

INVESTIGATOR'S SUMMARY¹

Nomination 2007-14
Investigator: Rasha Stino²

INSTA-VALVE PLUS

The Innovation

Introduction

Pipeline systems that convey pressurized fluids in municipalities, commercial and industrial settings typically include block valves that can be used to gain control of sections of the system for repair or maintenance. Because these existing block valves tend to be too widely spaced or may be old or inoperable, insertable valves are often used to limit the length of the pipeline that is shutdown. This helps limit the area or community (fire stations, schools, hospitals, businesses, etc.) that will be deprived of the utility service.

Insta-Valve Plus is an improved insertable valve that can be installed in a pipeline under its normal operating pressure without shutting down and draining the system. A significant distinguishing feature of Insta-Valve Plus is that it can operate as *both* a temporary valve (e.g., in emergency situations such as contamination) and as a permanent valve in the pipeline that can be operated repeatedly using a standard valve key to gain control of the utility system in the event of repair or maintenance. It requires only one cut in the pipe, no reaming and no excessive loss of pipe strength. Its claim to fame is that it is an “easy to install, easy to use” valve that can be inserted in less time, without interruption to utility service and at a lower overall cost than conventional valve systems. Insta-Valve Plus is a product of Hydra-Stop, a division of ADS LLC, a Nova Technologies Company.

A Closer Look at Insta-Valve Plus

Insta-Valve Plus is a patented seat wedge valve. “Seat wedge” is defined as the moving component in a gate valve that wedges tightly in the closed position to perform a seal. Its main contributions are its innovative sealing method, improvement of valve components (existing technologies) and applicability as both a temporary and permanent installation, i.e., it can function as both a temporary and permanent valve in a utility system. Exhibit 1 is a “Parts List” diagram of Insta-Valve Plus that shows each component’s part number, material and description.

The innovative component that distinguishes Insta-Valve Plus from other valves on the market and even its forerunner, Insta-Valve, is its unique sealing method. Previously, the

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sealing surface was a 360° vulcanized rubber sealing surface. The new sealing method was created by combining new manufacturing methods, new materials, and new geometric sealing contours for more effective pipeline control. More specifically, the innovation is a rubber compression molded, hyperbolic parabola shaped seating surface which is joined to the radial axis sealing area. The key is that it optimizes the seal 360° around both the interior of the utility pipe and around the coupon removal location (cut in the pipe where valve is inserted) and does not need any additional support (e.g., nozzle shoulder) to resist the upstream fluid pressure. A hyperbolic parabola can be thought of as a saddle shape or a Pringles potato chip shape. Exhibit 2 shows one image of Insta-Valve Plus's predecessor, Insta-Valve, and three images of Insta-Valve Plus's bullet (valve cartridge), mold, innovative seal and feed screw.

Insta-Valve Plus is also an evolution of its predecessor, Insta-Valve. The developers spent four years of research and development and field applications to maximize performance, reliability and sealing capabilities. Improvements in the technology include:

- Valve Stem – The thread pitch and diameter of valve stem were changed from 1 3/8-2 1/2 to 1 1/2-4 inches. The old valve stem was rated to 200 ft / lbs and the new one is rated to over 700 ft / lbs. In addition, the decrease in thread pitch increases valve stem strength, allowing for easier turning and better hydraulic control and less water hammer.
- Valve Stem Collar – The thread pitch and diameter of the valve's bronze stem collar match the valve stem. The valve stem collar was added to transfer the torque of the valve stem from the weak nylon to the stronger heavy duty collar. This adds years of service to the valve.
- Valve Guide Position – The stem guides are positioned at 90 degrees. This new position allows the cartridge to operate smoother and with less wear on the sides. This increases the service life of the valve.
- Valve Cartridge – The rubber seal on the bullet-shaped cartridge is now directly pressure molded and bonded to the nylon in a single cavity compression mold. It is bonded at 400 degrees F under 2000 pounds of force. This allows for the rubber to properly adhere and bond evenly to the nylon. The position of the hyperbolic parabola also minimizes drag and improves the seal against cut edge on pipe.

Insta-Valve Plus Installation Versus Hot Tapping

The insertion process for Insta-Valve Plus incorporates the conventional technique of under-pressure tapping (commonly referred to as a making a hot tap hole) with the addition of insertion equipment that leaves a flow control valve assembly permanently attached internally to the piping system. The fundamental steps for installing Insta-Valve Plus are illustrated in Exhibit 3 and can be described as follows:

1. Attach the valve body mechanically or weld to the desired pipe creating a drip-tight connection to the existing pipe. The valve body is the sealing chamber that connects to the existing pipe line creating a water tight seal and provides housing for the bullet-shaped valve cartridge (internal valve assembly) to be inserted into

- the pipe. In other words, the Insta-Valve Plus body can be described as a compact, leak-tight enclosed chamber attached to the existing pipe.
2. Mount the temporary valve (gate valve) to the top of the valve body creating a pressure-tight connection or (under pressure access to the pipeline).
 3. Mount the under-pressure tapping machine to the temporary valve (gate valve) and rotate and engage the travel of the tapping machine to drill a hole into the pipe.
 4. Retract or close the temporary valve and remove the tapping machine with the pipe cutout (called a “coupon”).
 5. Mount the valve insertion tool (fitted with the Insta-Valve Plus interior assembly) to the temporary valve (gate valve) creating a pressure-tight connection.
 6. Open the temporary valve (gate valve) and insert the valve interior assembly.
 7. Remove the insertion tool.
 8. Remove temporary valve (gate valve). Fit the new valve with a flange, secondary stem O-ring and the industry standard 2” operating nut.
 9. Operate the valve at will using the utility’s standard valve key (wrench), or motorized valve turner.

Hot Tapping

Because the term “hot tapping” is loosely used, it is important to make a distinction early on in this report between Insta-Valve Plus equipment and the common tapping tee and valve machines on the market that allow for connection of a side-line valve (also referred to as hot tapping equipment).

The similarity between hot tapping equipment and Insta-Valve Plus is that a hot tap hole is made in both processes.

The differences between Insta-Valve Plus (IV Plus) and hot tapping equipment are that:

- IV Plus can be installed in any piping of any age. Hot tapping equipment is to establish a new lateral service with new pipe.
- IV Plus provides valve control on the primary existing pipe. A hot tap valve gives control only to the new service; it does not provide control of the primary existing pipe.
- IV Plus installation machinery doubles as a hot tap tool. A hot tap machine does not double as IV Plus installation tool.
- IV Plus valve is installed into the existing pipeline live. The hot tap valve is mounted onto the pipe dry and then the hot tap is made.

In other words, hot tapping is not a ‘conventional or competing alternative’ to Insta-Valve Plus when gaining control of a primary existing pipe. Conversely, Insta-Valve Plus can always replace hot tapping. It is worth noting that in addition to manufacturing Insta-Valve Plus, Hydra-Stop also manufactures hot tapping equipment.

Insta-Valve Plus Features

Two main distinguishing features of Insta-Valve Plus have been selected from the patent document for discussion in this report:

- *Insta-Valve Plus does not need external supports / nozzle shoulders for its sealing mechanism and therefore does not require prior knowledge of the pipe size and thickness.* “Many conduit stoppers use a solid, cylindrical, deformable plug, which engages in sealing contact with the inner walls of the conduit [pipe] and the nozzle and with the cylindrical cut surface of the [coupon / cutout] in the [pipe]. If such a deformable plug is unsupported...the upstream fluid pressure capability rating of the stopper will be low, because increased pressure will further deform the unsupported plus into a failure shape that will allow leakage past the stopper...Higher stopper pressure ratings are attainable by providing substantial upstream and downstream external supports [nozzle shoulders]...[Use of nozzle shoulders requires knowing] the exact bore [coupon/cutout] and wall thickness of the [pipe]. With any given nominal [pipe] size, for instance 8-inch, there may be more than 10 combinations of wall thickness and [pipe] outer diameter...in emergency situations [pipe] wall thickness is often unknown. Nozzles with improper shoulder [support] locations are frequently installed, resulting in excessive leakage...[Insta-Valve Plus] totally eliminates the sealing shoulder in the nozzles of all fittings, thereby allowing shutdown using a single nozzle size for the full range of dimensional variation found in any given nominal [pipe] size.”
- *Insta-Valve Plus can efficiently function as both a temporary and permanent valve.* “Most conduit stoppers [insertable valves] are intended for temporary service...Other conduit stopper...are designed specifically for permanent installation into a pressurized [pipe]...permanent stopper [permanent valve] can be used in emergency situations and then abandoned, however the fitting material cost is considerably higher...[Insta-Valve Plus can] later be converted into a permanent embodiment [valve] under pressure and without interruption of flow. The designs of prior art temporary conduit stoppers [temporary insertable valves] preclude later conversion [into permanent valves] without shutdown...[With Insta-Valve Plus], substantially the same parts may be utilized for a temporary plugging operation or installation of a permanent valve into a system...” (Murphy et al. 2004)

Other important Insta-Valve Plus features can be summarized as follows (See Exhibit 4 for sales brochure):

- *Seal Effectiveness:* The American Waterworks Association (AWWA) provides written standards on waterworks products. The standards are written for products such as fire-hydrants, water meters, pipe, control valves, etc. These are products installed in the water system during its initial construction. To date there is not an ‘AWWA standard’ or a paragraph in writing for a valve installed into an existing water main under pressure. Standard Mechanical Joints (MJ) or Flange Valves that are installed in the pipeline during original construction seal against their own

valve body. Insta-Valve Plus does not seal on its body. Insta-Valve Plus seals on the existing pipeline. The existing pipe could be asbestos cement, PVC, ductile iron, cast iron, steel, copper, pit cast and all the varieties and wall thickness of those pipes. It is a significant contribution of Insta-Valve Plus to be able to seal against these existing pipes. Due to the wide range of pipes available a 100% seal tight guarantee is not provided. However, Insta-Valve Plus often achieves a 100% seal. An 8" pipe can easily flow over 3500 gallons per minute (gpm). In some cases, Insta-Valve Plus may allow leakage of 0-20 gpm. The guarantee is a 95% or better seal which provides the system operator a reliable control point in the event of an emergency. Another advantage is that when it is time to replace or repair an installed Insta-Valve Plus, a system shutdown is not required, since the moving components of the valve can be removed by simply reversing the under-pressure installation procedures

- *Lifetime:* Under pressure, Insta-Valve Plus was tested 200 times (200 cycles) over a 20 day period. Pressure remained constant on the upstream and downstream side of the valve. Torque applied to the feed screw did not exceed 200 pounds. Temperature was ambient. Inspection of the Insta-Valve Plus showed signs of use but it was still in good condition. The quality of the seal remained constant between the first cycle and the last cycle. According to the California Department of Health Services, Sanitary Engineering Branch, and U.S. Environmental Protection Agency, Office of Drinking Water the life expectancy of a valve is 50 years (at an average of 2 cycles per day).
- *Size:* The current Insta-Valve Plus is available in 4", 6", 8", 10" and 12" sizes. A 16" Insta-Valve Plus has been built and tested and is soon to be released for resale. Additional sizes will also become available in the future.
- *Pipe Size and Material:* Insta-Valve Plus is suited to any construction/site conditions. Insta-Valve Plus is relatively unlimited with respect to pipe material in sizes 12" and under. These include steel, cast iron, ductile iron, plastic (SDR, SCH, C900, C905 and C909), asbestos cement, and non-ferrous metals. In planned applications larger than 12" UPI valve insertions can be accomplished. Larger and greater sizes and pressures are being designed to meet the infrastructure needs of utilities. Temperature ratings to 212 degrees Fahrenheit (100 degrees Centigrade) are capable.
- *Water Pressure:* Insta-Valve Plus is currently rated for water line pressure up to 100 psi. Insta-Valve Plus has been used on test sights in water systems up to operating pressures of 220 psi successfully with superior control, tight sealing, and ease of operation.
- *Valve Style and Monitoring Devices:* The innovative hyperbolic parabola shape of the sealing surface optimizes the seal 360° around both the interior of the utility pipe and around the coupon removal location (cut in pipe) allowing the installation of other styles of valves into the water system such as butterfly and ball valves and the live installation of any number of monitoring or metering devices into a fluid conduit or pipe.
- *Types of Utilities:* Insta-Valve Plus is currently used on potable water mains, wastewater force mains and industrial (water) applications. By using alternate materials for the valve and seal, Insta-Valve Plus is expected to be used in the gas

and petroleum industry, chilled water, air and pneumatic lines, HVAC supply and return lines and refrigeration lines. For example, instead of using a standard SBR rubber, an EPDM rubber (different grade) will be used to make the valve compliant with natural gas and other petroleum applications. Currently, an independent testing firm, Packer Engineering, is conducting independent tests on Insta-Valve Plus for the natural gas industry. Two gas companies have already expressed interest in Insta-Valve Plus for their use.

Overview of Insta-Valve Plus Performance

The primary process for valve replacement in active pipelines through existing methods is to “shut down” the system. Any method that requires shutdown involves expenses and safety risks to the community including:

- Notifying the local health agency of the shutdown
- Notifying the fire department
- Notifying the clients that will be out of service
- Draining and pumping the lost water
- Saw cutting out the old valve and replacing it with a new valve
- Refilling and chlorinating the shutdown affected area
- Flushing and purging the shutdown affected area
- Sending a lab sample analysis of water quality to the health agency.

Insta-Valve Plus is an innovative alternative that avoids the shutdown, thus eliminating:

- Boil orders
- Complicated planning
- Loss of fire protection
- Large street excavations and street patches
- Working in unsafe trenching and knee-high mud
- Reaming the pipe wall of completely severing the pipe
- Not having isolation zones in the event of contamination

Insta-Valve Plus eliminates the need for line disinfection because the valve is installed without system disruption thereby reducing the risk of lurking bacteria entering into the sealed potable environment. This is of particular benefit to a potable water system. Insta-Valve Plus and installation equipment will always be disinfected before coming in contact with the pipeline. Insta-Valve Plus’s performance and applications are further highlighted in the following two sections that compare it to conventional valve systems and competing valve systems.

Insta-Valve Plus Performance Compared to Conventional Systems

The conventional/traditional systems that Insta-Valve Plus replaces are methods that shut down the utility system. Conventional systems and Insta-Valve Plus are compared under the headings 'Cost and Time', 'Environment', 'Safety' and 'Quality'.

Cost and Time:

- A conventional 8” mechanical joint cut-in gate valve with a cut-in sleeve can be purchased for \$800 versus the \$2000 purchase price of an 8” Insta-Valve Plus. To install a traditional valve, the existing pipeline system would have to be shutdown. Once factored in, the cost of shutting down the system by far exceeds the higher initial cost of Insta-Valve Plus. These costs, as previously mentioned, include, notifying the local health agency of the shutdown, notifying the fire department, notifying the clients that will be out of service, draining and pumping the lost water, saw cutting out the old valve and replacing it with a new valve, refilling and chlorinating the shutdown affected area, flushing and purging the shutdown affected area and sending a lab sample analysis of water quality to the health agency. For a cost comparison of the traditional shutdown method vs. uninterrupted valve insertion using 12-inch Insta-Valve Plus (and two competitors), see Exhibit 5. It shows that the use of IV Plus costs nearly \$10,000 less than a traditional shutdown method and nearly \$1000 less than the competitor, Romac (Occlude, another competitor, is not available in the 12-inch size).
- Under traditional methods, extra labor is required to operate the trash pumps, maintain personnel in the trench, and remove the draining water from the pipeline during the shutdown. There are also increased costs of the larger excavation, more pipe appurtenances (accessories), pumps/hoses, pipe cutoff saw(s), more restoration costs (concrete, asphalt or sod), and additional time for the planning of the shutdown on nights or weekends. An 8” Insta-Valve Plus can be installed in about one hour without interrupting the system pressure. Even though the Insta-Valve Plus has a more expensive upfront cost the labor and risk savings are significant. A case in point is David Halopoff, Secretary for Halopoff & Sons and Project Manager for the City of Orange Cove said, “The valves are really easy to install. After one day of training, the crews were averaging 4-5 valve installations in an 8-hour shift” (December 2006 WaterWorld Journal). On this project there were no shutdown risks, no backflow incidents, no loss of fire protection and no wasted treated potable water running down the storm drain. Insta-Valve Plus increases employee efficiency and reduces overtime.
- The cost of environmental risks and hazards with traditional systems that shut down the utility should also be factored in. These are discussed in detail under “Environment”.

Environment – Insta-Valve Plus maintains system water pressure and avoids a shutdown, thus significantly cutting down on backflow and backsiphonage incidents. Backsiphonage is the backflow caused by negative or sub-atmospheric pressure in a portion of distribution system or the supply piping (USC FCCCHR 1993). When the system pressure drops to below atmospheric (negative gauge pressure), ambient pressure on the distribution system, due to the atmosphere, water columns, or other sources will

cause the direction of flow within portions of the system to reverse. During a routine maintenance shut down, the pipe is cut to perform a repair or have a mechanical fitting removed creating backsiphonage in the water system. Any product or debris that is in the surrounding atmosphere or trench soils has the potential to contaminate the potable water pipe during negative pressure. When contaminants enter the water system, it requires more flushing and/or lab/sampling fees. Insta-Valve Plus also acts as a water conservation measure.

Three examples of backsiphonage costs and risks are:

- In Allegheny, PA, the pesticides heptachlor and chlordane contaminated a portion of a distribution system. A pesticide contractor had a garden hose submerged in the chemical mixing tank while a plumber shutdown a 6” water main to install a new control valve back into the water main. The shutdown resulted in backsiphoning the pesticides into the water main. The County spent approximately \$300,000 to replace the plumbing and water works piping affected by the contamination (Watts 1998).
- In Washington State, during a shutdown of a water main to repair a valve, the backflow of water from a boiler caused burns to the hands of an employee at the water department (American Waterworks Association Pacific Northwest Section 1995).
- In Georgia, during a fire hydrant repair shutdown, creosote was backsiphoned into the water system. (American Waterworks Association Pacific Northwest Section 1995).

The Environmental Protection Agency published a paper entitled, “Potential Contamination Due to Cross-Connections and Backflow and the Associated Health Risks” (2001). It stated the following:

“The costs associated with backflow incidents depend on the nature and scope of the incident....Depending on these factors, costs could be incurred for public notification; the repair of the damage to water distribution system infrastructure; investigation, sampling, and laboratory analyses; clean-up of structures and equipment; purchases of bottled water; responding to consumer complaints; lawsuits (both legal fees and judgments; the repair of property damage; replacement of spoiled food; missed work and school; loss of production; and medical expenses. Beyond actual cost, other losses could include leisure time and even loss of life.

A survey by the ABPA in 1999 (American Backflow Prevention Association) gathered information to estimate the costs that water systems may incur to mitigate a backflow incident. The survey collected data from 25 water systems serving fewer than 10,000 people and from 103 systems serving 10,000 people or more. Survey results show that from the 92 systems that responded, water system operators expended an average of 494 hours per event mitigating backflow incidents. At \$30 per hour (the average rate of technical labor reported by the Bureau of Labor Statistics - 2000) that averages \$14,800 per

event. Eleven of these were significantly more time consuming than the others, averaging 3,683 hours and about \$110,500 (at \$30 per hour) per incident. Excluding these 11 most time-consuming incidents, operators expended an average of 60.8 hours per incident and \$1,820 per incident. Utility-level costs such as these do not include costs for all possible elements described earlier, especially those for health-related effects.”

Safety – It is not uncommon to see a pipe crew in an excavated trench during a shutdown with water draining into the trench and being pumped out. Often times, thousands of gallons of water are being transferred in this fashion during a shutdown. An employee trying to maneuver in a muddy trench combined with the swirling waters that may be undermining trench walls is a significant health and safety factor that Insta-Valve Plus eliminates. See Exhibit 6 for photographs of Insta-Valve Plus installation.

Quality – Conventional gate valves provide a guaranteed 100% seal and are therefore AWWA approved, but when it is time to replace or repair the valve, a system shutdown is often required. Insta-Valve Plus does not guarantee a 100% seal, since it is dependent upon seating on the pipe, but a 95% or better seal is guaranteed and a 100% seal is “most often achieved”. When it is time to replace or repair an installed Insta-Valve Plus a system shutdown is not required, since the moving components of the valve can be removed by simply reversing the under-pressure installation procedures.

Insta-Valve Plus Performance Compared to Competitors

Insta-Valve’s main competitors are “Insert-Valve” by Occlude, “Easy Valve” by AVT and “Quick Valve” and “Inserta-Valve” by Romac. The Occlude valve is Insta-Valve Plus’s most viable competitor because it provides a quality shut down and aesthetically appears like a valve. The following comparison data was provided by a prospect in a competitive bid situation:

- *Cost*: Occlude’s valve is 33% more expensive than Insta-Valve Plus’s purchase price.
- *Application*: Occlude is only available in 6 and 8” sizes but can be used in waste water applications and gas (seal changes)
- *Time*: Occlude valve takes 30% longer to install.
- *Safety*: Trench and personnel safety is the same for Occlude and Insta-Valve Plus. Insta-Valve Plus is over 50% lighter in weight than Occlude.
- *Quality*:
 - Occlude boasts a guaranteed 100% sealing. This means that it provides a complete shutoff and the number of turns to open the valve will be standard. Inst-Valve Plus’s valve does not guarantee 100% sealing and the number of turns to open the valve is not standard (it varies for every installation, requiring the operator to know more).
 - Occlude’s 100% seal claim is at the expense of pipe strength and performance. During installation of Occlude’s valve, the whole pipe section is severed and removed creating a ‘cavity’ in the water way. In

most water systems sediment will deposit and build up in this cavity. This will result in decreasing performance over the life of the valve. Insta-Valve Plus does not sever the pipe, it only removes a small portion of pipe material above the spring line. Therefore, there is a constant unobstructed waterway without a cavity. This is a significant advantage over Occlude in the area of pumping costs. The more cavities and obstructions in a waterway the more energy it takes to pump the water through the pipe. Insta-Valve Plus does not create an obstruction in the waterway.

Application of the Innovation

The measurable benefits of Insta-Valve Plus are in avoiding the system shutdown and in providing uninterrupted service to customers throughout the maintenance or repair process. Avoiding a shutdown reduces health and safety risks and eliminates expenses as previously stated. It is impossible to list all of the projects on which Insta-Valve Plus has been used because the valves are predominantly supplied to contractors who install the valves at locations unknown to the manufacturer. Production of the Insta-Valve Plus is in excess of 650 valves for 2007. These valves have been shipped throughout North America on a number of different projects for utilities and contractors. Following are four examples of applications of Insta-Valve Plus that illustrate its success.

City of Orange Cove, CA

The City of Orange Cove, CA had 40% unaccounted for water loss and needed to update their system without shutting down the whole town. City Manager, Bill Little, needed a solution. As a former owner of four water systems, Little knew that he would need to address the community's growing water problems. "Our goal is to reduce unaccounted for water loss in Orange Cove to 3%-5%," stated Little. "This City has an old water system with no records or documentation to facilitate the management of the system. If we have a leak in a water main, we have to shut the whole town down. We need a solution that will allow us to make line replacements while the system is hot, rather than shutting down."

Little chose Insta-Valve Plus as the solution. 113 Insta-Valve Plus valves were installed in strategic locations to enable the contractor to perform 60-70 tie-ins with no shutdowns to the residents or businesses.

David Halopoff, Secretary for Halopoff & Sons and Project Manager for the City of Orange Cove said, "The valves are really easy to install. After one day of training, the crews were averaging 4-5 valve installations in an 8-hour shift" (December 2006 WaterWorld Journal). On this project there were no shutdown risks, no backflow incidents, no loss of fire protection and no wasted treated potable water running down the storm drain.

Perrysburg, OH

Rudolph/Libbe began a project on two lines: a North-South running line; and an East-West running line. They were told that there were three existing water valves on those two lines. The project included going in and turning off the water at those valves. This would allow them to go in and work on the water lines. Two of the valves that were supposed to be there had never been installed (they could not shut off the water). There was also supposed to be another existing water line down the road that had never been installed. This meant that in order for them to do the work that needed to be done, local businesses would now have to be shut off and go without water.

Rudolph/Libbe called on Hydra-Stop because of their reputation for working on under-pressure lines and finding solutions that eliminated the need to shut down the system. Rudolph/Libbe chose the Insta-Valve Plus valves as the solution primarily because they could be installed while the line was hot and the system would not need to be shut down. An added benefit was that the valves would be left there permanently for future access as needed.

Another surprise in the project was that one of the pipes turned out to be transite (asbestos) pipe. The fittings the City had wouldn't fit over the transite pipe, but Hydra-Stop had fittings for the Insta-Valve Plus that fit the transite pipe. Rudolph/Libbe pumped heat into the pipe so it wouldn't freeze. Hydra-Stop Contract Services came in and within a day completed all the work required to allow access to work on the pipes. Hydra-Stop installed two Insta-Valve Plus valves, one over the transite pipe and one over the PVC line.

This project is still ongoing. These Insta Valve Plus valves will be in service enabling easy access to that line for the life of the line.

City of Sanger, CA

The City of Sanger, CA was in need of additional isolation valves to replace steel water mains that were failing due to water hammer. The Project Engineer, Ron Yamabe of Yamabe & Horn Engineering, chose Insta-Valve Plus as the solution. "We had to replace the steel water lines that were breaking due to water hammer," Yamabe said. "However, the City had no way of isolating the system without shutting down."

Approximately fifty Insta-Valve Plus valves were installed in the City of Sanger. As a result, the system did not have to be shutdown during the rehabilitation. If the City would have used conventional methods, many system shutdowns would have been needed to make the necessary repairs. The business district would have been placed out-of-service during the repairs causing loss of revenue to local businesses and service interruption to residents.

Town of Bernalillo, NM

The Town of Bernalillo, NM was in need of isolation valves. HDR Engineering chose Insta-Valve Plus as the solution to provide the Town with isolation valves.

Gabriel Alvarado with HDR Engineering said, “The Town needed a way to isolate the system but had no isolation valves. Insta-Valve Plus valves were installed in strategic locations to enable future isolation without shutting down large portions of the system. Adding conventional valves was not an option because the Town would have to be shutdown. Since the installation of the thirteen Insta-Valve Plus valves, the Town has been able to isolate sections of the system without shutting down.”

By using Insta Valve Plus technology The Town of Bernalillo was able to avoid shutdown and gain control of their system.

Future Applications

Newer versions of Insta-Valve Plus are expected to be used in higher water pressure applications. Currently, it is rated for water line pressure up to 100 psi. Insta-Valve Plus has been used on test sights in water systems up to operating pressures of 220 psi with successful sealing and ease of operation. Currently, Insta-Valve Plus is available in 4”, 6”, 8”, 10”, and 12” sizes. A 16” Insta-Valve Plus has been built and tested and is soon to be released for resale. Additional sizes will also become available in the future. It is expected to be used in more industries and types of utilities including the gas and petroleum industry, chilled water, air and pneumatic lines, HVAC supply and return lines and refrigeration lines.

Background of the Innovation

The innovation originated as an idea when Hydra-Stop clients began asking for a valve insertion product with improved reliability and sealing capabilities as well as a product that could give them optimum pipeline control for years of service. In response to their interests and needs, they surveyed key municipality workers, contractors, and managers of Hydra-Stop contract services who were using Insta-Valve (the forerunner to Insta-Valve Plus) to gain a clear understanding of their desired changes for a new valve installation product.

The initial Insta-Valve Plus originated in the fall of 2006 in Alsip, IL. According to Brett Hanes, General Manager of Hydra-Stop, Insta-Valve (predecessor to Insta-Valve Plus) was originally invented by Kevin Murphy, Michael Murphy and Garland Smith. They no longer own the product and have since established a separate, competing company. The first attempt at developing a new product with an improved long term seal began by using a common process of vulcanizing rubber onto the surface of the internal valve. While it created a strong seal, the valve operated with difficulty and only had a 50 cycle operation life.

The operation difficulty was due to the drag caused by all the rubber being on the complete surface of the valve and not just in the strategic seating location. Research and Development began working on manufacturing processes, alternate materials, Computer Numeric Control (CNC) capabilities, vendor interviews, rubber types, application methods and a geometric study of the various wall thicknesses and contour shapes of pipe. Budgeting, designing prototypes, testing and test sites, establishing Enterprise Resource Planning (ERP) routing and Bill of Materials (BOM), building new molds, and implementing the production process were all considered during the development of Insta-Valve Plus. See Exhibit 7 for definitions of CNC, ERP and BOM.

All of the development issues were successfully resolved. The Insta-Valve Plus now opens and closes with ease and has been cycle tested to 200 while still functioning to design standards.

Insta-Valve Plus as a Practical System

The idea was implemented by communicating with water purveyors and gaining an understanding of their needs and challenges. The developers stayed up to date on important issues in trade magazines, EPA (Environmental Protection Agency) and state requirements for providing constant quality potable water, strict conservation methods and aging infrastructure issues (including valves which are the heart of controlling a system).

Since 9/11 there is an increased need for establishing isolation zones in the water system in the event of contamination, greater precautions against backflow issues, increased expense of lab and sampling costs, need for limiting risk to the utility owner and heightened safety standards. Insta-Valve Plus offers a solution for these critical industry issues that utilities consistently deal with on a day-to-day basis.

Brett Hanes, Brad Tolman, and Carl Mastny are the people responsible for the practical implementation of the idea.

The new Insta-Valve Plus was implemented in Sanger, CA and Orange Cove, CA on a large scale. The designer for both of those projects is the City Engineer, Ron Yamabe of Yamabe & Horn. He was the first to use Insta-Valve Plus.

Responsibility for the Innovation

The following three individuals are responsible for developing the innovation and should be invited from Hydra-Stop:

- Brett Hanes, General Manager
- Carl Mastny, Production Manager
- Brad Tolman, Services Manager

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Opinions of Persons Contacted

Four industry references were asked the following questions through electronic mail and telephone calls:

- 1. What specifically is **innovative** about Insta-Valve Plus? Is it an innovation or merely an evolution of existing technology?)*
- 2. Why should Insta-Valve be considered innovative compared to existing methods for replacing valves?*
- 3. What are its measurable benefits? (The jurors need a clear answer to this question, too, in dollars and cents if possible.)*
- 4. What are conventional / traditional systems that it replaces?*
- 5. What are its competing systems (competitors)?*
- 6. How does it compare to other alternatives (different systems that perform the same function) in terms of cost, time, safety and quality?*
- 7. How does it compare to other competitors (similar systems that perform the same function) in terms of cost, time, safety and quality?*
- 8. What are its limitations and what are its expected uses in the future? More specifically, to what types of pipe materials, pipe sizes, transported fluids, pipe systems, construction / site conditions is it suited / not suited?*

There was consensus among the interviewees that Insta-Valve Plus is an innovation, or at the very least a substantial evolution in the way existing pipelines can be controlled. For the interviewees, Insta-Valve Plus was the only option on the market that provided an in-line valve to service existing pipelines without interruption of service. According to one interviewee, "In an older area of a city, isolation valves are usually insufficient and/or inoperable which requires a shut down of a large area in order to repair a water line." Insta-Valve Plus solves that problem.

Its benefits are numerous, including a substantial time and cost savings, “Installation requires one day rather than weeks as compared to the conventional installation methods”. Other benefits are uninterrupted services to local businesses and communities, elimination of coordination with local municipalities and safer, cleaner working conditions. A common request among the interviewees was for more Insta-Valve Plus sizes (currently sizes range from 4-inch to 12-inch), which the Hyrda-Stop company is developing.

Investigator’s Comments

The effectiveness of Insta-Valve Plus is significant in that it offers utilities an option for system repair and maintenance that reduces risk and saves time and money. Insta-Valve Plus enables utility and pipeline contractors to safely achieve quality control of a pipeline without system interruption and without the hazardous side effects of a shutdown. I asked Brett Hanes, General Manager of Hydra-Stop, if Insta-Valve Plus could one day become the standard utility valve that is permanently installed with any new utility construction. He responded that as the price of the product goes down, that is in fact their ultimate goal.

The newer applications of Insta-Valve Plus to other utilities, particularly gas, and its availability in a wider range of sizes will further enhance the control and serviceability of pipelines. My opinion based on independent references, the patent documents, the literature and data provided by Hydra-Stop and internet searches is that Insta-Valve Plus is a significant innovation that will at least partially facilitate one of our biggest challenges: effectively maintaining the crumbling infrastructure. I also believe that more creative applications of Insta-Vale Plus will continue to appear because of the appeal of the easy application and relatively simple design of the product.

I would like to acknowledge Mr. Brett Hanes and Ms. Cindy O’Gorman of Hydra-Stop for their timely cooperation and for providing the interviews, figures, tables and data needed to produce this report.

SELECTED INTERVIEW SUMMARIES

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Date: June 28th, 2007

*1. What specifically is **innovative** about Insta-Valve Plus? Is it an innovation or merely an evolution of existing technology?)*

The Insta-Valve allows for the installation of a new valve on an existing pipeline without removing it from service. I would say that it is both an innovation as well as an evolution of existing technology. Hot tapping of valves has been in place for years and this takes it a step further.

2. Why should Insta-Valve be considered innovative compared to existing methods for replacing valves?

All other methods require taking a line out of service for installation.

3. What are its measurable benefits? (The jurors need a clear answer to this question, too, in dollars and cents if possible.)

Minimal disruption to the system.

Installation is relatively simple and fast.

4. What are conventional / traditional systems that is replaces?

The traditional way of installing a new valve is to shutoff the system. The Insta-Valve eliminates this requirement.

5. What are its competing systems (competitors)?

The only other system I know of is produced by Occlude. The difference is that with Occlude, you get an AWWA approved valve. Therefore you will get complete shutoff and the number of turns to open the valve will be standard.

6. How does it compare to other alternatives (different systems that perform the same function) in terms of cost, time, safety and quality?

I do not know of any similar alternatives.

7. How does it compare to other competitors (similar systems that perform the same function) in terms of cost, time, safety and quality?

I cannot specify how it compares to other competitors as I have not used them.

8. *What are its limitations and what are its expected uses in the future? More specifically, to what types of pipe materials, pipe sizes, transported fluids, pipe systems, construction / site conditions is it suited / not suited?*

Limitations are the size of pipe that it can be used on.

Maximum operating pressures.

Valve installed is not an AWWA approved valve.

The number of turns to open the valve is not standard. It varies for every installation. This requires that the operators know more.\

Valves are not guaranteed to provide complete shutoff.

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| | |
|-------------------------|---|
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| Date | July 3rd, 2007 |

1. *What specifically is **innovative** about Insta-Valve? Is it an innovation or merely an evolution of existing technology?)*

2. *Why should Insta-Valve be considered innovative compared to existing methods for replacing valves?*

With existing methods the waterlines need to be shut off in order to repair any pipe. With Insta Valve the waterline does not need to be shut off, which creates a safer and cleaner construction area.

Installation requires one day rather than weeks as compared to the conventional installation methods. The value is a reduced schedule.

3. *What are its measurable benefits? (The jurors need a clear answer to this question, too, in dollars and cents if possible.)*

The traditional system will require temporary loss of water to certain areas. Insta Valve eliminates the shut off of the water and minimizes coordination with the local municipalities.

4. *What are conventional / traditional systems that is replaces?*

5. *What are its competing systems (competitors)?*

Unknown at this time.

6. *How does it compare to other alternatives (different systems that perform the same function) in terms of cost, time, safety and quality?*

The cost is comparable to other alternatives. Insta Valve is quicker and safer than other alternatives because workers are not potentially exposed to an unknown pressurized line because of the contained environment Insta Valve works in. The quality matches other alternative methods.

7. *How does it compare to other competitors (similar systems that perform the same function) in terms of cost, time, safety and quality?*

Other competitors are unknown at this time.

8. *What are its limitations and what are its expected uses in the future? More specifically, to what types of pipe materials, pipe sizes, transported fluids, pipe systems, construction / site conditions is it suited / not suited?*

In our application it was applied to PVC and transite pipe. Insta Valve is applicable for most waterline pipes.

Limitation: It currently is in use for waterlines from 4" to 12" sized pipe.

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| | |
|-------------------------|--|
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| Telephone number | (559) 244-3123 |
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| Date | July 6th, 2007 |

1. *What specifically is **innovative** about Insta-Valve? Is it an innovation or merely an evolution of existing technology?)*

The Insta- Valve insertable valve is innovative because it allows for the installation of an in-line valve without having to shut down the any portion of the water main system. Without the Insta-Valve, if there are not sufficient existing water valves, portions of a water line system have to be shut down and isolated in order to do any water main repairs. The standard tapping tee and valve machines on the market only allow for connection of a side-line valve, not an in-line valve.

2. *Why should Insta-Valve be considered innovative compared to existing methods for replacing valves?*

Insta-Valve is the first product I became aware of that enabled an in-line valve to be installed on a water line without shutting down the line.

3. *What are its measurable benefits? (The jurors need a clear answer to this question, too, in dollars and cents if possible.)*

A major benefit of Insta-Valve is that any customers on a water line that needs repair will not need to have their water service interrupted while the repair was being made. In a commercial area, the cost benefits will be substantial if a long segment of water line had to be shut down to perform a repair. There is considerable cost savings when repairing a line that can be isolated by shutting off only a couple of valves. There is a reduced quantity of water in the pipeline that must be disposed. The fewer number of valves required to be shut down reduces the time involved.

4. *What are conventional / traditional systems that is replaces?*

The conventional method of repairing a water line that does not have appropriate shut-off valves in the immediate vicinity requires shutting down whatever valves are necessary in order to isolate the water line needing repair. In an older area of a city, isolation valves are usually insufficient and/or inoperable which requires a shut down of a large area in order to repair a water line.

5. *What are its competing systems (competitors)?*

I am not aware of any competing systems. In 2003, when we first considered using Insta-Valve, we could not find another similar product.

6. *How does it compare to other alternatives (different systems that perform the same function) in terms of cost, time, safety and quality?*

We have not compared any other products with Insta-Valve.

7. *How does it compare to other competitors (similar systems that perform the same function) in terms of cost, time, safety and quality?*

We have not compared Insta-Valve with any other competitors.

8. *What are its limitations and what are its expected uses in the future? More specifically, to what types of pipe materials, pipe sizes, transported fluids, pipe systems, construction / site conditions is it suited / not suited?*

We have only used Insta-Valves on municipal water distribution systems. Insta-Valves were installed on asbestos cement, steel and iron pipes and are performing as anticipated. The Insta-Valve drilling machine purchased by the Cities of Orange Cove and Sanger can be used for 4, 6, 8, 10 and 12 inch valves.

Respectfully submitted, Ronald S. Yamabe, City Engineer for Orange Cove, California and Sanger, California Contact me at (559) 244-3123 if you have any questions.

References

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- Murphy, Kevin P., Murphy, Michael, and Smith, Garland, (2004). *Conduit Flow Controller*. U.S. Patent No. 6,810,903, Application No. 09/296, 119.
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- US EPA (September 27, 2001), "Potential Contamination Due to Cross-Connections and Backflow and the Associated Risks", Page 5 of 44.
- Watts: Watts Backflow Prevention Products (1998), *Stop Backflow News Case Histories and Solutions*, Andover, MA.

SUPPORTING EXHIBITS

Exhibit 1: “Parts List” diagram of Insta-Valve Plus showing each component’s part number, material and description.

Exhibit 2: Photographs of Insta-Valve and Insta-Valve Plus (two pages).

Exhibit 3: Steps for installing Insta-Valve Plus (two pages).

Exhibit 4: Sales Literature for Insta-Valve Plus (two pages).

Exhibit 5: Cost comparison for Utility Shutdown versus Uninterrupted Valve Insertion using 12-inch Insta-Valve Plus, Occlude and Romac (competitors).

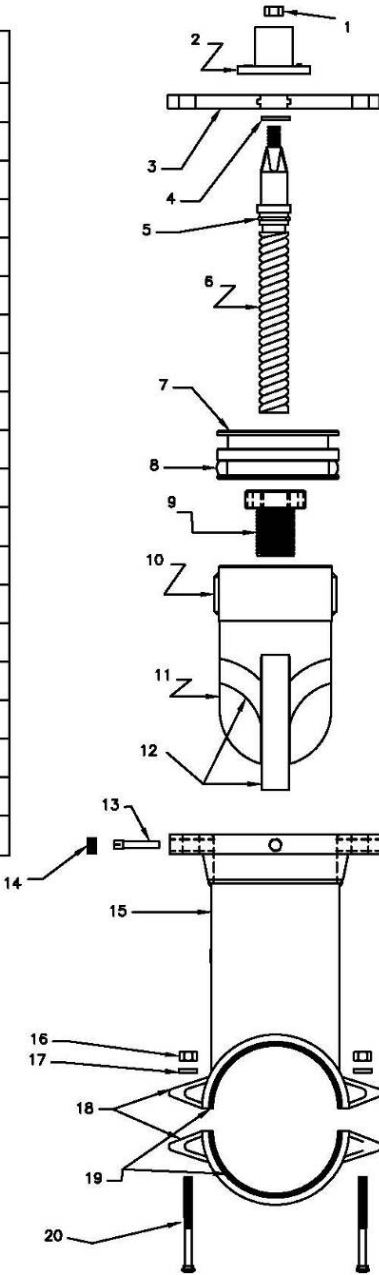
Exhibit 6: Photographs of Insta-Valve Plus installation (two pages).

Exhibit 7: Definitions of CNC, ERP and BOM (one page).

EXHIBIT 1: INSTA-VALVE PLUS PARTS LIST

EXHIBIT A

| PARTS LIST | | | |
|------------|---------------|---------------------------|------------------------------|
| ITEM | PART # | MATERIAL | DESCRIPTION |
| 1 | NUTH058-11 | STEEL ALLOY | HOLD DOWN NUT |
| 2 | NUTOPERAT2 | CASTING CAST IRON | OPERATING NUT |
| 3 | 8IVBLFG06 | STEEL ALLOY EPOXY COATED | VALVE BONNET |
| 4 | O-RING#343 | BUNA | O-RING |
| 5 | O-RING#319 | BUNA | O-RING |
| 6 | BFSIVLHD006 | BRASS/BRONZE | VALVE STEM |
| 7 | 8CMPPLV06 | NYLATRON | PLUG |
| 8 | O-RING625 | BUNA | O-RING |
| 9 | 8INSRTMLH112 | BRASS/BRONZE | VALVE STEM COLLAR |
| 10 | 8ALUMKEYV | ALUMINUM | STEM GUIDES |
| 11 | 8BLTVNNO8 | NYLATRON | VALVE CARTRIDGE BULLET SHAPE |
| 12 | 8BLTVNNO6 | 80-DUR-METER RUBBER | COMPRESSION MOLDED |
| 13 | BLOCFIN | STEEL ALLOY | LOCKING PIN |
| 14 | PLGPP34HEX | STEEL ALLOY | DEBRIS PIPE PLUG |
| 15 | 8IVNOZCS06-SS | CARBON STEEL EPOXY | VALVE BODY |
| 16 | NUTH034-10B | STEEL ALLOY OR S.S. | NUT |
| 17 | WASH034-10B | STEEL ALLOY OR S.S. | WASHER |
| 18 | SLVCS89012 | CARBON STEEL EPOXY COATED | LOWER VALVE BODY |
| 19 | GASK6IV | BUNA RUBBER | GASKET |
| 20 | BLTCRG3410 | STEEL ALLOY OR S.S. | BOLT |



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| | | | | | | |
|--|--|-------------|-----------------------------------|-------------------------|----------------------|------|
| <p style="font-size: large; margin: 0;">HYDRA STOP</p> <p style="font-size: small; margin: 0;">11700 S CICERO AVE. ALSFJL 60803</p> | UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES | | DRAWN BY & DATE BS 1/30/2007 | 6" I.V. BULLET ASSEMBLE | | |
| | | | CHECKED BY & DATE BH 2/1/2007 | | | |
| | | | APPROVED BY & DATE BH 2/1/2007 | SCALE: N/A | SHEET 1 | OF 1 |
| | REV | DESCRIPTION | APPROVED | DATE | DWG NO: 6"-I.V. ASSY | |

EXHIBIT 2: INSTA-VALVE & INSTA-VALVE PLUS PHOTOS (two pages).



**EXHIBIT B1 - Insta-Valve Bullet and Feed Screw
(Predecessor to Insta-Valve Plus)**



EXHIBIT B2 - Insta-Valve Plus Bullet and Feed Screw



EXHIBIT F1 -
Innovative Rubber
Seating Contours
of the Insta-Valve Plus

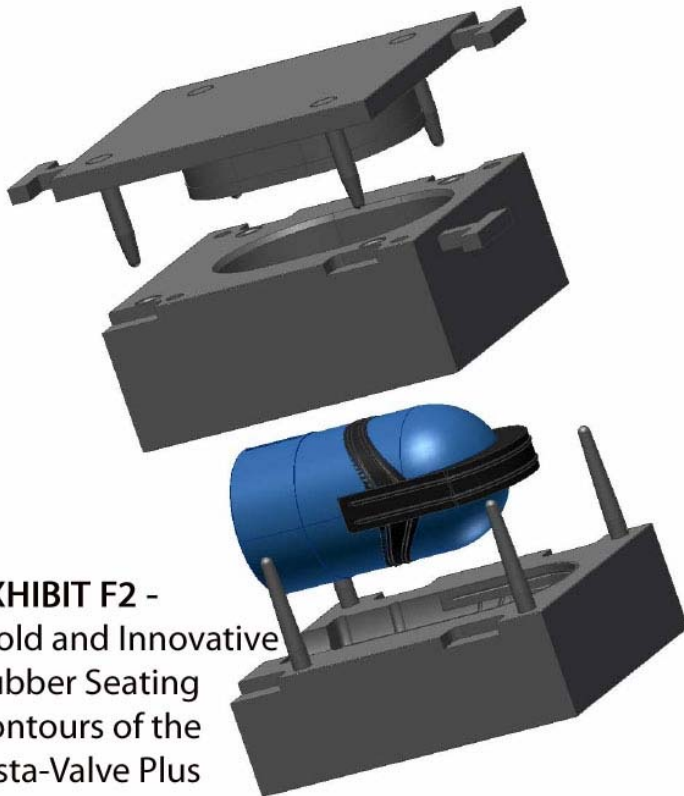


EXHIBIT F2 -
Mold and Innovative
Rubber Seating
Contours of the
Insta-Valve Plus

EXHIBIT 3: STEPS FOR INSTALLING INSTA-VALVE PLUS

Exhibit B page 1 of 2

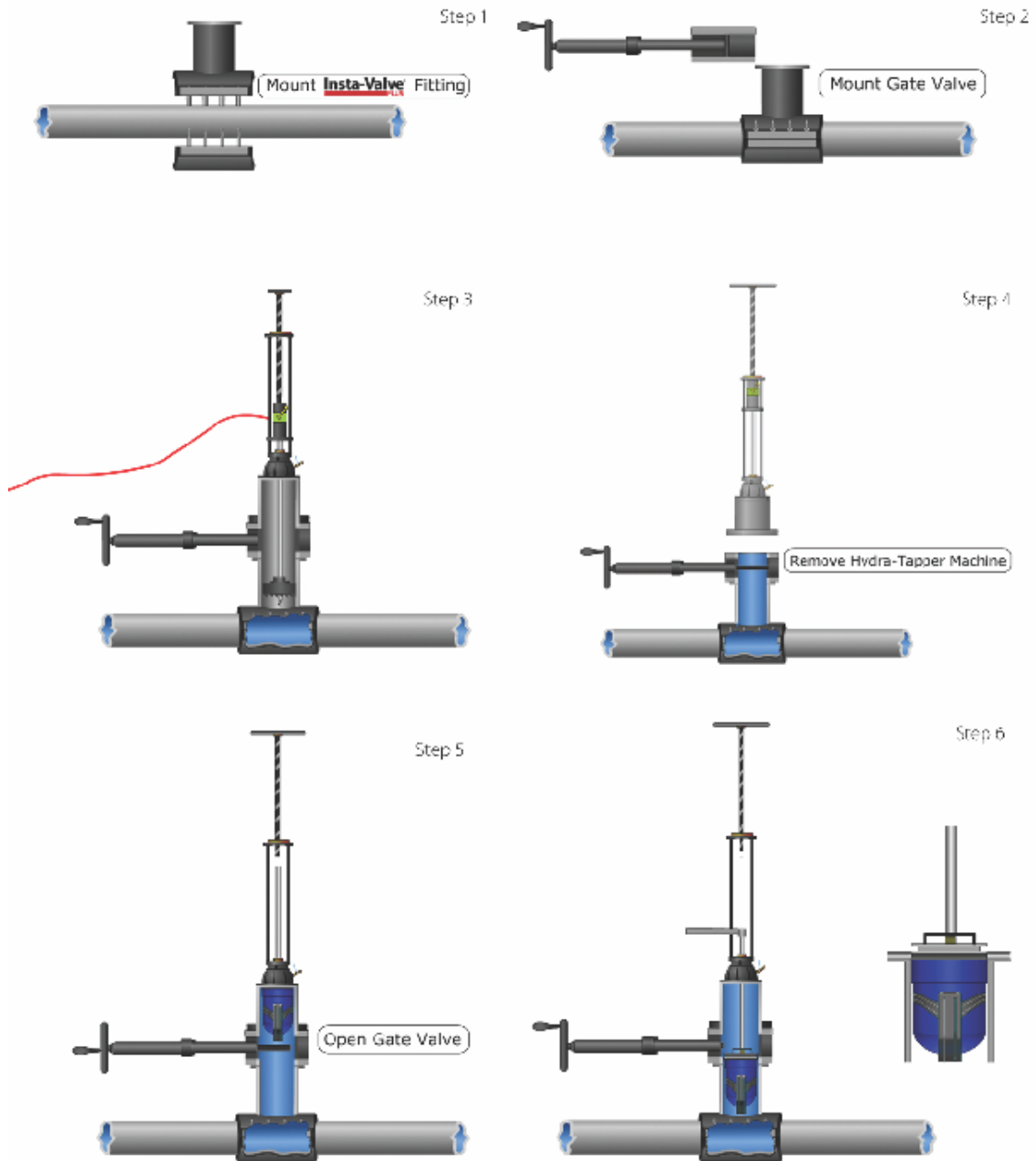


Exhibit B page 2 of 2

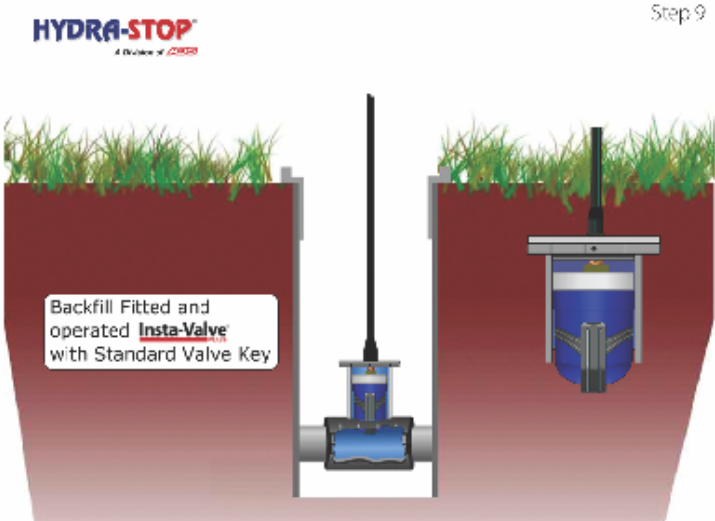
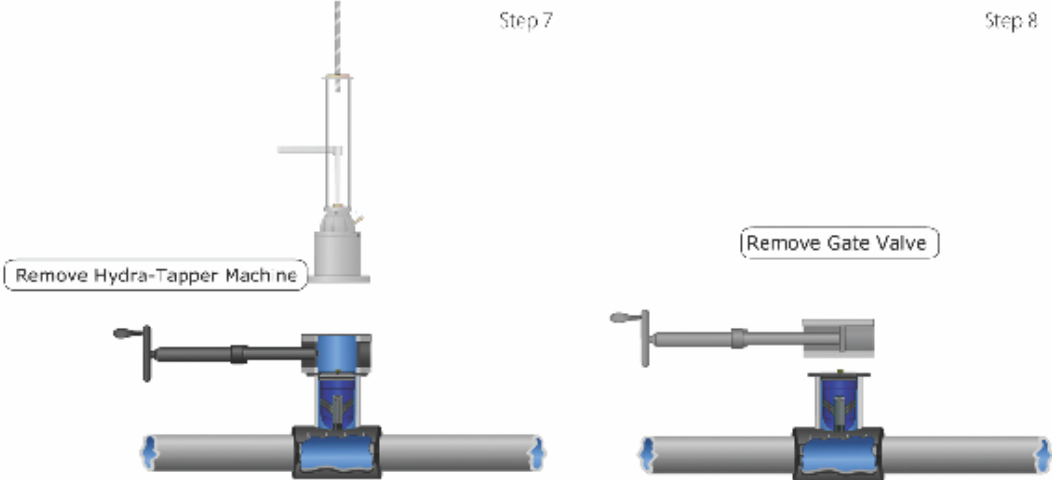


Exhibit 4: Sales Literature for Insta-Valve Plus (two pages).

HARDWARE

Insta-Valve[®]

PLUS

Insta-Valve Plus[®], the easy-to-install, easy-to-use insertable valve, gives professionals unprecedented control of their distribution systems. Imagine inserting valves wherever you need them, in a fraction of the time it used to take, without disrupting service. Take control with Insta-Valve Plus. It has never been easier.

Hydra-Stop Insertable ValvePatent # 6,810,903

The Insta-Valve Plus from Hydra-Stop[®] is a resilient seat wedge valve that uses bullet stopper technology to stop flow in all types of pipe and can be installed under pressure, up to 100 psi. The Insta-Valve Plus exceeds industry standards and provides a safer, more economical way of inserting valves in your system. The Insta-Valve Plus is easy to use and even easier to install. They install in half the time, without service disruption, providing immediate system control with only one cut.

The new Plus design includes the industry standard bronze stem collar and a heavy duty valve stem for the strongest of valve operators. Insta-Valve Plus stops flow in all types of pipe 4" to 12" including potable water mains, wastewater force and gravity mains, and industrial applications. It can be installed using existing Hydra-Stop equipment or as a stand alone system.

The sealing surfaces of the new Plus design have been completely re-engineered from the previous 360° vulcanized sealing surface. The new design consists of a compression molded hyperbolic parabola seating surface joined to the radial axis sealing area that optimizes the seal at both the pipe and the coupon removed location. Also important is the addition of a new centering plate for improved positioning control.

Insta-Valve Plus Features

Insta-Valve Plus provides:

- Constant flow
- Peace of mind
- System control
- Immediate results
- Value added options
- Clean drinking water
- Safe working conditions
- A water conservation measure
- Employee efficiency, reducing employee overtime

Insta-Valve Plus eliminates:

- Boil orders
- Complicated planning
- Loss of fire protection
- Large street excavations and street patches
- Working in unsafe trenching and knee-high mud
- Reaming the pipe wall or completely severing the pipe
- Not having isolation zones in the event of contamination



Insta-Valve Plus can be installed with your existing Hydra-Stop equipment or as a stand alone system. Easy installation makes the Insta-Valve Plus a versatile part of the Hydra-Stop System.

About HYDRA-STOP[®]

Hydra-Stop is the world's only manufacturer of pipe maintenance equipment designed to allow you to perform line stopping, valve insertion, and line tapping with its integrated and expandable Hydra-Stop System. Hydra-Stop provides planned and emergency contract services for municipal, industrial, and gas applications.

Insta-Valve Applications

- Potable water mains
- Wastewater force mains
- Industrial

Insta-Valve Plus is not guaranteed to provide 100% shutdown. Insta-Valve Plus will provide a workable shutdown for pipeline maintenance, often achieving 100%.

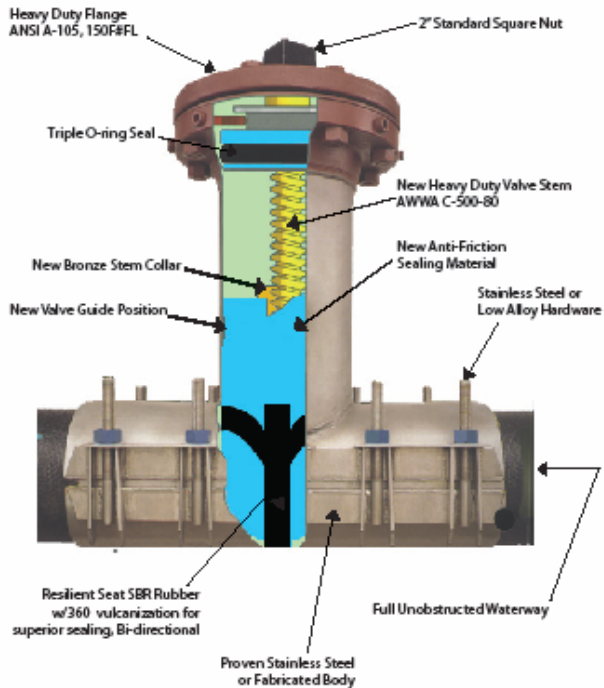
HYDRA-STOP[®]

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HARDWARE

Hydra-Stop's Insta-Valve Plus provides a means to install a permanent block (open-close) valve into a pressurized water main with no interruption of flow through the pipe and no reduction of line pressure (up to 100 psi). The insertion of an Insta-Valve Plus is accomplished through a single circular whole cut (under full line pressure) into the top of the pipe with no reaming. The Insta-Valve Plus, itself, permanently remains in the water distribution piping to allow shutdowns in the same manner as any gate valve which would have been originally installed with the water main.



Insta-Valve Plus is now available with a weld-on nipple and full encirclement in sizes 4" thru 12" and can be used on:

- Steel
- Cast iron
- Ductile iron
- Asbestos cement
- PVC
- PE

Custom sizes available on request.

Insta-Valve Plus Specifications

Insta-Valve Plus can be installed using existing Hydra-Stop equipment or as a stand-alone system. The high quality Insta-Valve Plus meets or exceeds industry standards for years of trouble-free service.

Insta-Valve Plus Insertable Valves

| Part Numbers | Size |
|--------------|------------|
| IV A 04.00 | 4in/100mm |
| IV A 06.00 | 6in/150mm |
| IV A 08.00 | 8in/200mm |
| IV A 10.00 | 10in/250mm |
| IV A 12.00 | 12in/300mm |

All sizes are approximate. Custom sizes available on request.

The Hydra-Stop Insta-Valve Plus includes:

1. Standard valve nut
2. Valve body made of 304 stainless steel
3. Valve gate made of SBR rubber
4. Valve stem made to AWWA C-500-93 Section 3.12 specifications
5. ANSI A-105, 150 lbs. rated flange
6. Available in:
 - Weld On - Nozzle or Split Tee
 - Clamp On - Standard or Extra Heavy

HYDRA-STOP®

A Division of ADS LLC - A Nova Technologies Company

11700 S. Cicero Avenue, Alsip, IL 60803
 Phone: 708-389-5111 / Fax: 708-389-5125
 Toll Free: 1-800-538-7867

Ask for our cost comparison sheet and visit us on the Web at www.Hydra-Stop.com

Specifications subject to change without notice.

Exhibit 5: Cost comparison for utility shutdown versus uninterrupted valve insertion of 12-inch Insta-Valve Plus, Occlude and Romac (competitors)

Cost Comparison - Shutdown vs. Uninterrupted valve insertion

| Description | Shutdown | | | Total | Insta-Valve Plus | | | Occlude | Romac |
|--|----------------|--------|------------|-------|------------------|---------|------------|---------------------------|-------|
| | Employees | Hours | \$ dollars | | Employees | Hours | \$ dollars | | |
| | of | | | | of | | | | |
| Reading Maps | 2 | 4 | 17 | 136 | | | 0 | 0 | 0 |
| Locate Valves | 6 | 12 | 17 | 1224 | | | 0 | 0 | 0 |
| Turn Valves | 6 | 24 | 17 | 2448 | | | 0 | 0 | 0 |
| Day | | | | 0 | | | 0 | 0 | 0 |
| Night | | | | 0 | | | 0 | 0 | 0 |
| Weekend | | | | 0 | | | 0 | 0 | 0 |
| Advertise the Shutdown | | | | 0 | | | 0 | 0 | 0 |
| Door - to - Door | 2 | 4 | 17 | 136 | | | 0 | 0 | 0 |
| Newspaper | | | | 75 | | | 0 | 0 | 0 |
| Telephone | 1 | 4 | 13 | 52 | | | 0 | 0 | 0 |
| Postcard mailing | 1 | 2 | 13 | 26 | | | 0 | 0 | 0 |
| Radio/Television | | | | 250 | | | 0 | 0 | 0 |
| Actually do Shutdown | | | | 0 | | | 0 | 0 | 0 |
| Find out one or more valves don't work | high risk | | | | no worries | | | | |
| Back to Maps | 6 | 2 | 17 | 204 | | | 0 | 0 | 0 |
| Locate Valves | 6 | 2 | 17 | 204 | | | 0 | 0 | 0 |
| Turn Valves | 6 | 4 | 17 | 408 | | | 0 | 0 | 0 |
| High line water lines to clients | 6 | 2 | 17 | 204 | | | 0 | 0 | 0 |
| Person to answer inquiries | 1 | 2 | 13 | 26 | | | 0 | 0 | 0 |
| Overtime | | | | 0 | | | 0 | 0 | 0 |
| Nights | 6 | 2 | 17 | 204 | | | 0 | 0 | 0 |
| Weekend | | | | 0 | | | 0 | 0 | 0 |
| Fire truck standby | | | | 250 | | | 0 | 0 | 0 |
| Contractor support | 2 | 60 | 8 | 960 | | | 0 | 0 | 0 |
| Increased Liability Fire Insurance | | | | 1000 | | | 0 | 0 | 0 |
| Backflow problems | | | | 0 | | | 0 | 0 | 0 |
| Burned up water heaters | 2 | 2 | 17 | 68 | | | 0 | 0 | 0 |
| System contamination | Very high risk | | | | No risk | | 0 | 0 | 0 |
| Regulation & Compliance Rulers | | | | 0 | | | 0 | 0 | 0 |
| Issuing of Boil orders | Very high risk | | | | No risk | | 0 | 0 | 0 |
| Sampling | 2 | 4 | 17 | 136 | | | 0 | 0 | 0 |
| Lab Costs | | | | 250 | | | 0 | 0 | 0 |
| Customer Notification | | | | 0 | | | 0 | 0 | 0 |
| Media Fallout | | | | 0 | | | 0 | 0 | 0 |
| Rechlorination | 2 | 4 | 17 | 136 | | | 0 | 0 | 0 |
| Sediment Loosening in line | | | | 0 | | | 0 | 0 | 0 |
| Water meter fouling | 2 | 8 | 17 | 272 | | | 0 | 0 | 0 |
| Backflow preventer fouling | 2 | 8 | 17 | 272 | | | 0 | 0 | 0 |
| Ruined laundry | | | | 0 | | | 0 | 0 | 0 |
| Loss of Treated Water | | | | 0 | | | 0 | 0 | 0 |
| Gallons lost during shutdown | | | | 250 | | | 0 | 0 | 0 |
| Gallons lost during purging | | | | 150 | | | 0 | 0 | 0 |
| Loss of Water Revenue | | | | 600 | | | 0 | 0 | 0 |
| Complaints | | | | 0 | | | 0 | 0 | 0 |
| Person to answer calls | | | | 0 | | | 0 | 0 | 0 |
| Bad Public relations | Very high risk | | | | No risk | | 0 | 0 | 0 |
| Site Restoration (Hard Surface) | | | | 2700 | | | 750 | | 750 |
| Night lighting | | | | 50 | | | 0 | | 0 |
| Materials for 12" Valve | | | | 1450 | | | 4500 | | 5600 |
| Vehicles | 3 | 4 days | Fuel | 180 | 1 | 1 day | Fuel | 60 | 60 |
| Excavating Equipment | 1 | 3 days | Fuel | 120 | 1 | 1/2 day | Fuel | 40 | 40 |
| Labor to install | 6 | 8 | 17 | 816 | 2 | 4 | 17 | 136 | 136 |
| Totals | Shutdown | | | 15257 | Insta-Valve Plus | | 5486 | Occlude 12" not available | 6586 |

Exhibit 6: Photographs of Insta-Valve Plus installation (two pages).



EXHIBIT G - Orange Cove, CA
(113 Insta-Valve Pluses Installed)



Exhibit 7: Definitions of CNC, ERP and BOM

ERP (Enterprise Resource Planning) is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. ERP can also include application modules for the finance and human resources aspects of a business. Typically, an ERP system uses, or is integrated with, a relational database system. The deployment of an ERP system can involve considerable business process analysis, employee retraining and new work procedures.

CNC (Computer Numerical Control) refers specifically to a computer “controller” that reads code instructions and drives the machine tool, a powered mechanical device typically used to fabricate metal components by the selective removal of metal. CNC does numerically directed interpolation of a cutting tool in the work envelope of a machine. The operating parameters of the CNC can be altered via a software load program.

BOM (Bill of Materials) is the term used to describe the “parts list” of components needed to complete a sellable end-item. BOMs are hierarchical in nature with the top level representing the sub-assembly or end-item. For example the end-item BOM for a personal computer would list the computer, its major sub-assemblies (power supply, mother board, chassis, modem, keyboard, display, etc.) as well as additional materials needed for a complete sellable product—shipping box, user manual, packaging, packaging labels, etc.