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Top Kill Procedure

for

MC252-1

Contingency: Alternative LCM Pills

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0	5/24/2010	Eric Beyer/ John Smart	Removed pressures in Well Status Section, first bullet	1	4

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ATTACHMENTS

1 Contingency: Alternative LCM Pills - Brinker Technology Bridging Platelets

Well Status

- Well is under blowout conditions.
- The Top Kill plan is to pump a momentum kill with only mud followed by cement. No attempt will be made to bridge or seal the flow upwards in the BOP.
- If the momentum kill operation does not kill the well, then Bridging Platelets® may be pumped to bridge BOP flow and allow well kill/cementing operations to proceed.
- Frac balls are also a contingency bridging option. The frac ball procedure is a part of the Top Kill Procedure.

Well Preparation

- Ready to perform the Top Kill Procedure
- Results of the Diagnostics Procedure are communicated and indicate the status of each BOP ram set, the pressures in the BOP stack, and the latest estimate of the flow rate in the BOP
- The HES ball drop subs are ready to use with hydrate inhibited fluid
- The platelet delivery manifold is ready to use
- The Platelets will be delivered down the Choke Line side only. The Kill Line side should be closed to flow so that all the flow goes down one line only.

Objective

If the first momentum kill procedure is unsuccessful, bridging, not sealing, material may be pumped to restrict, but not stop the flow upwards through the BOP stack. Brinker Technology Platelets® were specifically engineered and flow loop tested to create a bridge below the closed casing shear rams without causing a total seal. The platelets can be deployed in small numbers to determine the bridging effect on the pressure below the rams.

2 Brinker Technology Platelets

2.1. Partial Bridging Across Shear Rams using Brinker Platelets® Barrier Technology

2.1.1. *Introduction*

In order to transfer the objective from sealing the Casing Shear Rams in the BOP to a controlled partial bridging, while ensuring total sealing does not happen, the procedure has been amended for controlled sequential deployment of Bridging Platelets® only.

Current BOP analysis (pressure and ram location) suggests that Blind Shear Rams and/or the Casing Shear Rams are closed, but passing with a leak area of 0.4-in to 0.64-in equivalent throat diameter (based on 5,000-bpd total flow). The Bridging Platelets® are designed to collect at the 1-in x 8-in mud slot bypass area through the casing shear rams to reduce the calculated flow rate and increase the pressure drop across the casing shear rams.

2.1.2. *Risk of unintentional sealing:*

- Sand in produced formation fluids has potential to bridge and plug any restrictions. This will depend on the unknown quantities of sand particle size distribution and volume of sand in fluid. It is expected that the size of the formation sand grains will be insufficient to present a high risk of plugging in the flow area around the Bridging Platelets®.
- Bridging Platelets® may combine in configuration that will create a full seal. Until 10-mm Sealing Platelets® are released there should be no risk of this. 10-mm Platelets® are not expected to be able to seal completely on their own, but the higher the number pumped, the higher the risk.
- Bridging Platelets® may flow through the casing shear ram leak path and not bridge off. This is possible if the cubes line up perfectly with the mud slot geometry if opened more than 1.5-in, but unlikely in the turbulent flow. The platelets may then bridge in the blind shear rams if closed, but with a positive effect on the objective.
- The Bridging Platelets® could flow out of the BOP and into the riser and begin bridging at the riser kink area. Although this will not cause a seal, the forces acting on the riser would likely increase.

2.1.3. *Description*

The Brinker Bridging Platelets® pill is comprised of a polymer (rubber-like) material of variable durometer. Bridging Platelets® size and geometry are engineered based on the expected aperture size and geometry being bridged. In this case, the leak path to be bridged is assumed to be the two 1-in x 8-in mud slots on the bottom of the casing shear rams. For this application, Brinker has engineered a specialized Bridging Platelets® which is a very hard plastic-like (PEEK) material in the shape of a cube, with rounded corners and edges. This platelet has been tested in their Aberdeen test facility to ensure pumpability through 3-in 90-degreees flow paths, as exists in the well kill operation. The deformable Sealing Platelets®, which may be pumped after the primary Bridging Platelets®, will seal any smaller remaining apertures to affect the seal. The bridge is held in place by differential pressure; Brinker estimates that approximately 10-psi positive differential is sufficient to keep the bridge in place.

Notes:

- Platelets® material is selected to be lighter than both the 14.2-PPG and the 16.4-PPG mud density, but heavier than water density. Additional Platelets® are available with both with material density lighter than water, and also with density lighter than well produced fluids.
- The maximum calculated area reduction in the BOP for one slot is shown in the table below.
- For example, at 6-bbls/min surface pump rate, travel time for the Platelets® to reach BOP is approximately 30-minutes.

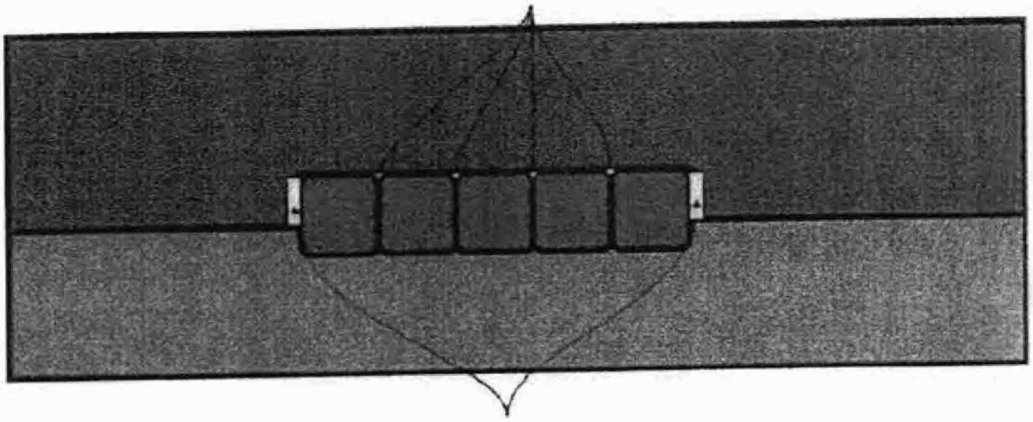
Table 1: Calculated Hole Diameters for Platelets® and Frac Balls - refer to Figure 1 below

Platelets	Equivalent Hole Diameter (inches)	Max Differential Pressure across BOP (psi)
5 x 1.5-in Bridging Platelets®	1.06-in	130
+ 5 x 1.5-in Bridging Plateles®	0.79-in	339
+ 10 x 1-in Bridging Platelets®	0.7-in	543
+ 25 x 10-mm Sealing Platelets®	0.65-in	1426
5 x 1.5-in Frac Balls	2.18-in	6

- Adding more frac balls will not significantly reduce the flow. Spheres are unable to fill more than 75% of space. To do this requires much smaller spheres to reduce the pore throats, then a further set of smaller spheres, each set approximately 1/6 of the size of the previous set.

- Above procedure represents 25% of available inventory of these sizes, and material, of Platelets®. There is sufficient large size Bridging Platelets® to pump four (4) bridging attempts. There is sufficient Sealing Platelets® to pump five (5) sealing attempts. The Platelets® are small enough and light enough to be transported by air in a suit case.

Leak Paths on Rounded Corners



Leak Paths on edges

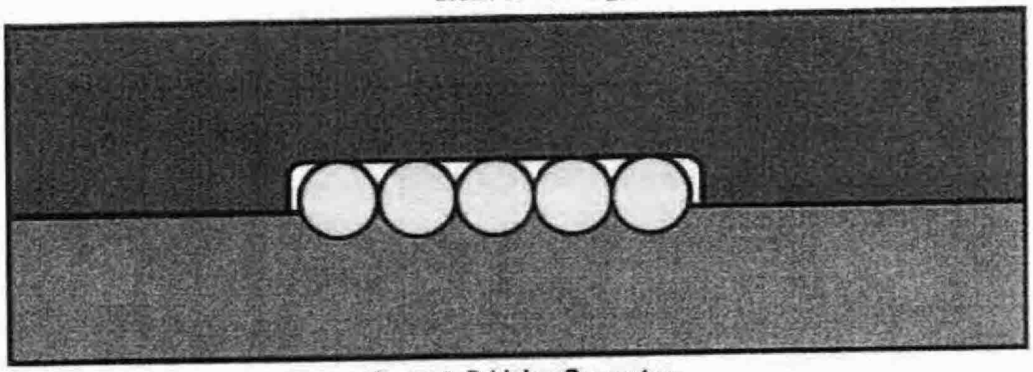


Figure 1: Bridging Geometry

2.2. Before Pumping

Complete all Pre-Job HSE requirements.

Before the start of pumping, ensure the following job design is discussed with Brinker engineer and understood:

- The Platelets will be delivered down the Choke Line side only. The Kill Line should be not be used in order to keep the Platelets delivered in the Choke Line only.
- Halliburton ball dropper will be loaded with 1.5-in cube Bridging Platelets® (maximum dimension 2.6-in diagonal).

- Platelets® can be released individually so that impact to flow at BOP can be monitored to confirm results are as predicted before releasing additional Bridging Platelets®. Initial release will be five (5) Platelets®. Subsequent releases will be determined based on pressures monitored, with expectation of pumping ten (10) in total.
- Monitor pressure response at BOP.
- Second ball dropper is to be loaded with 1-in cube Bridging Platelets® (maximum dimension 1.8-in diagonal) to bridge flow area between the larger Platelets®. Ten (10) of these Platelets® will be released, with release rate determined on pressure responses obtained on deployment of 1.5-in Platelets®.
- Monitor pressure response at BOP.
- Release one hundred (100) number of 10-mm (0.39-in) Sealing Platelets® from the Brinker Platelet® delivery manifold in batches of twenty five (25) (maximum dimension 0.7-in diagonal).

Note: **Test if the ball drop sub can effectively drop Platelets into the kill weight mud, evaluate loading the ball drop bypass line with the hydrate-inhibited brine of less viscosity to drop the Platelets for injection into the main flow line.**

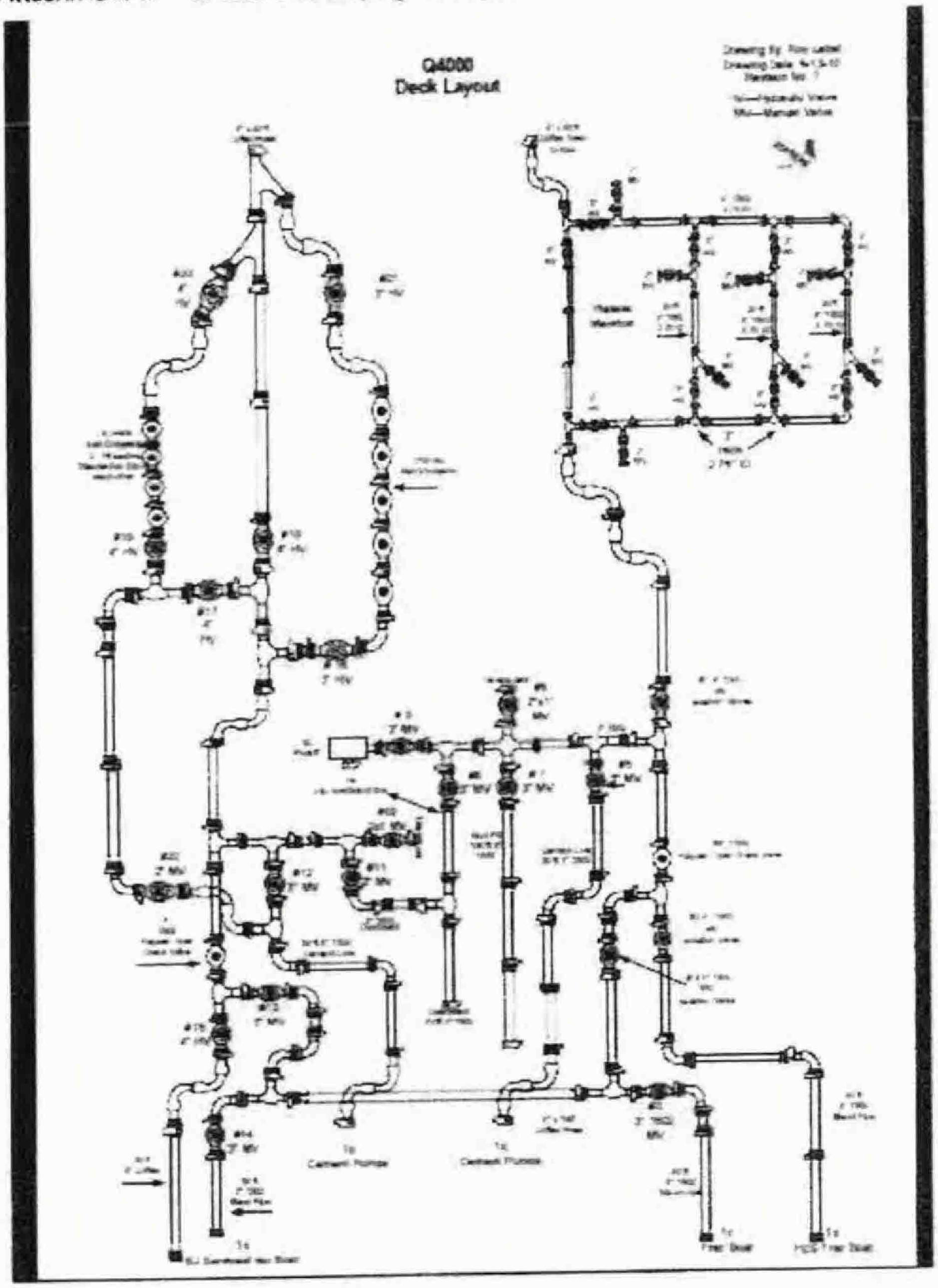
If the ball drop sub cannot be used to launch Platelets, switch to use the platelet delivery manifold to launch the Platelets.

1. Pressure test the HES ball drop subs (Attachment 1) and the platelet delivery manifold (Attachment 2) to the required working pressure.
2. The platelets are preloaded in the HES ball dropper subs per Halliburton instructions:
   - Batch 1 consisting of Bridging Platelets® as follows:
     - Up to 10 off, 1 ½-in, 10.93-ppg Polymer M4011 Bridging Platelets® cubes to form the initial bridge with ability to overlap deployed in smaller batches depending on flow estimate.
     - Load 1 Bridging Platelet® per 'Spoon' in the HES multi-spoon ball drop subs.
   - Batch 2 consisting of Bridging Platelets® as follows:
     - Up to 10 off, 1-in, 10.93-ppg Polymer M4011 Bridging Platelets® deployed in smaller batches depending on flow estimate and pressure response.
     - Load 1 Bridging Platelets® per 'Spoon' in the multi-spoon ball drop subs.
   - Batch 3 will be used as a contingency and contains lighter Sealing Platelets® to be used depending on observed pressure and rate response:
     - Up to 100 off, 10-mm (0.39-in), M3037 elastomeric Sealing Platelets®.
     - Load 25 Sealing Platelets® per loading tube in the platelet delivery manifold.
3. Arrange valves on Junk Shot manifold (refer to the Top Kill procedure for manifold schematic) to flow through bypass lines around junk shot tubes.
4. Arrange BOP valves to inject Bridging Platelets® into the upper choke line valve.
5. Keep the kill line side of the Junk Shot manifold closed.

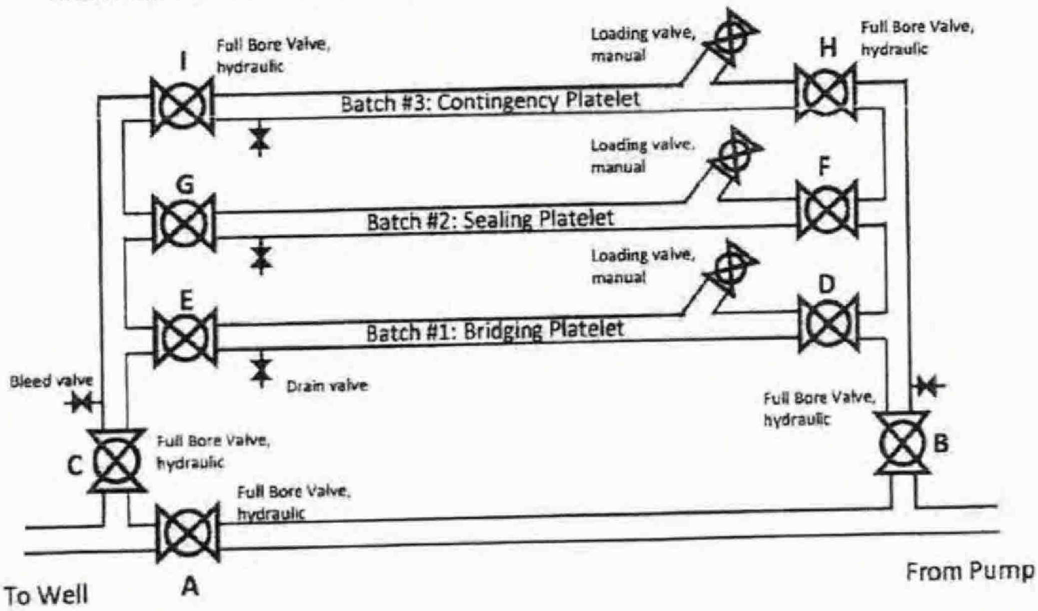
2.3. Pumping Sequence

1. Line up surface lines to inject through the HES ball drop bypass line (platelet delivery manifold bypassed):
   - Establish flow with kill weight mud (14.2-PPG or 16.4-PPG) through HES ball drop sub by-pass loop to 'flood' the ball drop subs containing Bridging Platelets®.
   - Set an optimum rate for the displacement. Determine maximum pump rate achievable through the system (pump rate dictated by system pressure constraints and HES ball drop operating guidelines). There is no restriction on flow rate for Bridging Platelets®.
   - Take note of baseline rates and pressures, both surface and down hole.
2. Actuate HES ball drop sub spoons one at a time to drop up to 5 off, 1.5-in Bridging Platelets®.
3. Chase with approximately 180-bbl kill weight mud spacer and displace to BOP at rate established in Step 1. Monitor all pressures.
4. At least 25-bbls displacement prior to Bridging Platelets® entering BOP, decrease the rate to 10-bpm to ensure platelets flow upwards into BOP.
5. Return to pumping at maximum achievable rate within safe operating envelope.
6. If pressure response is inadequate for top kill purposes, proceed to drop more Platelets.
7. Actuate HES ball drop sub spoons one at a time to drop up to 5 off, 1.5-in Bridging Platelets®.
8. Repeat Steps 3, 4, 5, and 6 above.
9. Actuate HES ball drop sub spoons one at a time to drop 1 off 1.0-in Bridging Platelets® with the release rate based on pressure responses obtained so far.
10. If pressure response is inadequate for top kill purposes, release up to 100 off 10-mm (0.39-in) Sealing Platelets® in batches of 25 off. Use the ball drop subs or the platelet delivery manifold as required.
11. Watch for indication of arrival of each Bridging (or Sealing) batch of Platelets® at the BOP. Monitor pressure and flow at surface and pressure on the BOP. If pressure rise or a change in flow conditions indicates an acceptable (per Top Kill Requirements) total pressure below the BOP shear rams, begin Top Kill Procedure. (Continue to monitor pressure and flow during operation for degradation of bridge.)

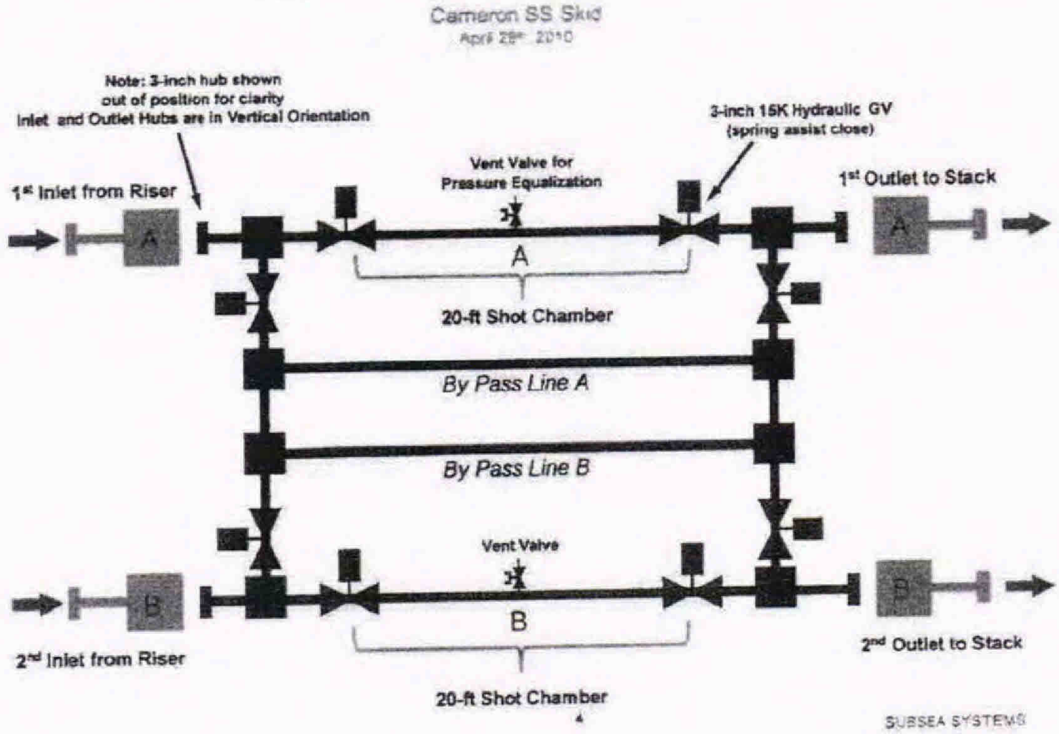
Attachment 1: Q 4000 Deck Piping Manifold



Attachment 2: Q 4000 Platelet Delivery Manifold



Attachment 3: Junk Shot manifold



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