Surface gas handling system and mud gas separator design

This guidance material is to provide technical advice to drilling operators and others, who have legal obligations under Chapter 9 of the *Petroleum and Gas (Production and Safety) Act 2004*, to engage in petroleum well drilling activities.

The aim is to ensure that the surface gas handling system for drilling operation is fit for purpose and use within their operating limitations.

1. Surface gas handling system

In a well control situation, the well bore fluid is directed through the choke and kill manifold to circulate hazardous gas in a safe and controlled manner using the Mud Gas Separator.

It is important to ensure that the operating limits of the surface gas handling system should not be exceeded.

The system must take into account the design and operating criteria of the mud gas separator, the arrangement of the derrick vent line, liquid seal and overboard relief lines.

A well specific analysis may be necessary to ensure the system capacity is compatible with the parameters of the reservoir gas and properties of the drilling fluids.

2. Mud gas separator

In the oilfield, the mud gas separator is sometime known as ‘poor boy degasser’ or ‘gas buster’. They may be vertical or horizontal in design.

Vertical separator is normally used for high fluid throughput, while horizontal separator provides a longer retention time and superior gas separating capacity. Internal design and configuration (e.g. blast chamber, baffle plate etc) governs the individual efficiency of the equipment.

3. Performance characteristics

The limitation to the efficiency of a mud gas separator is dedicated by:

(i) Separating Capacity – the capacity to separate gas from the liquid is determined by the internal configuration and fluid dynamic characteristics of the separator. (Graph 1)

(ii) Venting Capacity – the capacity to vent gas through the derrick vent is subject to the backpressure of the vent line and the hydrostatic head of the liquid seal. (Graph 2)

(iii) Liquid re-entrainment Capacity – the capacity when the liquid droplets breaking away from a gas/liquid interface to become suspended in the gas phase. The term re-entrainment is used in separator design because it is assumed that droplets have settled to the liquid phase and then are returned to the gas phase. (Graph 3)

It should be noted that the capacity of the separator to separate gas from the liquid may be considerably less than the capacity to vent gas within the limit of the liquid seal.

4. Pertinent features

The separator should be designed to a recognised pressure vessel code. To avoid plugging by solids or hydrates or mechanical malfunction, the separator back pressure should be controlled by a liquid seal rather than conventional back pressure regulators or liquid level control valves. A pressure gauge is required to monitor the pressure in the separator vessel.

5. Emergency relief lines

In exceptional situations, well control may require that displacement of the kick continues regardless of the capacity of the mud-gas separator to handle well bore fluids. All drilling facilities should have a means of diverting flow from the choke manifold through emergency relief lines and isolating the mud gas separator.

6. Well control procedure

As a well specific exercise, consideration should be given to establish the slow circulating rate SCR choke pressure (Graph 4) against the limiting capacities of the system for a well kill operation. The rate of delivery of reservoir fluids to the separator should be limited to the capacity that will not break the liquid seal. In the extreme this may mean shutting in the well, or alternatively diverting the returns through the overboard line(s) if closing the well will lead to a more prolonged and potentially more problematic well control situation. (Graph 5 Decision Tree)

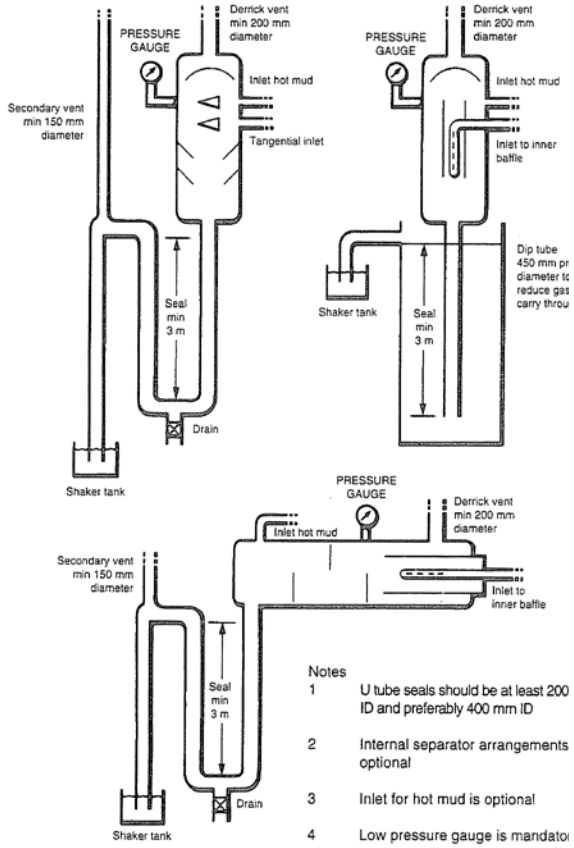
7. Instrumentation and chemical injection

Mud gas separator should be operated taken into account the risk of hydrate formation in cold climate. Where necessary, a hydrate suppressant such as glycol should be employed. Alternatively, means may be provided to heat the kick fluid prior to or during separation in the mud gas separator.

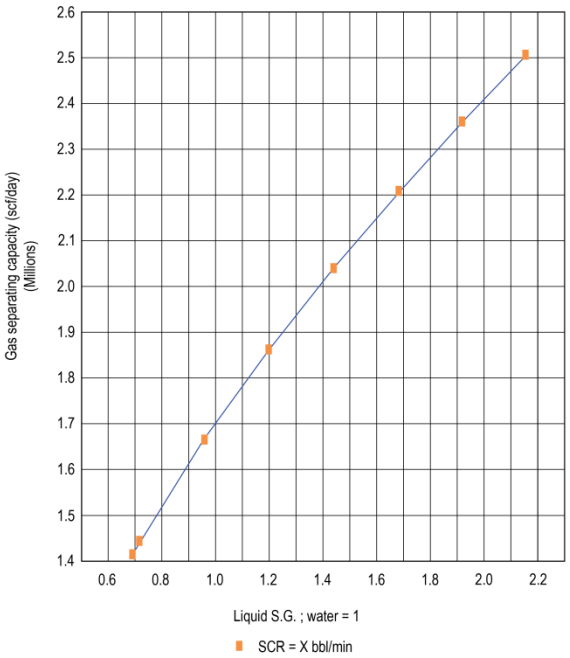
Further Information

Further information can be obtained from Petroleum Engineering Discipline, Department of Natural Resources, Petroleum and Gas Inspectorate.

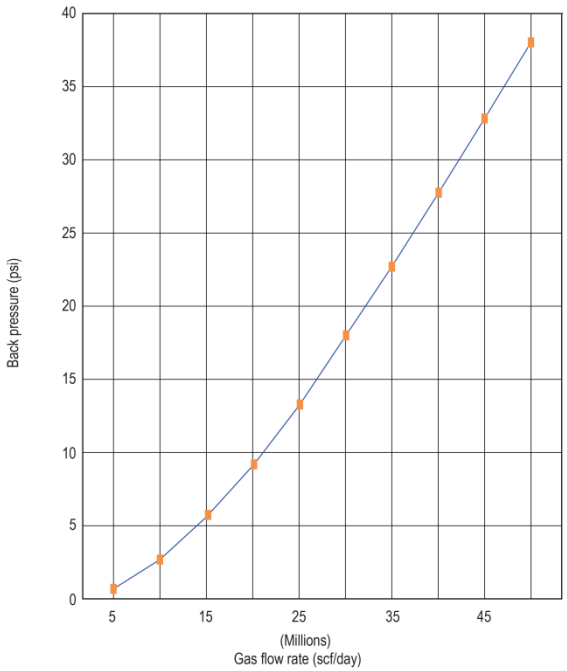
Appendix 1: MUD GAS SPARATOR



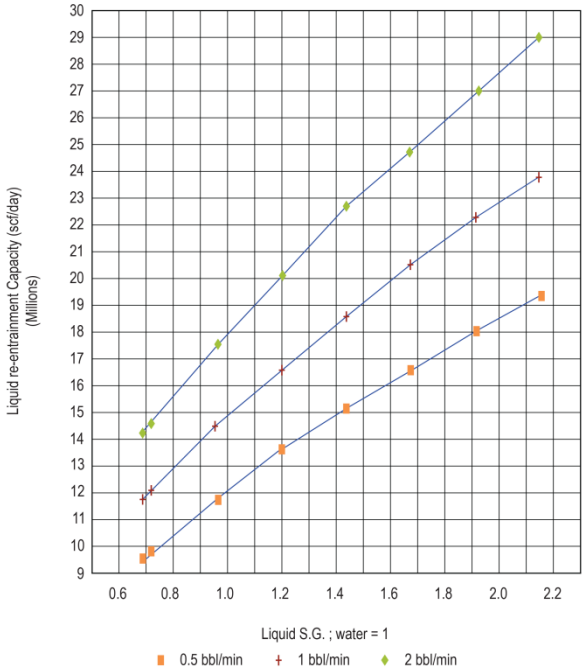
Graph 1 - Separating Capacity



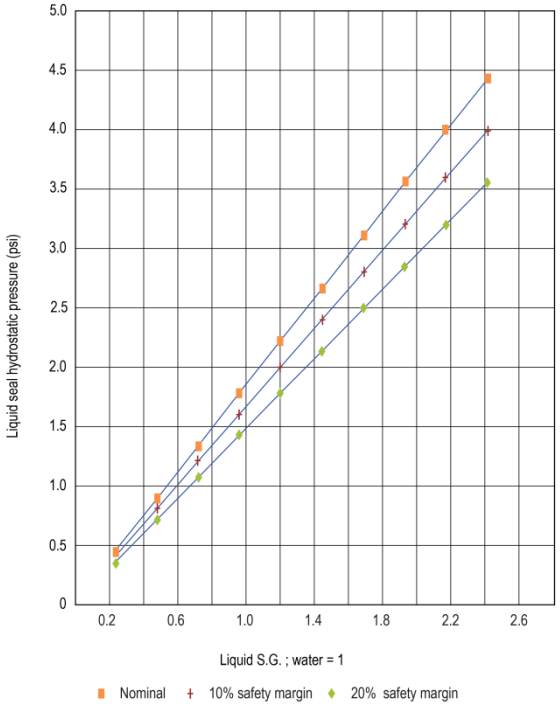
Graph 2 - Venting Capacity



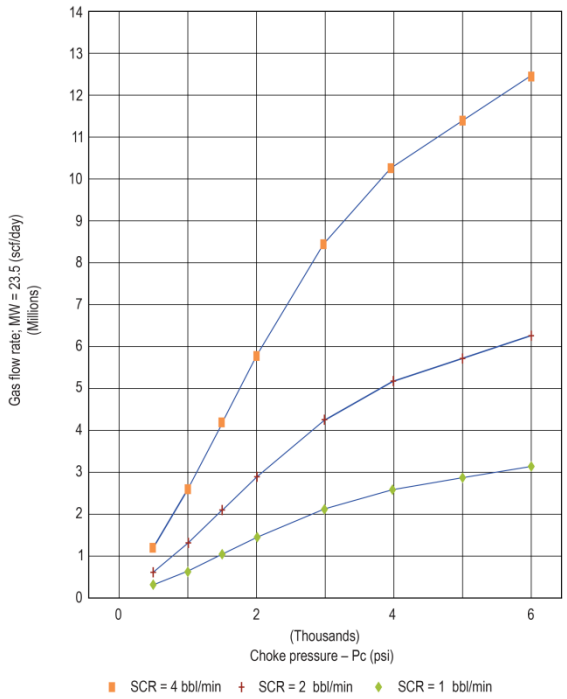
Graph 3 - Liquid Entrainment Capacity



Graph 4 – Liquid Seal pressure



Graph 5 – SCR Vs Choke Pressure



Graph 6 – Well Control Decision Tree