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GP 10-45

Working with Pressure

Group Practice

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Introduction

The introduction to this ETP mirrors section 24 of the revised DWOP.

All pressure testing and high pressure pumping activity is considered “Working with Pressure” and shall conform to Engineering Technical Practice GP 10-45.

1. Pressure Testing

- 1.1 All tests shall include a low pressure test of 200 to 300 psi for 5 minutes before proceeding to the full pressure test.
- 1.2 For routine operational assurance testing of valves, manifolds and BOPs, a satisfactory pressure test is represented by the test pressure held for a minimum of 5 minutes after the pressure has stabilized.
- 1.3 For well integrity testing of casing and tubing strings, where system volumes are typically large, a satisfactory pressure test shall be carried out for a minimum undisturbed 30 minute monitoring period.
- 1.4 All tests shall be recorded on a chart or an electronic data logger.
- 1.5 Water is the preferred medium for pressure testing.
- 1.6 The volume of test fluid pumped and returned shall be monitored and recorded.
- 1.7 Pressure testing shall be performed by increasing the test pressure in a series of appropriate pressure increments.
- 1.8 The possibility of a test pressure leaking past a pack-off or test plug and being applied to a weaker element shall always be considered.
- 1.9 Prior to any pressure testing, the area shall be isolated.

2. Pressure Testing of Well Control Equipment

- 2.1 All subsea BOPs including annular BOPs shall be pressure tested on a test stump prior to deployment.
- 2.2 All well control equipment, except annular BOPs, shall be tested to the lowest of the following criteria:
 - (1) Maximum anticipated wellhead pressure to be encountered in the hole section plus an acceptable safety factor.
 - (2) 90% of casing internal yield pressure.
 - (3) Wellhead rated pressure.
 - (4) BOP rated pressure.



- 2.3 Annular BOPs shall be tested to a maximum of 70% of rated working pressure if not otherwise specified and endorsed by the SPU Well Control Technical Authority and approval by the Wells EA.
- 2.4 Pressure testing and full functional testing of the well control equipment shall be carried out to the pressures determined at intervals not normally exceeding 14 days. They shall be recorded on the Daily Drilling Report form.
- 2.5 This 14 day interval may be extended under exceptional circumstances, after an appropriate risk assessment, endorsement by the SPU Well Control Technical Authority and approval by the Wells EA.
- 2.6 All wellhead components and pressure-containing connections associated with the well control equipment shall be pressure tested in accordance with the requirements of this ETP GP 10-45 upon installation or reinstallation.
- 2.7 An accumulator test shall be carried out as part of each regular BOPE test.

3. Pressure Testing of Tubulars

- 3.1 All surface, intermediate and production casings/liners shall be pressure tested prior to drilling out the shoe track or perforating.
- 3.2 Pressure tests shall not give rise to loads as described in continuing sections of GP 10-45:
- 3.3 Pressure testing of structural/conductor casing shall not be required unless a subsequent leak-off test is necessary.
- 3.4 Surface and intermediate casings shall be pressure tested to the greater of that required for the anticipated leak-off test or formation integrity test (with appropriate test margin), or the surface pressure for the well control burst load case.
- 3.5 For development wells the minimum pressure test for production casing and liners shall be equivalent to the shut-in tubing pressure on top of the annulus completion fluids.
- 3.6 Production or test tubing should be tested to the maximum anticipated surface pressure plus an acceptable safety factor expected in the well.
- 3.7 Pressure testing of tubing is dependent of the completion design and should be considered as part of the running procedure.
- 3.8 Where internal pressure integrity is required liner laps shall be tested to a minimum of 500psi above the formation leak-off pressure at the covered casing shoe or sufficient to demonstrate pressure integrity if a greater operational loading may be expected.

4. High Pressure Pumping

- 3.1 Risk assessments shall be conducted on each and every well treatment activity where diesel, hazardous materials or chemicals are involved.
- 4.2 The effects of extremes of temperature on personnel, equipment, fluids, and additives shall be considered.



- 4.3 All personnel, including non-essential personnel, shall be assigned a position or work area prior to the pumping operation.
- 4.4 Safe areas and egress routes shall be established prior to pumping operations.
- 4.5 During all pumping and pressure testing operations, all personnel shall be shielded and positioned as stated in continuing sections of GP 10-45.
- 4.6 When wellhead isolation tools are in use and the pumping operation is complete, the control panel for the isolation tool shall be tagged out until the service company is completely rigged down from the wellhead.
- 4.7 All treating iron / temporary pipe work shall have a mechanical integrity inspection tag attached, clearly stating the date of the last mechanical integrity test performed, and an identification number which references documentation of that equipment's inspection.
- 4.8 Line restraints may be used on liquid treating lines, but are not required. All energized treating lines shall be restrained from the pump discharge to the wellhead, and anchored at each end.
- 4.9 When pumping down a work string or completion equipped with a packer, the annular pressure shall be monitored and recorded on a chart during all pumping operations.
- 4.10 The annulus shall be pressure tested prior to the pumping operation to the maximum allowable annulus pressure.
- 4.11 Annular casing strings isolated from frac pressure with a packer shall be equipped with a pressure relief mechanism.
- 4.12 All pumps and treating equipment shall be tested to the maximum allowable treating pressure plus an acceptable safety factor, or the working pressure of the treating equipment, whichever is lower.
- 4.13 Where the treating line incorporates a check valve, the check valve shall be tested following the pressure test.
- 4.14 Pump trips / kick-outs are required on each pump.
- 4.15 An emergency pressure trip or shutdown system shall be used, which actuates when the pressure measured by the wellhead transducer exceeds the set point.
- 4.16 Maximum set pressure shall not exceed 95% of the maximum allowable treating pressure.
- 4.17 A manual emergency kill switch shall be easily accessible that kicks all pumps into neutral and/or shuts down the pump engines when actuated.
- 4.18 Pressure Relief Valves (PRVs) may be used on non-energized treating lines, but are not required.
- 4.19 PRVs shall not be used on any energized treating lines.



5. Remedial Pressure Operations

- 5.1 Methods of cleaning mud tanks should be identified that reduce exposure of personnel to potential risk from hose pressure and confined space entry.
- 5.2 All tank cleaning operations should be undertaken with equipment that can only be operated at or below pressures stated in the risk assessment for this activity.
- 5.3 Pump components, which are exposed to fluids being pumped during the life of the pump, shall be compatible with commonly utilized fluids.
- 5.4 Contractors that provide pressure pumping equipment should be expected to conduct regular maintenance checks on pumping equipment to confirm that all flow wetted components are in operational condition.
- 5.5 In situations where personnel are still required to operate a hose to clean tanks, a risk assessment of all components should be conducted.

6. General

- 6.1 Prior to commencing routine maintenance tasks for pumping operations, the pre-charge pressure in the pulsation dampener shall be observed for a period of fifteen (15) minutes to ensure the pre-charge pressure is static and there are no visible signs of leakage.
- 6.2 A risk assessment shall include detailed mitigation steps for pumping risks.
- 6.3 A detailed operational procedure shall be utilized to conduct any operation designated as “Working with Pressure”.
- 6.4 An incident report shall be completed and documented within the Tr@ction reporting system following any failures resulting from working with pressure.
- 6.5 Emergency evacuation and rescue drills shall be developed and conducted prior to commencement of any operations which may result in failure from working with pressure.
- 6.6 The BP WSL shall verify operator’s specific experience with relevant pumping equipment.



Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 10-45. This Group Practice (GP) is based on parts of the BP Drilling and Well Operations Practice (BPA-D-001), and for the subject matter covered herein, supercedes that document.

Working with pressure is a routine activity for drilling, completions and well operations personnel. So common place is this activity that occasionally personnel can become complacent and the risks of working with pressure can be underestimated resulting in a significant number of incidents, many resulting in damage to facilities or wells, but more importantly some resulting in injury or even fatalities.

The purpose of this ETP is to pull together guidance and best practice when 'Working with Pressure' that has been learned over the years and thereby reduce the number and severity of incidents sustained.

Everyone "Working with Pressure" will know that:

$$\text{Force} = \text{Pressure} \times \text{Area}$$

Most recognise that high pressure can develop significant forces, but many incidents result from relatively low pressures acting over large surface areas. The surface area over which pressure is acting should always be taken into consideration.

Equally, the energy stored in a volume of pressurised gas far exceeds that of the same volume of liquid under the same pressure due to the difference in compressibility. This difference should be considered when assessing risks of particular situations.

Understanding equipment limitations shall be understood prior to working with any pressures. Serious consequences have resulted from equipment or systems being exposed to pressure levels in excess of designed operating limits. Awareness of the risks associated with over pressure and pressure transfer between specification breaks is critical when managing pressure and shall always be considered when operating any contained process systems.

