OCS Report
MMS 2001-010

Investigation of Crane Accident and Injury
South Timbalier Block 185
OCS-G 1569
March 21, 2000

Gulf of Mexico
Off the Louisiana Coast

MMS

U.S. Department of the Interior
Minerals Management Service
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Jack Leezy
Freddie Mosely
David Dykes

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

New Orleans
January 2001

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Investigation and Report

Authority

An accident that resulted in one injury occurred on Louisiana Land and Exploration Company's (LL&E) Platform A, South Timbalier Block 185, Lease OCS-G 1569 in the Gulf of Mexico, offshore the State of Louisiana, on March 21, 2000, at approximately 2225 hours. Pursuant to Section 208, Subsections 22 (d), (e), and (f), of the Outer Continental Shelf Lands Act, as amended in 1978, and the Department of the Interior Regulations 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated April 13, 2000, the following MMS personnel were named to the investigative panel (panel):

Jack Leezy, Office of Safety Management, New Orleans, Louisiana (Chairman)

Freddie Mosely, Houma District, Houma, Louisiana

David Dykes, Office of Safety Management, New Orleans, Louisiana

Data Collection and Interviews

On March 22, 2000, a panel member flew to the incident location to gather information, take pictures of the scene, and interview personnel on location, thus initiating MMS's investigation of the incident. Two Incidents of Non-compliance were issued at this time.

On March 23, 2000, a panel member revisited the incident scene to continue gathering information and interviewing personnel.

On March 27, 2000, MMS personnel visited the Applied Hydraulics yard in Houma, La. and took pictures of the crane after it had been recovered from the seafloor.

On April 04, 2000, panel members visited the Applied Hydraulics yard in Houma to examine the crane in further detail.

On April 10, 2000, panel members revisited the Applied Hydraulics yard to locate serial numbers on the crane for the purpose of determining manufacturer and model. The panel members also discussed the mechanics of the hydraulic unloading system on the crane.

On April 18, 2000, a panel member revisited the incident location to gather copies of the annual inspection records of the crane.

On April 20, 2000, panel members revisited the Applied Hydraulics yard to re-examine the crane and to discuss winch loads and crane design with Applied Hydraulics personnel.

On May 10, 2000, a panel member visited the Applied Hydraulics yard to examine and take pictures of the recovered load block.

On August 2, 2000, a panel member revisited the incident location to obtain a copy of the load rating chart from the crane records.

On October 25, 2000, panel members revisited the Applied Hydraulics yard once again in an attempt to locate serial numbers for the purpose of determining the crane manufacturer and model.

To aid in the investigation, the panel requested and received various documents from Burlington Resources, Crown Oilfield Services, Applied Hydraulics, Allied Systems, Energy Operators, Tidewater Marine, and Hydraulic Well Control.

During the course of the investigation, the following personnel were interviewed:

Position	Company
Regional Drilling Engineer	Burlington Resources
Production Supervisor	Burlington Resources
Onsite Supervisor	Energy Operators
Operations Supervisor	Applied Hydraulics
Production Foreman	Baker Energy
Captain - M/V *Gate Dancer*	Tidewater Marine
General Manager	Crown Oilfield Services
Training Manager	Crown Oilfield Services
Relief Crane Operator	Crown Oilfield Services
Day Crane Operator	Crown Oilfield Services
Night Crane Operator	Crown Oilfield Services
ST 185/190 Lease Operators (6)	Baker Energy
Snubbing unit personnel	Hydraulic Well Control
Safety Representative	OSCA Services
Fourchon Yard Manager	Diamond Tank Rental
Technical Representative	Allied Systems Company

The panel made numerous attempts to interview the riggers involved in this incident. However, the riggers were no longer employed by Crown Oilfield Services and the attempts to contact them were unsuccessful. The panel's analytical techniques involved the use of a Management Oversight and Risk Tree, Event and Causal Factors Chart, and a Hazard Barrier Target chart.

Lease Information

Background

Lease OCS G-1569 covers approximately 5,000 acres and is located in South Timbalier Block 185, Gulf of Mexico, off the Louisiana coast. *For lease location, see Attachment 1*. The lease was issued effective July 01, 1967; LL&E became the designated operator of the lease on December 09, 1996. Burlington Resources (Burlington) has assumed operatorship of this lease because of a merger with LL&E; however, MMS records do not reflect Burlington as the designated operator.

Description of Platform

Platform A was installed in January 01, 1973, in 180 feet of water. This platform is a six-legged conventional type structure, with a complete production process system that processes the production from the six wells located on the platform. The wells were shut-in for the snubbing unit work that was being performed. The platform's deck space was limited, as the top deck measures 120 feet by 72 feet with process equipment and a 10-man living quarters.

Introduction

Brief Description of Accident

The crane boom was lowered to a position of near 0 degrees in an attempt to reposition a completion fluid tank located on the deck of the motor vessel *Gate Dancer*, to accommodate the offloading of snubbing pipe. As the tank was lifted off the deck approximately 6 feet, the ball ring for the crane failed, resulting in the crane falling along with the Crane Operator to the deck of the *Gate Dancer*. The Crane Operator received injuries that required hospitalization and surgery.

Contractors

There were six contractors involved in the snubbing operation. The contractors are listed as follows:

- Crown Oilfield Services Inc. – Provided crane operators and riggers for the snubbing operation.
- Energy Operators Inc. – Provided the onsite supervisor/consultant to act as Burlington's representative.
- Tidewater Inc. – Provided the vessel support services for the snubbing operation.
- OSCA Inc. – Provided the completion fluid and necessary personnel for the snubbing operation.
- Hydraulic Well Control Inc. (HWC) – Provided the snubbing unit and personnel necessary to conduct the snubbing operation.

- Offshore Warriors – Provided onsite dispatching services and clerical support.

Baker Energy Inc. provided production personnel to Burlington for production operations outside of the well workover operations. This contractor had personnel on the platform at the time of the incident; however, they were not involved in the operations at the time of the incident.

Findings

Personnel

Regional Drilling Engineer

Burlington's Regional drilling engineer, henceforth referred to as the Engineer, was tasked with the responsibility of designing a well workover project for Well A6 utilizing a snubbing unit. The Engineer also managed the coordination of all associated work with the help of the on-site supervisor. In the development of the project, there was no formal hazard or risk analysis performed to identify hazards/risks to eliminate or reduce them to the lowest acceptable level. Additionally, there were no job safety analyses (JSA) performed to ensure that all work would be performed in a safe and workmanlike manner. The Engineer placed the responsibility of safe operations on the On-site Supervisor. Furthermore, this was the Engineer's first project using a snubbing unit on an offshore facility.

On-site Supervisor

The on-site supervisor, an employee of Energy Operators, henceforth referred to as the Supervisor, was contracted to Burlington as one of the Supervisors for the project. This supervisor has been on contract to Burlington for several years; his working schedule was seven days on followed by seven days off. His responsibilities were to oversee all on-site activities on the facility, which included the safe working of all personnel. He has received mandatory training of API RP T-1 and T-3

training, in addition to first aid, CPR, and other safety training courses. Burlington had designated the Supervisor as the onsite Incident Commander for all emergencies on his tour. Burlington's *Employee Environmental, Health, and Safety Handbook* (safety handbook) requires an initial training of 24 hours for incident commander training followed by an 8-hour annual refresher. The Supervisor has not had any of the Burlington incident commander training as required. Additionally, the Supervisor claims to have had over 2,000 hours of supervisory training, but cannot produce any documentation of such training. The Supervisor stated during the interview that there was concern by the Day Crane Operator of the Night Crane Operator's lack of experience (less than one year) and ability to perform his assigned duties. The Engineer revealed during the interview that Burlington had received complaints about the Supervisor in past years. The Supervisor allegedly created an unsafe and stressful work environment by the demands he imposed on the workers. Interviews with other personnel involved in this incident revealed that the Supervisor created a stressful work environment on this job.

Day Crane Operator

The day crane operator, an employee of Crown Oilfield Services, henceforth referred to as the Day Crane Operator as assigned, arrived on location after a scheduled crew change on Sunday, March 19, 2000.

This was his first tour on this facility, and after arriving he received a generalized safety briefing of the facility. The Supervisor or his designee never explained to the Day Crane Operator his role or duties as Day Crane Operator as prescribed by Burlington's safety handbook. The Day Crane Operator has 33 years of experience in the operation of cranes. He has been employed by Crown Industries for a period of one year. The Day Crane Operator was the lead crane or senior operator for the operation. The Day Crane Operator did not receive the Burlington Pre-use Hydraulic Crane Preventative Maintenance Plan upon his arrival to the facility or be made aware of any such documentation. The Day Crane Operator stated that he conducted regulatory required daily pre-use inspections; however, there was no formal documentation. The Day Crane Operator stated during the interview that he was instructed on one occasion by the Supervisor to operate the crane during inclement weather. (Note – The crane is not equipped with a cab to protect the operator from the elements to ensure safe operation of the crane. Further, the Day Crane Operator wears corrective eyewear to perform his job.)

Night Crane Operator

On March 19, 2000, an employee of Crown Oilfield Services, henceforth referred to as the Night Crane operator as assigned, arrived on location after a scheduled crew change. This was his first tour on this facility, and after arriving he received a generalized safety briefing.

The Supervisor or his designee never explained to the Night Crane Operator his role or duties as Night Crane Operator as prescribed by Burlington's safety handbook. The Night Crane Operator had less than one year of experience as a crane operator. The Night Crane Operator did not receive the Burlington Pre-use Hydraulic Crane Preventative Maintenance Plan upon his arrival to the facility or be made aware of any such documentation. The Night Crane Operator stated that he conducted regulatory required daily pre-use inspections; however, he did not complete any formal documentation.

Both the Day and the Night Crane Operators stated in their interviews that they were not familiar with Burlington's Contractor Safety & Environmental Guidelines for Offshore Operations. This document states, in part: "Ensure all employees, and subcontractors are familiar with and follow not only these, but other Burlington Resources guidelines which are applicable to the work being performed." The Day Crane Operator and the Night Crane Operator both advised the Supervisor on several occasions of the poor performance of the crane.

Relief Day Crane Operator

The Relief Day Crane Operator, an employee of Crown Oilfield Services, henceforth referred to as the Relief Crane Operator as assigned, worked opposite of the Day Crane Operator. The Relief

Crane Operator was the initial crane operator at the start of this project. He has approximately 16 years of experience operating offshore cranes. The Relief Crane Operator stated that he conducted regulatory required daily pre-use inspections and he did complete the forms and give them to the On-site Supervisor.

It should be noted that the crane operators are all qualified as per API RP 2D – Recommended Practice for Operation and Maintenance of Offshore Cranes.

Master of M/V Gate Dancer

The Master of the M/V *Gate Dancer*, henceforth referred to as the Master, is an employee of Tidewater Marine Inc. The Master has approximately 10 years of experience on 100-ton vessels. The Master stated during the interview that sea conditions at the time of the incident were approximately 3- 4 feet. He arrived on location the morning of the incident. The Master stated that in his attempts to accommodate the movement of the tank as directed by the Night Crane Operator, he attempted to reposition the vessel closer to the platform. Discussions between the Master and the Night Crane Operator by radio on the Master's inability to reposition the vessel because of the wind and sea conditions were interrupted by the Supervisor. The Supervisor directed the Master to either position the vessel as directed or return to

shore and a master would be obtained that could perform the task. It was at this time that the Master informed the Supervisor that he could move back to the original position prior to the request of the Night Crane Operator. The Night Crane Operator radioed back to the Master after repositioning and stated that he would attempt to lift and turn the tank 90 degrees.

Crane Maintenance

The panel has been unsuccessful in making a positive identification of the manufacturer or model of the crane involved in the incident. There are several cranes similar to this one manufactured by various crane manufacturers; however, the panel was unable to locate serial numbers on the unit to make a positive identification. Burlington has made no attempt to determine the manufacturer of the crane.

When the crane was recovered from the bottom of the Gulf, the load chart was not attached. The load chart located in the platform crane inspection records indicates that the load chart was generated as per API SPECIFICATION 2C – Specifications for Offshore Cranes. (Note – Although the manufacturing date is unknown, the crane was installed in 1977 prior to the original development and publication of the API 2C specifications (1983). The load chart found in the records was generated by Diversified Oilfield Services (DOS), Inc. *For a copy*

of the load chart, see Attachment 2.

The last annual inspection, dated February 12, 2000, by Applied Hydraulics indicated a gap of 0.014 inches between the ball ring flange and top of the turret on the sides where there are no bolts. This measurement is not a measurement of the ball ring deflection as required by API RP 2D; however, it is an indication that a gap has been noted between the turret and the ball ring. (The ball ring does not meet the specifications of API Specification 2C [1983] edition.) The crane mechanic noted in the inspection report that this gap should be monitored for increase on a monthly basis.

A crane inspection on March 09, 2000, by American Aero Cranes included a ball ring deflection over the deck with a measurement of 0.034 inches indicated. A deflection measurement of 0.044 inches was indicated over the water. These measurements were determined to be within tolerance according to the American Aero personnel.

The crane inspection on March 17, 2000, by Wadleigh Offshore Inc. indicated that the main hoist cable was changed out. The crane was load tested to 33,000 pounds. The crane mechanic noted in the report that two of the sheaves in the boom tip were bad. The report also noted that the crane's dead-end connection needed to be replaced. (Note: No

other reports indicate that the sheaves or the dead-end connection were repaired or replaced.)

Applied Hydraulics conducted a crane inspection on February 19, 1999. The crane was load tested to 41,000 pounds at 25 feet radius and 75^{o} boom angle with a 5/8 inch 19x7 wire rope. (Note: The radius of 25 feet does not match the load chart for a 75^{o} boom angle. According to the load chart [generated by DOS and maintained in the crane records], the radius should be 15 feet.

A crane inspection conducted on June 21, 1996, by Louisiana Land and Exploration Company (LL&E) indicated that a load test to 31,000 pounds was conducted. The test indicated a 19 foot radius at a 77^{o} boom angle using a 5/8 inch 19x7 wire rope in a five-part configuration.

The load chart for the main hoist identifies static and dynamic capacities for two-part, three-part, and four-part reeving. Capacities for the main hoist are only identified in the four-part category. The capacities on the upper end of the scale (high boom angle and short radius) are incorrect. The published numbers appear to be calculated for five-part reeving of 5/8 inch 19x7 wire rope (nominal breaking strength of 33,600 pounds with a 5:1 safety factor). For a four-part

reeving of 5/8 inch 19x7 wire rope, the maximum load capacity calculates out to 26,880 pounds.

Operational History of the Crane

The investigation revealed that Burlington attempted to operate the crane outside of the designed working limits. During the month of November 1999, personnel unsuccessfully attempted to move a quarters building with a weight of approximately 20,000 pounds. The hydraulic unloading system that is designed to prevent overloading of the crane prevented the lifting of the quarters. An inspection was requested of the crane, along with a load test. It was determined at this time that the lift was outside the designed weight limitations of the crane for the angle and radius for the lift. The weight limitation at this angle and radius was 18,000 pounds.

The Relief Crane Operator stated in the interview that he made a lift of approximately 25,000 pounds 9-10 days prior to the failure of the crane. He stated that the lift was slightly outside the designed weight limitations of the crane. He recommended reconfiguring the load line to a six-part line to increase the lifting capability. He stated that he was instructed by the supervisor in charge at that time to make the lift and not to worry about it. The decision to continue with the lift outside of the designed weight limitations was in violation of both Burlington and Crown's safety manuals and API RP 2D. The Relief Crane Operator

informed the panel of other operational issues regarding the crane. Those include the following:

- The configuration of the control handles was unique to this crane and not the typical control configuration as other cranes he had operated. *For pictures of the control handles, see Attachment 3.*
- The crane would rock on the pedestal at high boom angles.
- The operation of the crane was not smooth.

Additionally, these issues were conveyed to the On-site Supervisor.

During the course of the interviews with various platform personnel, all stated that they had experienced similar problems while operating the crane.

Tank Markings

Burlington's safety handbook states: "All loads in excess of 5,000 pounds to be lifted by a crane offshore should, if possible, have the weight of the load clearly marked on the load before the load leaves the shore base as a precaution against overloading the crane."

The tank involved in this incident was a 25-barrel tote tank owned by Diamond Tank Rentals. *For picture of the tank, see Attachment 4.* The empty weight of the tank was 4,080 pounds. This weight is marked on the manufacturer's plate located on the inside support leg of the tank.

For picture of the manufacturer's plate, see Attachment 5. At the time of the incident, the tank was filled with Calcium Bromide ($CaBr_2$). The density of the $CaBr_2$ was 14.2 pounds per gallon. This calculates to 14,910 pounds of $CaBr_2$ with a total weight of 18,990 pounds. The tank involved in this incident and other numerous pieces of equipment were not marked with the associated lift weight.

Safety Manuals

Burlington does not have a fully integrated safety and environmental management program as recommended by MMS.

Both Burlington and Crown's safety manuals are in opposition to API RP 2D. API RP 2D states in part, "No fewer than five (5) full wraps of rope will remain on the drum(s) in any operating condition." Burlington's safety manual states in part, "During operation, there shall always be at least four wraps of cable on the winch drum." Crown's safety manual states in part, "There should be at least two wraps of cable on the drum at all times when operating."

Sequence of Events to the Accident

Night Crane Operator discusses work to be performed prior to the start of his shift with Day Crane Operator. They discuss the necessity to move tank to offload pipe, the tank weight, and crane boom angle.

Night Crane Operator starts offloading pipe to the *Gate Dancer* and

rearranging other cargo located on the *Gate Dancer* to accommodate more pipe.

Night Crane Operator radios Master to reposition vessel in order to relocate tank to accommodate more pipe.

The Master attempts to reposition vessel sideways to platform. Master radios back to Night Crane Operator that he is having trouble repositioning vessel because of current and wind conditions.

Supervisor overhears conversation on the radio between Night Crane Operator and Master. Supervisor intervenes and tells Master to return to base if he can't hold position and the Supervisor will get someone who can.

Master advises that he can reposition vessel back to its original position and was only attempting to honor the request of the Night Crane Operator.

Supervisor orders Night Crane Operator to quit moving cargo around on deck of vessel and continue offloading pipe.

Master repositions vessel back to its original position and then moves

closer to platform.

Night Crane Operator radios to Master that vessel is too close to platform and he cannot see tank from the crane operator's station. Master positions vessel farther away from platform.

Night Crane Operator radios Master of his intentions to rotate tank 90 degrees to allow the offloading of pipe and to advise riggers located on the vessel.

Night Crane Operator lowers boom angle to near zero degrees and lowers block in preparation to pick up tank. At boom angles less than four degrees, the hydraulic unloading system cannot function.

Riggers attach slings to tank and signal Night Crane Operator to pick up tank.

Night Crane Operator raises tank approximately 6 feet off deck. Ball ring on crane snaps in four places and crane and operator fall onto deck of vessel. *For pictures of the ball ring, see Attachment 6.*

Riggers move Night Crane Operator away from wreckage to safety.

Crane falls off the side of vessel and hangs from rigging over side of vessel.

Personnel from platform board boat and administer first aid and move the Night Crane Operator back to platform and prepare for medical helicopter flight.

Night Crane Operator is flown to Terrebonne General Hospital and undergoes surgery for his injuries.

On the following day personnel use torch to cut load line from crane and crane sinks to Gulf floor.

Conclusions

Causes

During the course of the investigation, the Panel detected numerous immediate causes and underlying causes that are factors in this incident that, by themselves, do not lead to the conditions that ultimately caused the event; however, the factors facilitated the occurrence of the event or increased its severity.

Immediate causes

Immediate causes are categorized as either technical failure or human error and are listed in no particular order.

- The Night Crane Operator operated the crane outside of the designed limitations of the crane by
    1. Picking up weight outside the safe load limitations of the crane as indicated on the load chart.
    2. Not knowing that the hydraulic overloading system cannot function at boom angles less than four degrees.
- The Night Crane Operator had minimal experience.
- The On-site Supervisor failed to recognize hazards or ignored them.

Underlying causes

The underlying causes included personnel factors, capability, knowledge and skill, stress, improper motivation, job factors, organizational structure, management and supervision.

- The On-site Supervisor created a stressful work environment in that he placed productivity above safety.
- Burlington failed to ensure that all onsite supervisors adhere to the guidelines set forth in Burlington's *Contractor Safety & Environmental Guidelines for Offshore Operations*.
- Burlington failed to perform a job hazards analysis of the well workover operation during the planning stages of the job. (Note – This should have included historical incidents that involved snubbing operations.) Burlington experienced a similar crane failure incident on July 19, 1996, during similar snubbing operations with HWC on Eugene Island 196 C platform.
- Burlington failed to perform a job safety analysis.
- The crane does not meet API Specification 2C specifications, as the crane was designed and built prior to the development of the first edition of API Specification 2C (1983).
- Burlington failed to follow the recommendations as noted in their safety manual on the marking of equipment with the weight.
- Burlington failed to ensure that daily crane inspections were performed by not providing their Pre-use Hydraulic Crane Preventive Maintenance Plan to the contract crane operators.

Recommendations

Safety Alert

MMS should issue a Safety Alert on the referenced incident to heighten the awareness to the current specifications of API Specification 2C. Specifically, attention should be directed to the current recommended ball ring design criteria and to those cranes manufactured under a different design criterion.

Other issues that should be included in the Safety Alert are the following:

- Control handle configuration
- Adherence to manufacturer's recommended maintenance
- Accuracy of the load charts
- Adherence to all safety policies and recognized standards

Annual Performance Review

MMS should stress to each operator during the annual performance reviews the critical role that the on-site supervisor plays in implementing an effective safety program.

Regulatory Change

MMS should incorporate by reference API Specification 2C into the regulations.

Study

MMS should audit/count/inventory the number of pre-API 2C cranes still in use in the Gulf of Mexico. All pre-API 2C cranes that do not meet 2C design specifications should be either upgraded or

decommissioned.

Location of Lease OCS-G 1569 South Timbalier Block 185

Attachment 1

LOAD CHART

Nautilus 60B4000N
S/N 1068
60' Boom

MAIN HOIST ROPE = 5/8 19 x 7 950'
AUX. HOIST ROPE = 5/8 19 x 7 400'
MAIN LOAD BLOCK WEIGHT= 600 lbs.

LL&E
LL&E
ST185 A

	MAIN HOIST						AUXILLIARY HOIST	
BOOM ANGLE	RADIUS OF LOAD (FT)	TWO (2) PART REEVING		THREE (3) PART REEVING		FOUR (4) PART REEVING		ONE (1) PART REEVING	
		STATIC CAPACITY	DYNAMIC CAPACITY	STATIC CAPACITY	DYNAMIC CAPACITY	STATIC CAPACITY	DYNAMIC CAPACITY	STATIC CAPACITY	DYNAMIC CAPACITY
85	5					33,600	33,600	6,720	6,720
75	15					33,600	33,600	6,720	6,720
60	30					29,550	19,503	6,720	6,720
50	40					22,800	15,048	6,720	6,720
45	42					21,750	14,355	6,720	6,720
30	52					17,500	11,550	6,720	6,720
0	60					11,000	7,260	6,720	6,720

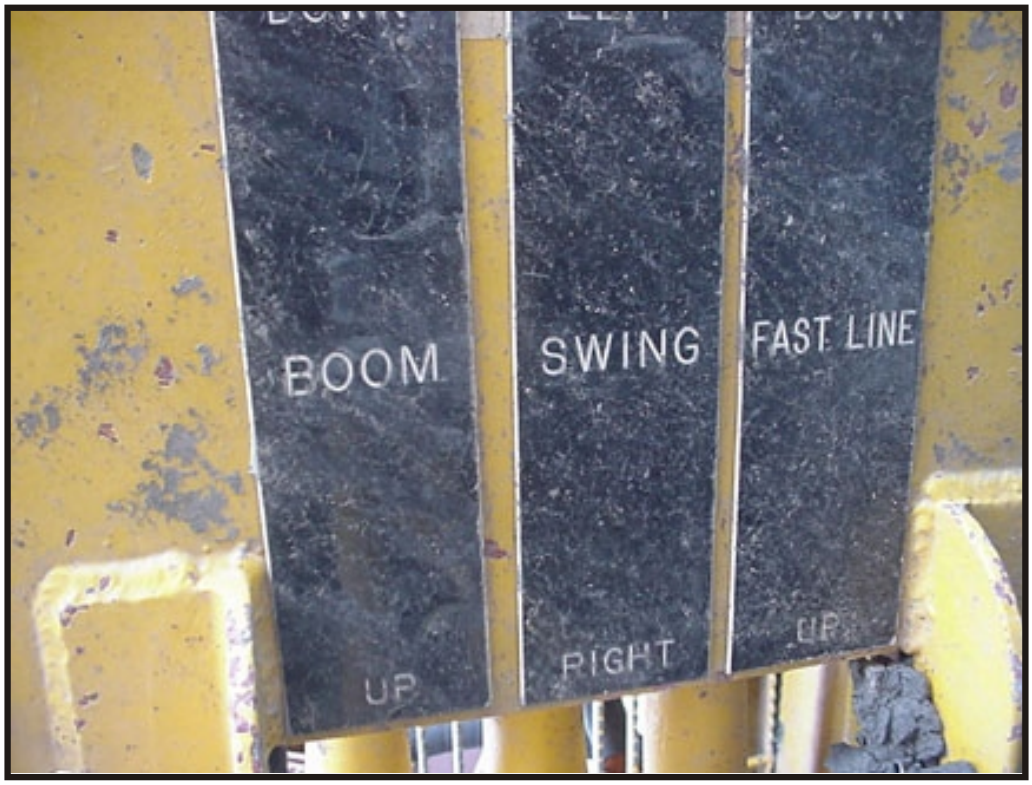
CAPACITIES SHOWN ABOVE DO NOT INCLUDE WEIGHT OF HOOK BLOCK OR RIGGING
* PER API 2C OFFSHORE CRANES

DIVERSIFIED OILFIELD SERVICES, INC.
(504) 892 - 1338 FAX 892 - 1270

Load Chart Found in South Timbalier Crane File

Attachment 2

Attacnment 3

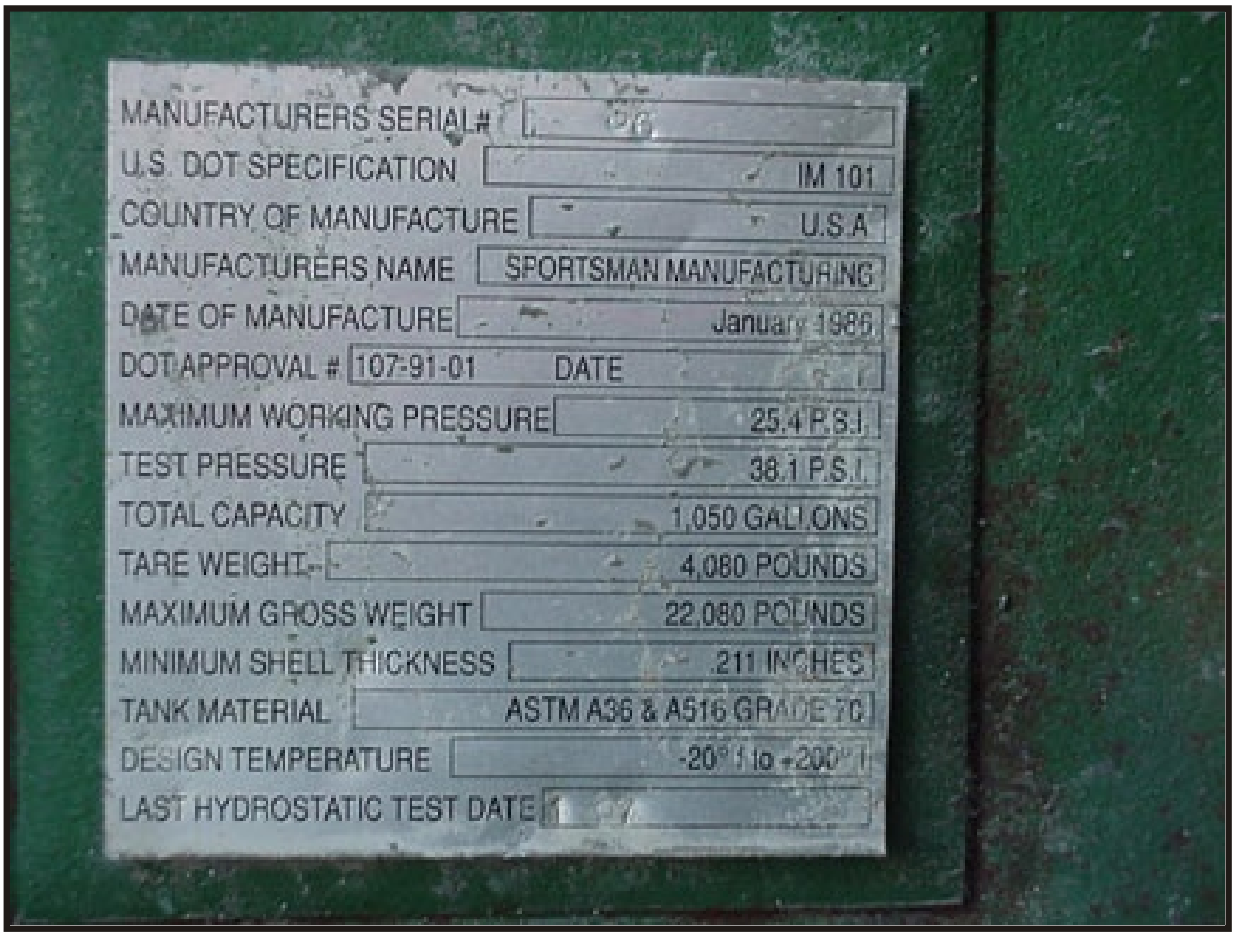


Photographs of Control Handles - ST185 Crane

Attacnment 4

Photograph of Diamond Tank Rental 25-Barrel Tote Tank

Attacnment 5



Photograph of Tote Tank Manufacturer's Identification Plate