

PETRONAS TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

**High Pressure and Ultra High Pressure
Water Jetting**

PTS
60.2101

April 2006



PREFACE

Petronas Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice. The objective is to set the recommended standard for good technical practice applied by PETRONAS in oil and gas production facilities, oil refinery, gas processing, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardisation.

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1.0 INTRODUCTION

This procedure covers safe work practices to protect employees in a place of work from the hazards of high pressure water jetting equipment and high pressure water jetting activity.

Water jetting has been recognised for many years as an environmentally friendly technique for cleaning and cutting.

Water jetting activity is a high risk activity and the consequence can be very serious and, in the worst case, can result in fatality.

The requirements in this procedure shall be applicable to all PETRONAS and PETRONAS Joint Ventures (JVs) plants and installations carrying out high pressure and ultra high pressure water jetting activities. In addition other existing procedures e.g. hazard identification, risk assessment and control and environmental procedure may apply.

2.0 SCOPE

This procedure applies to all High Pressure (HP) and Ultra High Pressure (UHP) Water Jetting as defined below.

It covers drain and sewer jetting, tube and bundle jetting, surface preparation and cleaning and high pressure abrasive cutting.

3.0 DEFINITIONS

3.1 High Pressure Water Jetting

The term High Pressure Water Jetting covers all water jetting processes including those using additives or abrasives where there is energy input to increase the pressure applied to water. A separate section is included to cover some of the additional operational requirements associated with abrasive jetting work (Section 13).

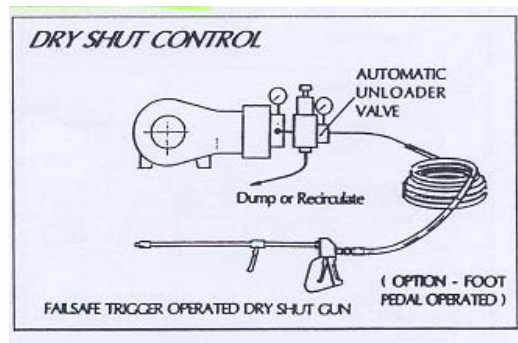
3.1.1 High Pressure Water Jetting (HP)

The term High Pressure Water Jetting (HP) will be taken to include all pressures up to 20,000 psi (1,400 barg).

3.1.2 Ultra High Pressure Water Jetting (UHP)

Equipment operating above 20,000 psi (1,400 barg) is referred to as Ultra High Pressure (UHP). Some of the additional requirements associated with UHP Jetting are described in Section 12.

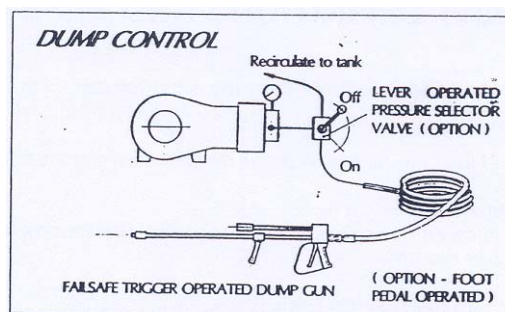
3.2 Dry Shut-Off Safety Control Valve



This operator controlled valve, normally hand controlled, automatically shuts off flow to the lance and/or nozzle assembly when released by the operator, but retains the operating pressure within the supply line when shut off. This valve shall be used only in systems with an Automatic Pressure Regulating Valve.

This valve may be actuated either by solenoid or pilot pressure mechanism.

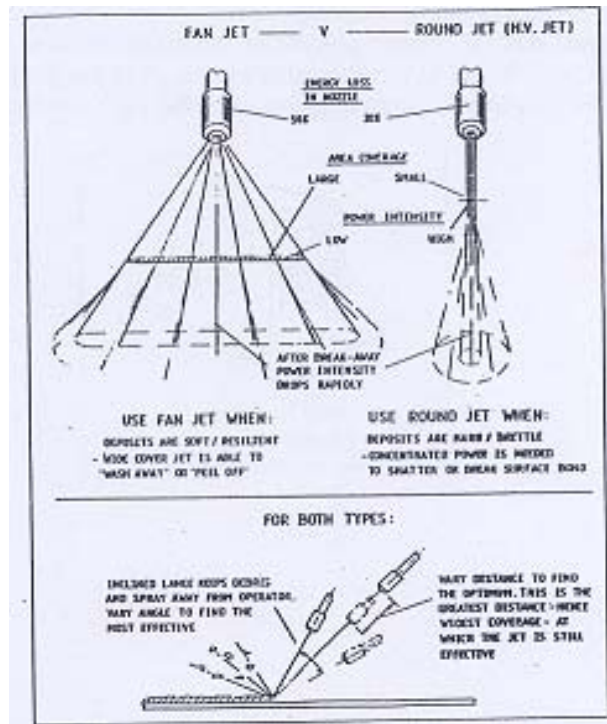
3.3 Dump Safety Control Valve



This operator controlled valve which may be hand or foot activated, automatically terminates significant flow to the lance and/or nozzle assembly when released by the operator. This relieves the operating pressure within the whole system by diverting the flow produced by the pump to atmosphere through an aperture or dump line. These must be of sufficient size to avoid the possibility of generating significant back-pressure at the maximum possible pumping rate of the pump/motor assembly. The dump line must be firmly secured.

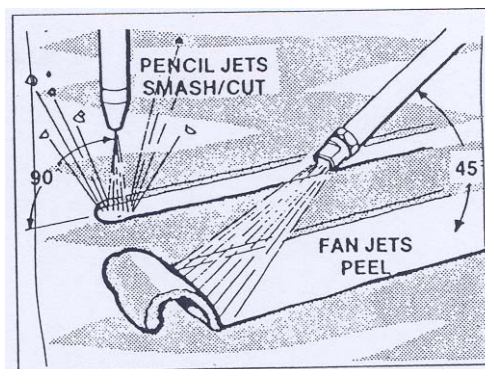
Alternatively this valve may be actuated either by solenoid or pilot mechanism.

3.4 Water Jet



A jet is the stream of water produced from the individual outlet of a nozzle. The shape of the jet is determined by the form of the nozzle orifice while the speed at which it travels is determined by the operating pressure and flow. The two most commonly used jet shapes are the 'straight or round' jet and the 'fan' shaped jet.

3.5 Straight Jet

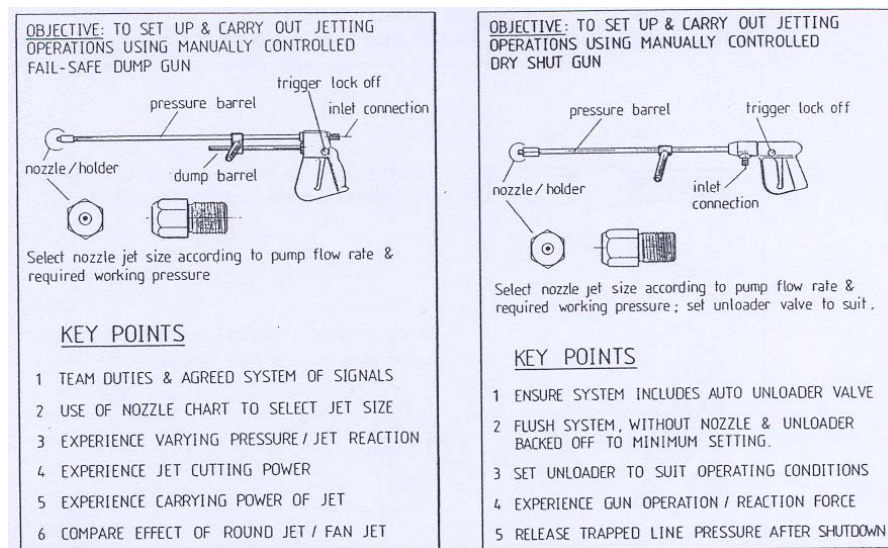


Sometimes called a pin jet, round jet or pencil jet, this concentrates the stream of water over a small circular work area by minimising the spread.

3.6 Fan Jet

This spreads the stream of water in one plane so giving a wide band coverage of the work piece.

3.7 Jetting Gun



A portable combination of a hand grip, control valve, barrel or adapted lance and nozzle, resembling a gun in layout and outline.

The control valve is hand operated, (dry shut-off or dump type) or remotely controlled, the gun being named accordingly. The hand control normally takes the form of a trigger or lever, which is provided with a guard adequate to prevent accidental operation and which shall have the means of being immobilised in the "off" position using a safety catch. The gun may be fitted with a shoulder pad or hand grips to facilitate reaction force control.

3.8 Drains and Sewer

Sewer and drains can be of the following types:

Foul (carries domestic and/or industrial waste only)

Storm (carries surface or rain water only)

Combined (a system carrying both foul and storm flows)

3.9 Job Safety Analysis/Job Hazard Analysis

A method to identify hazard and use it to help operate a safe system of work and formulate safe work procedures.

4.0 REFERENCE

Code of Practice For The Safe Working and Use of Water Jetting in Drains and Sewers, UK, **2000**

Code of Practice For The Use of High Pressure and Ultra High Pressure Water Jetting Equipment, UK, **2002**

Recommended Practices For The Use Of Manually Operated High Pressure Waterjetting Equipment, WaterJet Technology Association (WJTA) 2002

Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety))**1986**

Code of Practice For Safe Working In a Confined Space. JKPP COP(I/BM) 02/2001

5.0 REGULATORY REQUIREMENTS

5.1 MALAYSIA

Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety))1986

- PART XVI HAND AND POWER TOOLS

Occupational Safety and Health Act, 1994

- PART IV GENERAL DUTIES OF EMPLOYERS AND SELF-EMPLOYED PERSONS

5.2 INTERNATIONAL OPERATIONS

Refer to respective country's legislation.

6.0 ROLES AND RESPONSIBILITIES

6.1 Supervisor (Company or Contractor)

The Supervisor is responsible for supervising the work of the team which also includes assessing the nature of work and its associated hazards. He shall ensure that the work has a thorough Job Method Statement (JMS) and JSA/JHA resulting in a safe system of work.

He is also responsible to ensure that the scope of work is correctly identified on the permit-to-work and control measures for identified hazards are in place.

He has to ensure only trained, competent and/or qualified operators conduct the HP water jetting activities

6.2 Team Leader/Foreman (Contractor)

The Team Leader/Foreman shall be responsible for:

- i. Completing all the operational checks detailed in the Daily Checklist (refer Appendix I)
- ii. Conducting a tool box talk prior to starting the work.
- iii. Ensuring compliance with any requirements of the Permit-to-work or other site specific documentation.
- iv. Ensuring that all team members clearly understand the means of communication and any signals to be used.
- v. Ensuring that operators are rotated in their duties to minimise fatigue.

7.0 OPERATIONAL PROCEDURE

The recommended team composition of any HPWJ activity under the following situations should be as follows:

Situation/Equipment in use	Team numbers/duties
Jetting Gun with conventional or rotary nozzle.	Jetting Gun (Lead) Operator (1) Machine Operator/Safety Watcher (1)
As above but with Jetting Gun Operator (Lead Operator) out of sight of Machine Operator.	Jetting Gun (Lead) Operator (1) Machine Operator (1) Safety Watcher (1)
Manually Controlled Flexible Lance.	Flexible Lance (Lead) Operator (1) Additional Operator (1) Machine Operator/Safety Watcher (1)
As above with Lead Operator out of sight of the Machine Operator	Flexible Lance (Lead) Operator (1) Additional Operator (1) Machine Operator (1) Safety Watcher (1)
Manually Controlled Rigid Stainless Steel Lance	Rigid Lance (Lead) Operator (1) Machine Operator/Safety Watcher (1) Additional operators (as required)
As above with Rigid Lance Operator out of sight of Machine Operator	Rigid Lance (Lead) Operator (1) Machine Operator (1) Safety Watcher (1) Additional Operators (as required)

In some circumstance an additional Foot Control Valve Operator may be required.

7.1 Lead Operator