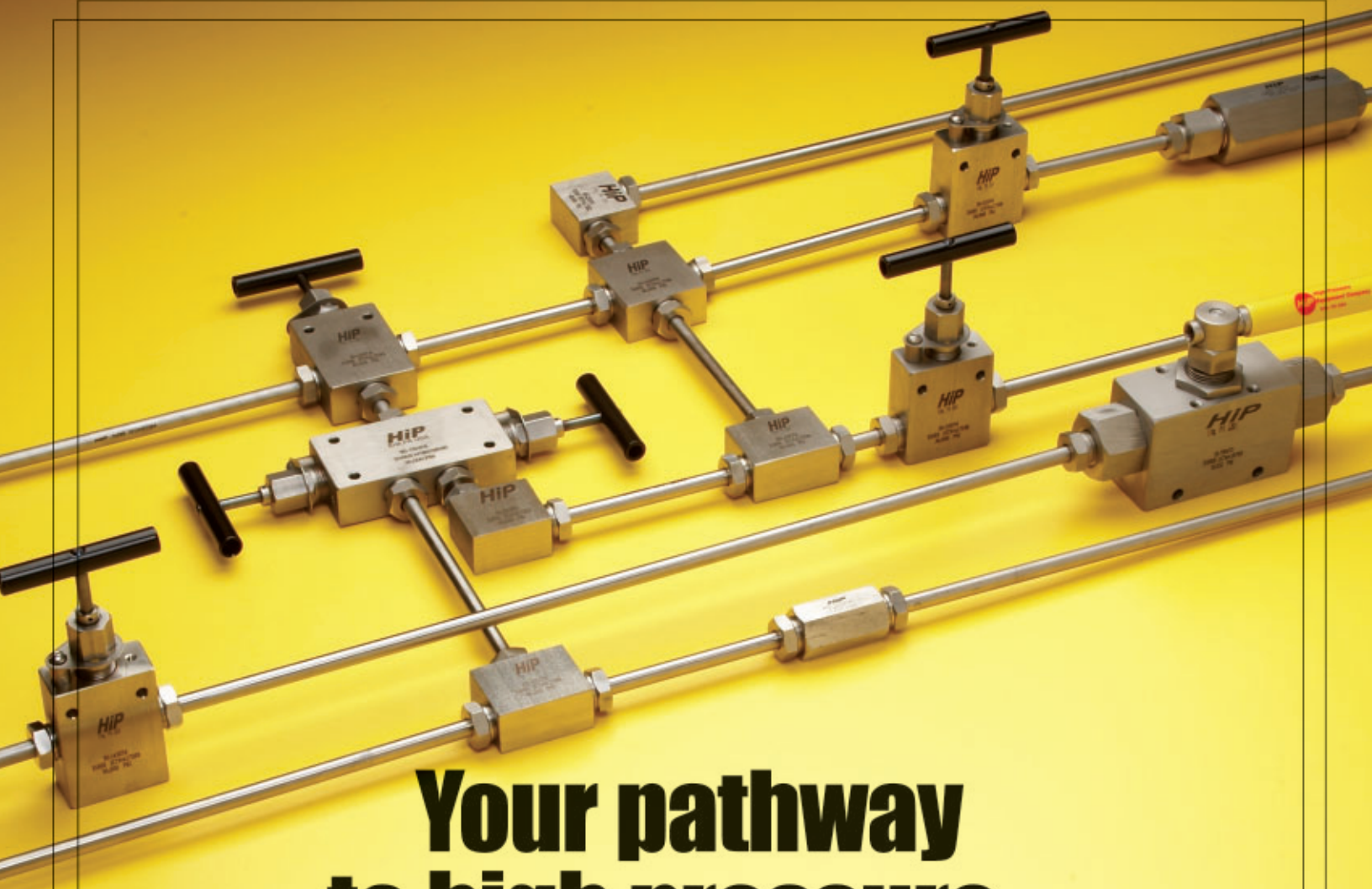
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