

**HALLIBURTON**

*Bp America Prod Co-sorac/gom Ebiz  
PO Box 22024 - Do Not Mail  
Tulsa, Oklahoma 74121-2024*

Macondo 1  
MISSISSIPPI CANYON Blk: 252

United States of America

## 9 7/8" X 7" Production Casing

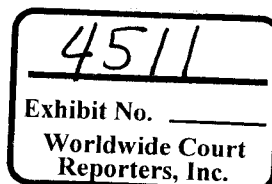
Prepared for: Brian Morel

April 17, 2010  
Version: 5

Submitted by:  
Jesse Gagliano  
Halliburton  
10200 Bellaire Blvd  
Houston, Texas 77072-5299

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CONFIDENTIAL



BP-HZN-2179MDL00250658

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*Halliburton appreciates the opportunity to present  
this proposal and looks forward to being of service to you.*

### Foreword

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Enclosed is our recommended procedure for cementing the casing strings in the referenced well. The information in this proposal includes well data, calculations, materials requirements, and cost estimates. This proposal is based on information from our field personnel and previous cementing services in the area.

Halliburton Energy Services recognizes the importance of meeting society's needs for health, safety, and protection of the environment. It is our intention to proactively work with employees, customers, the public, governments, and others to use natural resources in an environmentally sound manner while protecting the health, safety, and environmental processes while supplying high quality products and services to our customers.

We appreciate the opportunity to present this proposal for your consideration and we look forward to being of service to you. Our Services for your well will be coordinated through the Service Center listed below. If you require any additional information or additional designs, please feel free to contact myself or our field representative listed below.

Prepared and Submitted by:

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Jesse Gagliano  
Technical Advisor

SERVICE CENTER: Lafayette, La

SERVICE COORDINATOR: Danny Mooney  
OPER. ENGINEER: Yarisca Aviles  
PHONE NUMBER: 1-800-444-7830

# HALLIBURTON

## Job Information

## 9 7/8" X 7" Production Casing

Well Name: Macondo	Well #: 1
Riser	0 - 5067 ft (MD)
Outer Diameter	24.000 in
Inner Diameter	19.500 in
16" Casing	5067 - 11585 ft (MD)
Outer Diameter	16.000 in
Inner Diameter	14.920 in
Linear Weight	97 lbm/ft
13 5/8" Liner	11185 - 13100 ft (MD)
Outer Diameter	13.625 in
Inner Diameter	12.375 in
Linear Weight	88.20 lbm/ft
11 7/8" Liner	12816 - 15113 ft (MD)
Outer Diameter	11.875 in
Inner Diameter	10.711 in
Linear Weight	71.80 lbm/ft
9 7/8" Liner	14803 - 17163 ft (MD)
Outer Diameter	9.875 in
Inner Diameter	8.625 in
Linear Weight	62.80 lbm/ft
10 1/2" Average Hole Size	17163 - 18130 ft (MD)
Inner Diameter	10.500 in
Job Excess	0 %
8.88" Average Hole Size	18130 - 18304 ft (MD)
Inner Diameter	8.880 in
Job Excess	0 %
6 5/8" Drill Pipe	0 - 5067 ft (MD)
Outer Diameter	6.625 in
Inner Diameter	5.291 in
Linear Weight	40.01 lbm/ft
9 7/8" Casing	5067 - 12485 ft (MD)
Outer Diameter	9.875 in
Inner Diameter	8.598 in
Linear Weight	62.80 lbm/ft
7" Production Casing	12485 - 18304 ft (MD)
Outer Diameter	7.000 in
Inner Diameter	6.143 in
Linear Weight	32 lbm/ft

## HALLIBURTON

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Water Depth	4992 feet
Air Gap	75 feet
Mud Type	Synthetic
Mud Weight	14 lbm/gal
BHST	210 degF
BHCT	135 degF

# HALLIBURTON

## Calculations

## 9 7/8" X 7" Production Casing

Mud: (110.00 ft fill)

$$\begin{aligned} 110.00 \text{ ft} * 0.3585 \text{ ft}^3/\text{ft} * 0 \% &= 39.43 \text{ ft}^3 \\ \text{Total Mud} &= 39.30 \text{ ft}^3 \\ &= 7.00 \text{ bbl} \end{aligned}$$

Spacer:

$$\begin{aligned} 88.00 \text{ ft} * 0.3585 \text{ ft}^3/\text{ft} * 0 \% &= 31.55 \text{ ft}^3 \\ 310.00 \text{ ft} * 0.1385 \text{ ft}^3/\text{ft} * 0 \% &= 42.93 \text{ ft}^3 \\ 2050.00 \text{ ft} * 0.1385 \text{ ft}^3/\text{ft} * 0 \% &= 283.89 \text{ ft}^3 \\ 137.00 \text{ ft} * 0.3341 \text{ ft}^3/\text{ft} * 0 \% &= 45.77 \text{ ft}^3 \\ \text{Total Spacer} &= 404.25 \text{ ft}^3 \\ &= 72.00 \text{ bbl} \end{aligned}$$

Cement: (100.00 ft fill)

$$\begin{aligned} 100.00 \text{ ft} * 0.3341 \text{ ft}^3/\text{ft} * 0 \% &= 33.41 \text{ ft}^3 \\ \text{Total Lead Cement} &= 33.41 \text{ ft}^3 \\ &= 5.95 \text{ bbl} \\ \text{Sacks of Cement} &= 24 \text{ sks} \end{aligned}$$

Cement: (904.00 ft fill)

$$\begin{aligned} 730.00 \text{ ft} * 0.3341 \text{ ft}^3/\text{ft} * 0 \% &= 243.87 \text{ ft}^3 \\ 174.00 \text{ ft} * 0.1628 \text{ ft}^3/\text{ft} * 0 \% &= 28.33 \text{ ft}^3 \\ \text{Foamed Tail Cement} &= 272.20 \text{ ft}^3 \\ &= 48.48 \text{ bbl} \end{aligned}$$

Shoe Joint Volume: (189.00 ft fill)

$$\begin{aligned} 189.00 \text{ ft} * 0.2058 \text{ ft}^3/\text{ft} &= 38.90 \text{ ft}^3 \\ &= 6.93 \text{ bbl} \\ \text{Tail plus shoe joint} &= 311.10 \text{ ft}^3 \\ &= 55.41 \text{ bbl} \\ \text{Total Tail} &= 191 \text{ sks} \end{aligned}$$

Total Pipe Capacity:

$$\begin{aligned} 5067.00 \text{ ft} * 0.1527 \text{ ft}^3/\text{ft} &= 773.67 \text{ ft}^3 \\ 7418.00 \text{ ft} * 0.4032 \text{ ft}^3/\text{ft} &= 2990.95 \text{ ft}^3 \\ 5819.00 \text{ ft} * 0.2058 \text{ ft}^3/\text{ft} &= 1197.67 \text{ ft}^3 \\ &= 883.82 \text{ bbl} \end{aligned}$$

Displacement Volume to Shoe Joint:

$$\begin{aligned} \text{Capacity of Pipe - Shoe Joint} &= 883.82 \text{ bbl} - 6.93 \text{ bbl} \\ &= 876.89 \text{ bbl} \end{aligned}$$

# HALLIBURTON

## Job Recommendation

## 9 7/8" X 7" Production Casing

### Fluid Instructions

Fluid 1: Mud

Base Oil

Fluid Density: 6.70 lbm/gal

Volume Behind: 7 bbl

### Fluid 2: Water Based Spacer

#### TUNED SPACER III

0.6 gal/bbl Dual Spacer Surfactant A (Additive Material)

0.6 gal/bbl Dual Spacer Surfactant B (Additive Material)

0.6 gal/bbl SEM-8 (Additive Material)

1 lbm/bbl WellLife 734 (Additive Material)

Fluid Density: 14.30 lbm/gal

Fluid Volume: 72 bbl

### Fluid 3: Lead Cement - Un-Foamed

#### Premium Cement

94 lbm/sk Premium Cement (Cement)

0.07 % Halliburton EZ-FLO (Bulk Flow Enhancer)

0.25 % D-AIR 3000 (Defoamer)

1.88 lbm/sk KCL (Additive Material)

20 % SSA-1 (Additive Material)

15 % Common White-100 Mesh, SSA-2

0.2 lbm/sk SA-541 (Additive Material)

0.11 Gal/sk Zonesealant 2000 (Foamer)

0.09 Gal/sk SCR-100L (Retarder)

1 lbm/bbl WellLife 734 (Additive Material) - added by hand to down hole side

Fluid Weight 16.74 lbm/gal

Slurry Yield: 1.37 ft<sup>3</sup>/sk

Total Mixing Fluid: 5.04 Gal/sk

Top of Fluid: 17300 ft

Calculated Fill: 100 ft

Volume: 5.95 bbl

Calculated Sacks: 24.37 sks

Proposed Sacks: 30 sks

### Fluid 4: Foamed Tail Cement - Foamed to average density of 14.5 ppg

#### Premium Cement

94 lbm/sk Premium Cement (Cement)

0.07 % Halliburton EZ-FLO (Bulk Flow Enhancer)

0.25 % D-AIR 3000 (Defoamer)

1.88 lbm/sk KCL (Additive Material)

20 % SSA-1 (Additive Material)

15 % Common White-100 Mesh, SSA-2

0.2 lbm/sk SA-541 (Additive Material)

0.11 Gal/sk Zonesealant 2000 (Foamer)

0.09 Gal/sk SCR-100L (Retarder)

1 lbm/bbl WellLife 734 (Additive Material) - added by hand to down hole side

Fluid Weight 16.74 lbm/gal

Slurry Yield: 1.37 ft<sup>3</sup>/sk

Total Mixing Fluid: 5.04 Gal/sk

Top of Fluid: 17400 ft

Calculated Fill: 904 ft

Volume: 55.41 bbl

Calculated Sacks: 191.44 sks

Proposed Sacks: 200 sks

## HALLIBURTON

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Fluid 5: Water Based Spacer

TUNED SPACER III

0.6 gal/bbl Dual Spacer Surfactant A (Additive Material)

0.6 gal/bbl Dual Spacer Surfactant B (Additive Material)

0.6 gal/bbl SEM-8 (Additive Material)

Fluid Density: 14.30 lbm/gal

Fluid Volume: 20 bbl

Fluid 6: Mud

Mud

Fluid Density: 14 lbm/gal

Fluid Volume 856.89 bbl

# HALLIBURTON

## Job Procedure

## 9 7/8" X 7" Production Casing

### Detailed Pumping Schedule

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
1	Mud	Base Oil	6.7	4.0	7 bbl
2	Spacer	TUNED SPACER III	14.5	4.0	72 bbl
3	Cement	Cap Cement	16.7	2.0	30 sks
4	Cement	Foamed Tail	16.7	2.0	200 sks
5	Spacer	TUNED SPACER III	14.5	4.0	20 bbl
6	Mud	Mud	14.0	4.0	856.89 bbl

### Foam Output Parameter Summary:

Fluid #	Fluid Name	Un-foamed Liquid Volume	Beginning Density lbm/gal	Ending Density lbm/gal	Beginning Rate scf/bbl	Ending Rate scf/bbl
Stage 1						
4	Foamed Tail	39.82bbl	14.5	14.5	521.1	521.1

### Foam Design Specifications:

Foam Calculation Method:	Constant Gas Flow	Calculated Gas =	20748.4 scf
Backpressure:	14.70 psig	Additional Gas =	50000 scf
Bottom Hole Circulating Temp:	210 degF	Total Gas =	70748.4 scf
Mud Outlet Temperature:	150 degF		

Hold Safety Meeting with all personnel to discuss foam cementing operations and possible hazards.

1. Run the 9 7/8" X 7" casing as per procedures.
2. Rig up lines for the cementing and nitrogen units while casing is being run, this should be out of the critical path.
3. When casing lands, have chickens lines ready to be picked up. Follow proper HSE and JSA requirements for personnel in riding harness. Assure all personnel are away from rig floor and monitoring hand in riding belt while hammering union between chickens and valve.
4. Assure Lo-Torc Valve on side door sub is open and top TIW is closed, bottom TIW to be open.
5. Once personnel are on deck contact cementer and have cementer break circulation.
6. Assure that returns are identified.
7. Assure all lines are filled with mud and then have lo-torc valve closed on side door sub.



## HALLIBURTON

8. Once hand has identified closed lo-torc, all personnel must clear rig floor while testing commences.
9. Make announcement to rig concerning high pressure testing.
10. Test should be performed to 5000 psi and held for at least 3 minutes.
11. Once pressure is on, Zone Seal Specialist should walk line and assure no leaks.
12. Only Zone Seal specialist may bleed line pressure off.
13. Once cement line is tested, the Halliburton unit will pump 7 bbls of Base Oil ahead of the spacer.
14. Once Base Oil has been pumped the Halliburton unit will pump 72 bbls of 14.3 ppg Tuned Spacer III with 1 lb/bbl of WellLife 734 @ 4 bpm. While pumping of spacer, test of nitrogen line can be performed.
15. Clear all personnel from rig floor.
16. Make announcement of test of nitrogen unit.
17. Zone seal specialist must close N2 valve, after cool down Zone seal specialist gives Nitrogen operator permission to test.
18. All personnel must clear area while testing.
19. After test is complete, Zone Seal specialist must walk line to assure no leaks.
20. After test is complete Zone Seal specialist must bleed lines.
21. Cementing may commence once spacer has been pumped.
22. Weight cement up to proper weight as per lab results.
23. Start pumping cement at a rate of 2 bpm. Do not exceed 2 bpm during cementing operations. 1 lb/bbl of WellLife 734 will be added to the cement by hand on the down hole side.
24. Once 5 bbls of cement has been pumped drop dart to launch bottom plug. Assure indication is seen and reported. This can be done on the fly.
25. Once foamed cement is complete, bring off line nitrogen unit first.
26. Pump shoe slurry; continuing injection of all additives.
27. Drop Dart to launch top plug. Assure indication is seen and reported.
28. Pump 20 bbls of 14.3 ppg Tuned Spacer III behind the cement.
29. Begin pumping displacement with Halliburton unit at 4 bpm.
30. Halliburton unit will displace until indication of Top plug has launched (+/- 145 bbls).
31. Once top plug has launched turn displacement over to the rig. Rig to displace at 4 bpm.
32. Look for top plug to land. Pump calculated volume plus 14 bbls for compressibility. If there is still no indication of plug bumping pump 1/2 shoe track volume the shut down.
33. Zone Seal specialist to be on rig floor to bleed off pressure and check floats.
34. Release running tool and P/U one stand. Upon breaking connection place wiper ball in connection and pump through landing string.

# HALLIBURTON

## Cost Estimate

## 9 7/8" X 7" Production Casing

SAP Quote # 0

Mtrl Nbr	Description	Qty	U/M	Unit Price	Net Amt
7523	CMT PRODUCTION CASING BOM	1	JOB		0.00
	***Spacer Material***				
483826	TUNED SPACER III	92	BBL	122.28	11,249.76
100003664	DUAL SPACER SURFACTANT A	56	GAL	91.32	5,113.92
100003665	DUAL SPACER SURF. B	56	GAL	42.88	2,401.28
101235090	SEM-8	56	GAL	47.45	2,657.20
101492086	WELL LIFE 734	118	LB	4.10	483.80
	***Cement Material***				
100003687	PREMIUM CEMENT	230	SK	14.72	3,385.60
101002314	EZ-FLO	16	LB	10.57	169.12
101007446	D-AIR 3000	55	LB	4.31	237.05
100001585	KCL POTASSIUM CHLORIDE	433	LB	0.55	238.15
100003691	SAND-200 MESH SILICA FLOUR SSA-1	4324	LB	0.24	1,037.76
100003676	SAND-COMMON WHITE-100 MESH, SSA-2	33	SK	24.28	801.24
100009911	SA-541 SUSPENDING AID -	46	LB	13.20	607.20
101207218	ZONESEALANT 2000	26	GAL	77.25	2,008.50
100012238	SCR-100 L	21	GAL	76.65	1,609.65
	***Personnel***				
130443	ZONESEAL CERTIFIED SPECIALIST H/DAY/MO	1	H	145.24	13,943.04
	TOTAL NUMBER	96			
	HR/DAY/WEEK/MTH/YEAR/JOB/RUN				
576784	CMT, Offshore Engineer, per hr	1	EA	134.32	12,894.72
	HOURS	96			
	***Equipment***				
583768	CMT, Foam Cmt Base Rate(3-day)-SORAC	1	EA	24,295.68	24,295.68
583769	CMT, Addl Day Foam Cmt Day Rate-SORAC	5	DAY	3,100.45	15,502.25
	Total	USD			98,635.92

# HALLIBURTON

## SAP Quote # 0

Mtrl Nbr	Description	Qty	U/M	Unit Price	Net Amt
342210	N2 BOM-Foam Cementing w/o CT	1	JOB		0.00
13459	Nitrogen Charge	70748	SCF	6.60	4,669.37
	***Personnel***				
576758	CMT, Equipment Optr, per hr	2	EA	46.62	8,951.04
	HOURS	96			
	***Equipment***				
583772	CMT,N2 Base Rate(3day)Foam Cmt Job-SORAC	1	EA	31,745.54	31,745.54
583773	CMT,Addl N2 Day Rate Foam Cmt Job-SORAC	5	DAY	8,056.40	40,282.00
583837	CMT,Addl 100ft N2 Iron, ZI Foamed-SORAC	8	DAY	300.00	2,400.00
	Total	USD			88,047.95

# HALLIBURTON

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## Conditions

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### NOTE

The cost in this analysis is good for the materials and/or services outlined within and shall be valid for 30 days from the date of this proposal. In order to meet your needs under this proposal with a high quality of service and responsive timing, Halliburton will be allocating limited resources and committing valuable equipment and materials to your area of operations. Accordingly, the discounts reflected in this proposal are available only for materials and services awarded on a first-call basis. Alternate pricing may apply in the event that Halliburton is awarded work on any basis other than as a first-call provider.

The unit prices stated in the proposal are based on our current published prices. The projected equipment, personnel, and material needs are only estimates based on information about the work presently available to us. At the time the work is actually performed, conditions then existing may require an increase or decrease in the equipment, personnel, and/or material needs. Charges will be based upon unit prices in effect at the time the work is performed and the amount of equipment, personnel, and/or material actually utilized in the work. Taxes, if any, are not included. Applicable taxes, if any, will be added to the actual invoice.

It is understood and agreed between the parties that with the exception of the subject discounts, all services performed and equipment and materials sold are provided subject to Halliburton's General Terms and Conditions contained in our current price list, (which include LIMITATION OF LIABILITY and WARRANTY provisions), and pursuant to the applicable Halliburton Work Order Contract (whether or not executed by you), unless a Master Service and/or Sales Contract applicable to the services, equipment, or materials supplied exists between your company and Halliburton, in which case the negotiated Master Contract shall govern the relationship between the parties. A copy of the latest version of our General Terms and Conditions is available from your Halliburton representative or at:

<http://www.halliburton.com/terms> for your convenient review, and we would appreciate receiving any questions you may have about them. Should your company be interested in negotiating a Master Contract with Halliburton, our Law Department would be pleased to work with you to finalize a mutually agreeable contract. In this connection, it is also understood and agreed that Customer will continue to execute Halliburton usual field work orders and/or tickets customarily required by Halliburton in connection with the furnishing of said services, equipment, and materials.

Any terms and conditions contained in purchase orders or other documents issued by the customer shall be of no effect except to confirm the type and quantity of services, equipment, and materials to be supplied to the customer.

If customer does not have an approved open account with Halliburton or a mutually executed written contract with Halliburton, which dictates payment terms different than those set forth in this clause, all sums due are payable in cash at the time of performance of services or delivery of equipment, products, or materials. If customer has an approved open account, invoices are payable on the twentieth day after date of invoice.

Customer agrees to pay interest on any unpaid balance from the date payable until paid at the highest lawful contract rate applicable, but never to exceed 18% per annum. In the event Halliburton employs an attorney for collection of any account, customer agrees to pay attorney fees of 20% of the unpaid account, plus all collection and court costs.