

# Many factors are involved to properly size mud gas separator, or gas buster, systems

By Dan Eby, Cudd Well Control

## A MUD GAS SEPARATOR

(MGS), or gas buster, is common on most drilling rigs throughout the world. The MGS is used to separate wellbore gas from the drilling fluid while circulating out a kick or circulating any gas present in drilling fluids during drilling or workover operations. The MGS is a very important component in underbalanced drilling. A typical MGS is constructed of a cylindrical vessel with a series of baffles in it. The drilling fluid from the wellbore enters the MGS, and the action of the fluid hitting the baffles separates easily removed gas from the fluid. The gas exits through a vent line at the top of the MGS and is safely vented away from the rig floor. The mud exits the MGS through a line near the bottom of "up hill" to return to the pit system.

Typically, the maximum allowable pressure of the MGS when in use is determined by the fluid leg or (fluid seal) height. The density fluid in the fluid leg is dependent on the fluid in use at the time, and, therefore, operating pressure of the system is variable. This pressure is usually below 15 psig. However, there are MGS applications in which the vessel can operate at pressures up to 100 psi.

The friction pressure of the gas flowing through the vent line must be less than the hydrostatic pressure of the fluid in the fluid leg. If this friction pressure is greater than the hydrostatic pressure in the fluid leg, gas will exit the fluid line and flow to the pit system.

There are numerous factors that go into properly sizing a MGS system:

- Kick size – A reasonable scenario for a kick size is needed so that the size of the gas bubble when it is circulated to the surface can be calculated. This volume of gas is dependent on the method (Driller's or Engineer's) chosen to circulate the kick out of the well. Several methods are commonly used to calculate the gas volume.
- Maximum casing pressure – The casing pressure realized when the gas reaches the surface.



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- Kick circulation rate – The kick circulation rate is required in order to calculate the gas flow rate through the system. This is a simple calculation. Boyles' law is used to determine the gas volume after it passes through the choke. This calculation is usually very basic as a number of assumptions regarding temperature and gas composition are required.
- Vent line friction – The vent line friction is needed in order to calculate the required height of the fluid leg. There are numerous methods that can be used to determine the friction pressure.
- Mud leg height – The minimum mud leg height is calculated using the vent line friction pressure and the fluid



**At left, a failed MGS due to excessive pressure.**

density anticipated during the kick circulation. As a worst-case scenario, oil (or condensate) density can be used if a significant amount of liquid hydrocarbon is anticipated with the kick.

The API has a brief explanation of the MGS in API RP 53. The document refers to a Society of Petroleum Engineers document No. 20430 for sizing calculations.

Gas cut drilling fluid is common when circulating out kicks. The vessel size of the MGS can be used to help alleviate this problem to some degree. The retention time of the fluid in the MGS can be used to allow gas bubbles to migrate out of the mud as it flows through the MGS. The retention time is dependent on the circulation rate and the vessel volume below the fluid level in the vessel. If the flow rate of mud down the vessel is slower than the migration rate of the gas bubbles in the fluid, the severity of the gas cutting of the fluid is lessened.

Improperly sized MGS systems can lead to the following safety hazards:

- If the fluid leg is compromised, gas will be returned to the shale shaker and/or mud pits.
- Oftentimes, in order to prevent excessive gas, the flow through the system is reduced by closing the choke. This can lead to increasing back pressure on the well and will increase the chances of formation or shoe breakdown.
- The separator itself can rupture or split if the vent line becomes plugged.

As a rule of thumb, the MGS system should include the following.

- A large vessel (diameter and height).
- A large diameter vent line with a minimum number of turns.
- A relatively tall fluid leg.

However, as can be seen, proper sizing calculations are dependent on a number of factors, and sizing calculations should be conducted for all wells where the system may be required during kill operations.💧