

SAFETY AND HEALTH STANDARDS HIGH PRESSURE WASHING/CUTTING (> 3000 PSI)

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Introduction:

This standard outlines the minimum requirements for managing the risks associated with high pressure water cleaning (or cutting) activities and applies to all Rio Tinto Kennecott Copper (RTKC) managed operations and projects, suppliers and contractors.

High pressure water cleaning is a process of using a stream of pressurized water to remove material, coatings or contamination and debris from the surface or substrate material where the output capacity of the water jetting system exceeds 200 bar (> 3000 psi). High-pressure water cleaning can involve manually held and robotic high-pressure water cleaning systems. High-pressure water can also be used as a method for cutting materials as an alternative to other cutting methods.

There are two categories of water jetting systems, based on output capacity:

- Class A** systems refer to water jetting systems with an output capacity between 200 bar (3,001 psi) and 2,000 bar (30,000 psi).
- Class B** systems are water jetting systems with an output capacity greater than 2,000 bar (>30,000 psi).

Key terms:

The following key terms are found throughout this standard.

Competent person means a person who has acquired through training, qualification or experience the knowledge and skills to carry out the task.

High pressure water cleaning/cutting system means a water delivery system consisting of an energy source, for example electric motor or internal combustion engine, pump, control mechanism, hoses and pipes, nozzles and various other attachments and components necessary for the equipment to function as a system. The function of the system is to increase the velocity of the liquids at the point of application. Solid particles or extra chemicals may also be introduced but the exit in all cases will be a free stream.

Hose assembly means a hose with couplings or end fittings attached in accordance with the hose manufacturer's recommendations.

Nozzle means a device with one or more openings where the fluid discharges from the system. The nozzle restricts the area of flow of the fluid accelerating the water to the required velocity and shaping it to the required flow pattern and distribution for a particular use. Combinations of forward and backward nozzles are often used to balance the thrust.

Relief valve means a valve which automatically opens to discharge fluid to relieve pressure.

Safety observer means a member of the work team assigned with the following tasks:

- Observing the jetting operations and barricaded area;
- Shutting down the system in an emergency or if the system malfunctions;

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- Controlling or communicating to the controlling operator the system pressure as requested by the jetting operator; and
- Controlling access of people into the safety zone.

High-pressure cutting includes equipment that is normally fully enclosed and protects the high-pressure cutting fluid (normally water) from escaping the enclosure. Although this standard covers high-pressure washing, cutting operations using fully enclosed pressure systems should be handled via pre-task risk assessments to best determine personnel placement, PPE protection, barricade placement, and any other applicable critical control management options.

Control Requirements:

1. Planning

- 1.1 Where high pressure water cleaning activities are to be completed by contractors, the requirements of this protocol must be clearly identified within the scope of services and must be explicitly stated in any general terms and conditions of the contract.
- 1.2 The use of robotic/remote controlled high pressure cleaning systems is preferred.
- 1.3 A pre-task hazard assessment that addresses the specific hazards of the task must be completed before commencing any high-pressure water cleaning operations.
- 1.4 All hazards identified in the risk assessment process must have appropriate controls in place to reduce the risk to as low as reasonably practicable.
- 1.5 There must be a process to ensure that control measures remain in place and are effective.
- 1.6 For each high pressure cleaning operation there must be:
 - a) A safety observer;
 - b) A supervisor; and
 - c) Nozzle operators
- 1.7 There must be a specific pre-start inspection checklist for all high-pressure water cleaning units.
- 1.8 The pre-start inspection must be completed prior to the equipment being used each shift.
- 1.9 Checklists used for pre-start inspections must be:
 - a) Specific to the class of high pressure water cleaning being performed (**Class A or B**);
 - b) Based on the risks associated with the type of work being performed; and
 - c) Reviewed and approved by a competent person prior to the commencement of work.
- 1.10 There must be an agreed communication method to be used by the work team.
- 1.11 Where there are two or more high-pressure water cleaning units in use, there must be documented evidence of pre-task workflow planning.
- 1.12 The pre-task workflow plan must be completed and agreed with the work team.
- 1.13 In addition to the requirements above, manually operated **Class B** systems must:
 - a) Only be used as a last resort;
 - b) Include a documented risk assessment, and
 - c) Have the written approval of the relevant area manager before commencing the task.

2. Training and competency

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2.1 Operations (or contractors) that conduct high-pressure water cleaning/cutting activities must have a training program that addresses the following elements:

- a) Hazards and risks associated with high-pressure water cleaning including water injection;
- b) Cutting action and hazards;
- c) Safe system operation referencing manufacturer's instructions;
- d) Inspection and maintenance;
- e) Identifying and connecting hoses; and
- f) Personal protective equipment

2.2 Operators of high pressure water cleaning equipment must complete the training and be assessed as competent in the proper operation of the equipment before performing work.

2.3 Other personnel involved in high-pressure water cleaning work must receive hazard training relevant to their risk of exposure prior to commencing the task.

2.4 First aid and rescue personnel must be familiar with the risks associated with high-pressure fluids and how to respond to an incident where high-pressure fluid injection is suspected.

2.5 In addition to the training requirements above, persons operating **Class B** equipment must:

- a) Have completed a training course applicable to the operation of high pressure equipment, and
- b) Hold a relevant competency for the specific piece of equipment they use.

3. PPE Requirements

3.1 The following minimum PPE must be used for operators of **Class A** equipment:

- a) Leg, body, and forearm protection (e.g. Kevlar or equivalent)
- b) Hard hat;
- c) Face shield;
- d) Safety glasses with side shield;
- e) Waterproof steel-capped boots;
- f) Water-resistant gloves; and
- g) Metatarsal guard and appropriate shin protection

3.2 In addition to the requirements above, the minimum PPE must address:

- a) The manufacturer's operating instructions;
- b) The type of activities being performed;
- c) Equipment identified in the pre task hazard assessment;
- d) The use of high visibility waterproof jacket and pants where two or more persons are operating high pressure water cleaning equipment in close proximity; and

4. Equipment standards

4.1 All high-pressure water cleaning devices must be fitted with a fast acting self-actuating, hold-to-activate shutoff device, which is controlled, by the nozzle operator, and a secondary method of shutting down the system at the pump.

4.2 The point where the hose attaches to a hand or foot controlled device must:

- a) Be protected by an over-sheath shroud manufactured from materials capable of withstanding the direct force of the water jet; and

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- b) Must also be protected by a braided stocking that will stop the hose from whipping if the hose separates or the end fails.
- 4.3 The high-pressure cleaning gun must be fitted with either a dump system or dry shutoff control valve.
- 4.4 The length of the gun 'barrel' must be such that the nozzle strikes the ground before the operator can inadvertently direct it onto their feet or legs.
- 4.5 Where guns with shorter barrels are required:
 - a) The use of short barrel guns must be noted in the risk assessment,
 - b) Foot and leg protection must be used;
 - c) Dual hold-to-activate devices on the gun must be used; and
 - d) The use of the short barrel gun must be approved by the Rio Tinto area manager
- 4.6 Guns, foot controls, hoses, nozzles and fittings must be rated for pressures greater than or equal to the maximum operating pressure of the high pressure pump.
- 4.7 Wherever practicable the pressure rating of guns, foot controls, hoses, nozzles and fittings must be marked on all equipment.
- 4.8 A safety relief device must be in place on all high-pressure water cleaning systems.
- 4.9 The outlet of the pump must be fitted with a pressure gauge to allow verification of maximum system pressure.
- 4.10 High pressure water cleaning systems must be fitted with a permanently mounted nameplate, which provides the following information:
 - a) Manufacturer's name or mark;
 - b) Model designation, serial number and year of manufacture;
 - c) Maximum volume and pressure performance;
 - d) Maximum input speed; and
 - e) Maximum operating pressure
- 4.11 Maintenance of high-pressure water cleaning systems must be performed in accordance with the manufacturer's recommendations and by trained and competent personnel.
- 4.12 Maintenance records must be kept for each major piece of equipment.
- 4.13 Defects identified in any high-pressure water cleaning system must be reported immediately to the supervisor so that the defect may be investigated and rectified or tagged out of service immediately.

5. Operations

- 5.1 The gun or nozzle operator must be in control of the primary stopping device.
- 5.2 When there is a situation where there is no line of sight between the nozzle operator and the pump operator, a second safety person that has line-of-sight to both must be used. The safety observer, when required, must have control of the emergency stop or relief device.
- 5.3 High pressure cleaning systems must not be left unattended while pressurized.
- 5.4 Objects to be cleaned by the high pressure water cleaner must never be manually held.
- 5.5 High pressure water cleaning operations must stop when:
 - a) Conditions change or new hazards are introduced or detected;
 - b) Unauthorized people enter the barricaded area;
 - c) Recommended safe work practices are not being followed;
 - d) A malfunction occurs;
 - e) An alarm is sounded in the plant or area; and

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- f) Any of the recommended risk assessment controls are not observed; or work practices are not followed.
- 5.6 Each worker within the work team must have a defined role, e.g. nozzle operator.
- 5.7 The area around a high-pressure water cleaning task must be suitably barricaded as per relevant site procedures.
- 5.8 The high-pressure water cleaning unit must be placed as close to the job as practicable to minimize the length of pressurized hose which has been unrolled.
- 5.9 The safety observer must:
- a) Be familiar with the agreed communication method;
 - b) Not start the equipment until told to do so;
 - c) ensure that each of the team members are in proper position to perform their tasks (at least 25 feet from the nozzle operator unless a risk assessment details alternate safe distance with additional controls i.e. additional PPE, hard barricades);
 - d) Ensure the nozzle is either directed at, or positioned within the workpiece before bringing the unit up to pressure;
 - e) Ensure that the nozzle operator has a secure stance and control of the nozzle;
 - f) Monitor the positions of the other team members while the system is in operation; and
 - g) Depressurize the system if any team member approaches a hazardous or potentially hazardous position
- 5.10 Pressure must be increased slowly while the system is being inspected for leaks and/or faulty components.
- 5.11 Apart from the normal adjusting of valves and other components required for standard high-pressure water cleaning operations, no attempt must be made to adjust or repair a component of a high-pressure water cleaning system while the system is under pressure.
- 5.12 Procedures must be established to:
- a) Ensure that no person enters the working area while high-pressure water cleaning is in progress;
 - b) Provide a brief orientation outlining the hazards, prior to entry into the work area; and
 - c) Ensure no pressure remains in the line or the gun after shutdown.

REVISION HISTORY:

MOC#	Description of Change	Prepared By	Date
58080	Creation of document	Angelo Kallas	6/14/19
67724	Updated to include the requirement to wear Kevlar type PPE, corrected pressure/volume parameters, and safety spotter	Angelo Kallas	10/6/20