ULTRA HIGH PRESSURE SERVICES

- Surface Preparation
- Wet Abrasive Cutting

Member

W J T A

Water Jet Technology Association
SURFACE PREPARATION

With the growing concern over changing environmental regulations and increasing waste disposal costs, every avenue should be explored to reduce waste generated by surface preparation techniques. On that basis, we have dedicated our efforts to developing and using the latest technology available for removing existing coatings from steel and concrete structures. The use of Ultra High Pressure (UHP) waterjets provides many advantages in a wide variety of applications. The advantages of this method are discussed later in this text.

Description of UHP Technology

Ultra High Pressure surface preparation uses waterjets at pressures up to 40,000 PSI and flow rates of up to 10 GPM to remove coatings, hard deposits and rust scale which are tightly adhered to the base metal. The high velocity waterjets strike the surface to be cleaned in much the same manner as small solid particles, shearing away unwanted materials from the surface.

Our high pressure pumps and variety of rotating tools give great flexibility in the types of applications for which ultra high pressure water can be used. This equipment has been greatly improved in the last 5 years and is now an economically feasible alternative in many cleaning applications.
Cam-Quip Limited uses an internally compensated, positive displacement pump capable of 40,000 PSI discharge pressure. Because it is a direct drive mechanical pump, its efficiency is above 90%. The internal pressure compensation allows us to run multiple surface preparation tools from one pumping unit with no loss in effectiveness. These advantages allow us to get higher productivity with less equipment on the job site.

Diesel Eagle (45,000psi unit) & Diesel Husky (40,000psi unit)

As with all high pressure pumping systems, this equipment requires proper maintenance and care. It is highly dependent on proper operator training to keep downtime to a minimum. Due to the precise nature of replacement parts, the operating costs are also very dependent on operator training.

Method of Cleaning

Cam-Quip can supply both handheld rotating UHP surface preparation tools and automated systems to remove the existing coatings. The handheld Jetlance can be used to remove coatings from areas that are not efficiently cleaned by automated equipment. The nozzle on this tool rotates at 4,800 RPM with very little reactive thrust in tight areas. This reduced reactive thrust (approximately 5-20 lbs.) greatly increases the safety of the employee when working on elevated structures or in confined spaces.

Cam-Quip has obtained a number of versatile tools that can be adapted to individual cleaning problems. The length of these tools is variable as is the rotation speed. Semi-
automated equipment can also be used to increase productivity on certain types of projects. These tools provide dry shutoff which further reduces water at the jobsite.

UHP Surface Preparation for BP

UHP Surface Preparation at Mariners Haven
Surface Appearance after Cleaning

This method of surface preparation has been recognized by many of the technical societies that provide specifications to the painting industry. In 1995 SSPC and NACE issued the first joint written standard in the history of both organizations for UHP waterjetting. NACE No. 5 and SSPC-SP12 were issued to give some consistency to inspection techniques. SSPC-SP12 definition: Cleaning performed at pressure above 25,000 psi. Cam-Quip uses 40,000 psi waterjets for optimum performance and production rates.

Coatings manufacturers have also seen many benefits to this technology. Because these companies have recognized it as a valuable alternative that provides good coating life when properly used and matched with appropriate coatings they have issued their own standards. Jotun, International Paint, Hempel, and others have published standards for their products.

This method of surface preparation will give a high cleanliness level as referenced in the above specifications. The visual appearance may be different because there is no deformation of the surface as occurs with abrasive blasting. The visual appearance will be a dark gray matte finish. See NACE/SSPC proposed specifications for UHP work.

Surface contamination
It is generally accepted that UHP technology does a better job of removing soluble contaminants than most abrasive systems. Ultra high pressure does not distort or abrade
the metal surface and therefore does not give the white metal appearance. Also, UHP does not trap iron oxide or contaminants in the metal folds. Contamination in the metal folds has proven detrimental and can cause spot failures of the coatings that result in blistering. Support documents are available upon request.

We recommend a surface cleanliness as specified in SSPC SP-12 SC-2. A SC-2 surface shall have less than 7 ug/cm² chloride contaminants, less than 10 ug/cm² of soluble ferrous ion levels, and less than 17 ug/cm² of sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test equipment.

Cam-Quip uses a Bresele test kit to determine the level of contaminants that remain on the surface prior to coating application.

**Abrasive Blasted Fuzzy Interface**  **UHP Water jetting provides a clean interface**

UHP cleans deep into pits

Powertool cleaned areas
Advantages of this Cleaning Method

There are many advantages to using this technology in an industrial environment. The most obvious advantages are environmental. There are no airborne contaminants that can cause problems with the surrounding environment, sensitive equipment operating nearby or other contractors in the area. This method also limits the amount of waste that has to be collected and disposed. The only waste generated is from the previous coating as it is removed, which can be contained and disposed of in drums. These disposal costs are sometimes hidden from the customer, but should greatly reduce the overall costs of the job.

Since there is no dust contamination, maintenance work in adjacent areas should not be hampered. Surface preparation work can be done in close quarters while mechanical work continues. Also, there is no risk of spark with UHP technology, as with abrasive blasting, therefore there is no hot work permit required. Abrasive blasting presents a risk of spark, and may become hazardous in certain areas such as refineries and offshore installations.

Less support is needed with UHP cleaning since no abrasives have to be lifted to the job site and then removed as spent abrasive. By eliminating the onsite storage of this abrasive and the possible structural loading of equipment, staging or buildings caused by spent abrasive a safer worksite exists. Using UHP technology also eliminates the need for storage of the abrasive and significantly reduces cleanup requirements and environmental liability.

UHP Surface preparation on Petrotrin Launch
UHP technology offers a much cleaner surface in less time than mechanical cleaning methods. This allows a better surface preparation job and hence a better coating application, while sticking to tight schedules.

UHP technology also reduces the need for complicated containment procedures that are required with abrasive cleaning. This eliminates expensive containment rig-up and reduces the possibility of waste escaping to the environment. Eliminating this vertical containment for exterior work also eliminates the strain of this containment on the structure of the building and reduces set up time.
Conclusions

Historically, surface preparation work has been considered a commodity service and little attention has been paid to it in the overall coating program. Research by SSPC, NACE, and some coatings manufacturers has proven that surface preparation is an important part of successful coatings life. This work has usually been awarded on the lowest cost per square foot basis with little or no regard to the downstream costs of disposal, environmental impact, or coating rework.

Many are turning to new technology to comply with regulations and still remain competitive. The quicker these alternative technologies are developed, improved and implemented, the quicker our industry will be perceived as being environmentally concerned. When all cost factors are considered, UHP technology is a competitive alternative for Industrial and Marine work.

Cam-Quip Ltd. has been providing turnkey surface preparation technology for over 3 years. We have completed many projects and have proven that this is a viable and cost effective service.
Visual Surface Preparation Definitions

Listed below are definitions for standards of surface finish, comparing Water Jetting terms (WJ-1, WJ-2, WJ-3 and WJ-4) with Abrasive Blasting terms (White metal, Near-white metal, Commercial, and Brush-off). Note that all Water Jetting terms fall under Nace No. 5 SSPC-SP-12 (Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating).

**WJ-1:** A WJ-1 surface shall be free of all previously existing visible rust, coatings, mill scale, and foreign matter and have a matte metal finish.

**WHITE METAL (SSPC-SP5, Nace No.1, SA-3):** A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter.

**WJ-2:** A WJ-2 surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previously existing residues and the remaining 5% containing only randomly dispersed stains of rust, coatings, and foreign matter.

**NEAR-WHITE METAL (SSPC-SP10, Nace No.2, SA-2.5):** A Near-White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and any other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks or minor discolorations caused by stains of rust, stains of mill scale or stains of previously applied paint.

**WJ-3:** A WJ-3 surface shall be cleaned to a matte finish with at least two-thirds of the surface free of all visible residues (except mill scale), and the remaining one-third containing only randomly dispersed stains of previously existing rust, coatings, and foreign matter.

**COMMERCIAL (SSPC-SP6, Nace No.3, SA-2):** A commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks or minor discolorations caused by stains of rust, stains of mill scale or stains of previously applied paint. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.

**WJ-4:** A WJ-4 surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.
BRUSH-OFF (SSPC-SP7, Nace No.4, SA-1): A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust and loose paint. Tightly adherent mill scale, rust and paint may remain on the surface. Mill scale, rust and paint are considered tightly adherent if they cannot be removed.

Nonvisual Surface Preparation Definitions

**SC-1:** An SC-1 surface shall be free of all detectable levels of contaminants as determined using available field test equipment with sensitivity approximating laboratory test equipment. For purposes of this standard, contaminants are water-soluble chlorides, iron-soluble salts, and sulfates.

**SC-2:** An SC-2 surface shall have less than 7 µg/cm² chloride contaminants, less than 10 µg/cm² of soluble ferrous ion levels, and less than 17 µg/cm² of sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test equipment.

**SC-3:** An SC-3 surface shall have less than 50 µg/cm² chloride and sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test equipment.
WET ABRASIVE CUTTING

Wet abrasive cutting systems can solve a variety of commonly encountered industrial tank and pipe cutting issues. It can be very expensive to completely shut down and evacuate all personnel and potentially flammable substances in order to clean or rehab pipes or tanks, so conventional torch cutting becomes not only expensive but very dangerous. Wet Abrasive Cutting Systems is a lot cooler and safer because it generates a minimal amount of spark and heat.

Description of Equipment

Our Cutting Equipment comprises of 40,000 psi. ultra high pressure pumps, an abrasive hopper, and a Super-Flex rail and carriage system which consists of an all position positive rack and pinion drive unit mounted on a Super-Flex rail. The rail conforms to any shape with a radius of 24” (600mm) or larger and is easily mounted directly on the workpiece. The Super-Flex rail can be used on compound curvatures and can be twisted 10º per 24” (600mm) of length. Powerful permanent magnets or vacuum cups clamp the rail onto the work surface, fixture or jig. Super-Flex rails can be bolted together for unlimited lengths. Super-Flex rails are made of stainless steel for long life and rugged durability. Several sections of rail, bolted together can be used for wide range of diameters, shapes and sizes.

Purpose of Garnet (abrasive)
Garnet is inducted into the UHP water stream which accelerates the particles to approximately 2400 ft/sec. The cut is relatively small with very smooth surfaces. This provides a low heat cut that can be used when there are concerns about combustible materials in the area such as process equipment, tank doorsheets, heat exchanger shells, etc. The abrasive hopper used for the storing and feeding the garnet, includes the necessary metering devices, abrasive hose and controls.