Pressure testing incident Summary

- ***Pressure testing 5K choke manifold TX 54-10***
- ***Choke tested inside GY base well test pressure test bay***
- ***Workshop Foreman and Technician inside test bay to inspect for leaks***
- ***Thermowell (3/4” NPT) failed***
- ***Hit Workshop Technician in leg, resulting in serious injury to right knee***

Pressure testing incident
Summary

WARNING

The following slide may cause distress

A picture of the incident scene will now be shown

Pressure testing incident Summary

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Incident Scene

Pressure testing incident Summary

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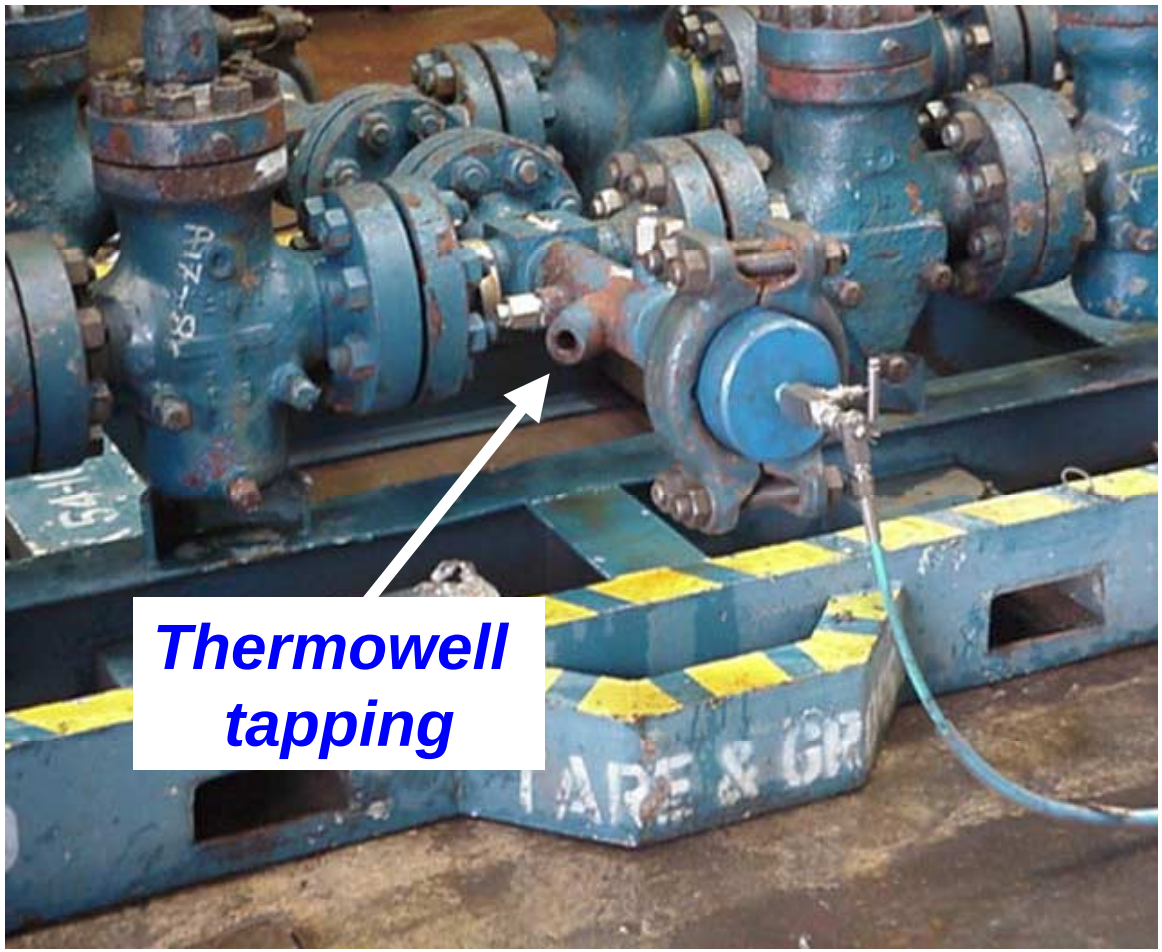
The injury was caused when the Technician was struck by a thermowell ejected from a 3/4” NPT female tapping in a 5K choke manifold during a pressure test.



Pressure testing incident Summary

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3/4” NPT Thermowell

The thermowell is about 9 ins long and weighs approx 1 kg.

It struck the Technician on his knee from approx 0.5 metres.

Pressure testing incident Summary

Severe corrosion had affected the mechanical integrity of the female thread.

The forces generated by the 5000 psi test pressure overcame the mechanical strength of the corroded thread and caused the thermowell to be ejected.

Pressure testing incident Forces

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Pressure = Stored Energy

When pressure acts upon an area, a force is generated

Pressure is measured in Pounds per Square Inch (psi)

1 psi = 0.0689 bar
1 psi = 6.895 kPa

Expro Separator - Pressure Containing Device

Pressure testing incident
Forces

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The higher the pressure ie 10,000psi **OR** *The larger the area ie 400 barrel tank* → ***THE GREATER THE FORCE***

Calculating the force acting upon the thermowell

Force	**=**	***Pressure x Area***
Test pressure	**=**	***5000 psi***
Affected area	**=**	***0.785 sq ins***
Force	**=**	***1 3/4 tons***

Pressure testing incident Forces

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When the NPT thread failed...

… the stored energy was released and propelled...

=

...the thermowell at a velocity of 42 metres/ sec or

94 MPH

Pressure testing incident
Underlying causes

- **Procedural failure**

Pressure retaining threads and tappings should have been inspected for wear and corrosion during the maintenance of the choke manifold. See the photographs and answer the question, had they been?

Calibrated thread gauges are to be used for checking the condition of the threads. The gauges were specified in the procedures but had not been used.

A review of the risk assessment for pressure testing had not been conducted prior to starting the test.

Two maintenance technicians entered the test bay to investigate leaks from the choke manifold assembly. It was not known if the pressure had stabilised prior to the technicians entering the bay. Actual pressure on the assembly was not know/recorded.

Pressure testing incident
Underlying causes

- **Procedural ineffectiveness**

The procedures were found to be outdated with several cross-references to memos, some 5 years old.

Pressure tests had not been recorded on charts, although calibrated gauges were routinely used.

Job cards were not being completed as the maintenance work was progressed.

The technician was working under the supervision of the workshop foreman during the re-build and testing of the choke manifold.

Pressure testing incident
Underlying causes

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- **Facilities**

The test bays were built to contain the failure of equipment during pressure testing. However, the bay walls and doors were not fitted with viewing ports or any other means to identify the source of leaks.

Normal practice was to apply the test pressure and wait for pressure stabilisation before entering the test bay to visually inspect for leaks.

Pressure testing incident
Actions

Dismantle and inspect ALL pressure retaining threads on Yarmouth Base equipment using calibrated thread gauges. Ensure condition of threads are established and deficient components are scrapped and replaced as required prior to any further pressure testing activity.

Action: Closed

Investigate alternative materials and options for pressure retaining threads for Expro owned equipment with a view to adopting same.

Action: Region Technical Manager/SES BS

Issue an alert to all Expro bases and clients upon completion of the investigation (Interim alert already issued).

Action: Region HSEQC Manager

Pressure testing incident
Actions

Review and revise the procedures for the maintenance and inspection of pressure retaining equipment (particularly threads and threaded fittings). Revise the pressure testing procedures for all equipment.

Action: Region Technical Manager/SES BS

Train staff in the application of these new procedures and ensure that the training is recorded.

Action: Region Manager(s)

Review and report upon the Region's pressure testing facilities against industry best practice with a view to implementing best practice.

Action: Region Technical Manager

Pressure testing incident
Actions

Disseminate and roll out the investigation findings to workshop and operations staff involved in maintenance and pressure testing activities.

Action: Region Manager(s)

Perform an audit of all the actions arising from this incident to verify that they are effective and have been consistently applied throughout the Region.

Action: Region HSEQC Manager