ENFORM The Safety Association for Canada's Upstream Oil and Gas Industry

Gate Valve Bonnet Failures From Thermal Expansion of Fluids at High-Temperature

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Enform
Enform is the health and safety association for Canada's upstream oil and gas industry. We provide leading health and safety training, programs and services, touching the lives of hundreds of thousands of workers each year. We are dedicated to the continuous improvement of safety with a vision of eliminating work-related incidents or injuries in the upstream oil and gas industry.

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For more information on this event, please contact: safety@enform.ca

Description of Incident:

- In a SAGD application, immediately after start-up, a gate valve bonnet failure caused a release to atmosphere. In thermal applications throughout the oil and gas industry, there have been incidents of valve failures during start-up. Resulting damage can include stretching studs and loss of pressure integrity between the body and bonnet.

What Caused It:

- Pressure build-up occurs in the gate valve cavity from thermal expansion of fluids. Extreme pressure build-up from fluid expansion can occur if the valve body is completely full of fluids (e.g., a grease/oil/water mixture) and heated to elevated temperatures. Such pressure can exceed the rated working pressure of the valve.
- A valve with the ability to isolate the body cavity from the flow line may be at risk.
- Presence of grease or compounds designed to enhance sealing ability may exacerbate the condition.
- Grease or a grease/oil/water mixture when heated in a sealed enclosure can exceed 7000 psi (48.5 MPa) at 250 °F (121 °C).
- Gate valve body cavities that are not 100% full of fluids do not experience excessive pressure as the vessel was heated. Trapped air or gas allows room for thermal expansion.

Corrective/Preventive Actions:

- Before start-up for thermal applications, ensure the valve bodies have a void for fluids to expand into as the temperature rises.
- Before start-up, ensure valves are in good working order and have not been compromised by ice expansion damage.
- During start-up, position the valves' sealing mechanism (if possible) where the cavity is not isolated.