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TREASURY DEPARTMENT
UNITED STATES COAST GUARD

ADDRESS REPLY TO:
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Headquarters
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13 July 1966

MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Subject: Floating Drill Rigs

1. Purpose: To advise Merchant Marine Technical Units of current standards and criteria applicable to plan review of floating drill rigs.

2. Background:

a. Floating structures, self-propelled and non-self-propelled are becoming more numerous and are being used for an increasing number of purposes in both foreign and domestic waters. Although this technical note deals primarily with floating drill rigs, much of the information will apply to platforms and vessels of similar characteristics.

b. Rules and Regulations for Cargo and Miscellaneous Vessels (CG-257), pertinent portions of Marine Engineering Regulations (CG-115) and Electrical Engineering Regulations (CG-259) are generally applicable to self-propelled floating drill rigs of 300 gross tons and over and non-self-propelled floating drill rigs over 100 gross tons (seagoing barges). The provisions of SOLAS 1960 are applicable to floating drill rigs if self-propelled, 500 gross tons and over and engaged on international voyages. Certain portions of the regulations are not directly applicable to drill rigs and the regulations do not cover some of the special problems. Study is being given to developing regulations specifically for industrial vessels, including drill rigs.

c. Mobile drill rigs which drill only in the bottom bearing mode, such as the "jack up" or "submersible" type do not presently come under inspection as vessels. The Coast Guard imposes limited requirements on these structures which may be found in the Rules and Regulations for Artifical Islands and Fixed Structures on the Outer Continental Shelf (CG-320).

3. Action: The following appendicies address themselves to those characteristics of drill rigs which are different from ordinary cargo vessels and barges. Rigs using conventional hulls, including twin hulled (catamaran type)

vessels should conform to applicable regulations and classification society standards with regard to their hull construction and conventional hull equipment. The following deals with the unusual aspects of drill rigs and should be interpreted as a summary of experience which can be used as guidance in the review of future rigs.

J. B. McCARTY, Jr.

Encl:
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APPENDIX A TO MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Safety

I. Emergency Shutdown Equipment

1. Recently increased attention has been focused on the design aspects of drill rigs to enable operators to best cope with major emergencies. Even though good practice on one rig is not necessarily good practice on another, there are some design features which have general application. In the case of a blowout, operators have indicated the best action is first to try to control the well; and if that fails, then either abandon the rig or in some instances attempt to move off location. An investigation of a major casualty involving a catamaran type of rig revealed that in the particular instance of a catamaran rig (low to the water) and an uncontrollable burning blowout, an ability to move off location with mooring tension might have saved lives. It should be noted that moving off location involves "breaking" the well head and almost certain ignition of gases if ignition has not already taken place.

2. From the foregoing, it appears a "dead ship" switch is desirable during the phases when the well is being brought under control or the rig being abandoned. This switch should shut down everything including all electrical equipment, diesels and prevent the emergency generator from coming on the line. If for a given rig configuration it was desired to include in the design an ability to move quickly off the drilling location, fire would be assumed to be present and complete shutdown would not be of immediate importance. Therefore, the devices for releasing mooring cables or chains need not necessarily be "ignition proof".

II. Closure and Tightness

1. To the maximum extent possible, the area adjacent to the well head is to be free of openings through which gases or water can enter the hull structure. Any such openings which are absolutely necessary should be equipped with quick acting closing devices.

III. Ventilation

1. Special attention should be given to ventilation intake and exhaust locations and air flow. Intakes should be located high and as far away from the well head as possible -- and in any event at least 50 feet distant (measured horizontally).

2. Hazardous areas such as spaces containing mud pits should be maintained under a negative pressure by providing a higher exhaust capability than intake or a forced exhaust with a natural intake. On some rigs, multiple intakes and exhausts or a capability to reverse air flow may increase the overall effectiveness of the ventilation system by making use of the prevailing wind direction.

3. Living and work spaces which are free of possible gas emitting apparatus should be maintained under a positive pressure whenever practicable to lessen the chance of gases entering the spaces.

IV. Removal of Ignition Sources

1. In addition to the provision for a "dead ship" switch, drill rigs should be designed to minimize other possible sources of ignition. The type of galley equipment and other miscellaneous equipment should be reviewed with this thought in mind.

V. Casualty Control Stations

1. There should be at least two central control points, one to be as remote from the other as practicable. Due to the nature of the drilling operation, one such control point should be at the drilling console. Each of these central control points should be fitted with a general alarm switch, sound powered phone communications to key points and a P. A. system microphone.

APPENDIX B TO MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Hull

I. Structure

1. A partial list of sources of information on various structural designs is included in appendix F.

2. Drill rigs have been the object of numerous design studies. These studies range from simple direct two dimensional analyses to very sophisticated three dimensional analyses. Techniques such as two dimensional moment distribution and pin ended truss analysis are commonly used. Allowables or design stresses are taken from recognized handbooks or engineering design standards. Designers should be required to include references by page and paragraph number to the sources of formulation for design calculations and standards.

3. Depending on the particulars of the rig under consideration, all or part of the following information should be presented:

   a. Analysis of the structure taking into consideration the following loads:

      (1) dead loading

      (2) hydrostatic loading

      (3) mooring loads (may govern major scantlings in certain cases)

increased to approximate the effects due to:

      (1) dynamic wave loading*

      (2) wind induced loads on the derrick tower in a heeled condition as transmitted into the deck structure

      (3) increased loads on structural members due to heel

4. Although the certificate for a floating drill rig with the dual capability of drilling both while floating and in the bottom bearing mode is in effect only while the rig is floating, an analysis may be appropriate to show the effects of an accidental grounding.

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*~~A significant wave height of 50 ft~~. is recommended as a minimum design standard. The most adverse wavelengths and angles of approach should be assumed. Large torsional moments may be induced in some rigs depending upon the angle at which the waves hit them.

APPROX 60' MAX HT FOR GULF

5. Most drill rigs include a system of columns, braces and diagonals which require considerable care in joint design. Detailed plans showing joint and welding details should be provided. Members should be checked for possible failure due to buckling. If special steels are used, weld procedure qualification should be required in accordance with the procedures outlined in Subchapter F, "Marine Engineering Regulations".

6. It is important that low air and water temperature effects be considered in the choice of materials and design. Alaskan waters and North Sea sites are currently thought to be possible locations for extensive drilling operations. Transition temperatures of materials used should be considered.

7. It may be rightly argued that the design techniques applied by many designers to drill rigs are crude and very approximate. For example, column stabilized rigs are almost "transparent" to wave action due to a minimum waterplane area. Inertial and drag forces then become important. To determine the force inputs requires a knowledge of the energies and characteristics of various sea states. This is information not readily available and not easy to use. Refining the structural analysis involves a three dimensional approach which is generally not practical for hand solutions. The history of platforms in service today indicates, however, that less sophisticated approaches coupled with healthy safety margins result in adequate structures, as major structural failures on floating rigs infrequently occur. As high strength steels become more prevalent in rig designs, the margin of safety will necessarily reduce. Thus, more sophisticated approaches in the future seem to be indicated.

II. Structural Fire Protection

1. Due to the large number of exempted spaces and the variance in design between rigs of various configurations, gross tonnage is not a good criterion for determining the requirements for structural fire protection. Rigs of relatively low gross tonnage may have large crews and extensive accommodation areas. In such cases, the structural fire protection standards of 46 CFR 92.07 should be strongly encouraged. Future regulation is envisioned which will require compliance with this Subpart.

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2. Research or drilling platforms with large numbers of persons on board and rigs carrying special category persons such as scientists or students should be considered as special cases. Portions of 46 CFR 72.05 should be applied as appropriate to the rig configuration. Special cases of this nature may be referred to the Commandant for policy guidance.

III. Fire Fighting Water Supply

1. On some rigs, the height to which it is necessary to pump water for fire fighting purposes is extreme. As a result, installations have included a tank at an intermediate height in which water is kept at a prescribed level ready for use at all times in case of a fire. The fire pump(s) can then be located in an accessible position high in the "vessel" with the tank(s)

offering a convenient suction for fire fighting water. If this arrangement is used, the intermediate tank(s) should be of such size and operated so that the lowest water level permitted will assure that the supply of water is adequate for two hoses at a minimum of 50 psi pitot pressure for at least 15 minutes (minimum tank capacity of 2,500 gals). The intent is to allow sufficient time for bringing a replenishment pump into service. This does not preclude systems which pump directly from the sea. In all instances, valves and pumps in the fire fighting system which are not readily accessible should be capable of remote operation whenever practicable.

2. The following features should be incorporated in a system using an intermediate tank for fire fighting water:

a. A low water level alarm.

b. A reliable and adequate means to replenish water in the intermediate tank, i.e., if a make up pump is used which is not capable of replenishing water in the intermediate tank at a rate greater than the flow through two hoses at 50 psi pitot pressure, an additional pump of sufficient capacity and head to supply make up water at the above rate should be available. Automatic operation of the make up pump is desirable.

3. If the drill rig is intended to operate in cold weather, the entire fire fighting system must be protected from freezing. Any tank used for a water reservoir must be adequately protected from freezing.

IV. <u>Access</u>

1. Drill rigs of the column stabilized type or similar configuration should have a minimum of one exterior inclined wrap around or zig zag ladder and one shielded vertical ladder for access and emergency escape. Ladders should be broken into sections not longer than twenty feet and each section separated by rest platforms. Vertical descent ladders can be constructed so as to have step out platforms at intervals of at least 20 feet. Requirements should be increased to accommodate larger crews so as to be compatible with rig configuration and methods of emergency embarkation into life saving equipment. Escape routes should be as remote from the well head as practicable.

V. <u>Helicopter Facilities</u>

1. Reference 34 (see Appendix F) is an acceptable standard for the structural requirements of helicopter landing areas. Wood may be used as an overlay for the landing surface if the area is sufficiently segregated so that in the event a fire continued to burn, it could be contained without undue hazard to the vessel or personnel.

2. Firefighting equipment should be reviewed with three factors in mind: (a) the hazard present, (b) accessibility and (c) the vulnerability of the firefighting stations. A backup firefighting capability should be available

in the event the primary equipment becomes unuseable due to its proximity to the fire. It is important therefore that vulnerability be a prime consideration in the location of the backup equipment.

3. Helicopter landing areas should be equipped to meet a fuel spillage hazard regardless of whether a fueling facility is provided. The difference would be that in the case of no permanent fueling facility, the spillage could be assumed to be relatively small.

4. Although the installation of a fuel dispensing facility aboard cargo and miscellaneous vessels is not specifically provided for by regulation, such an operation may be permitted aboard drill rigs. The vessel's certificate will require endorsement to permit an operation of this type. The following general requirements apply:

a. Landing areas with no permanent fueling facility:

(1) Approved combination nozzles and applicators shall be provided for fire hoses protecting the landing area.

(2) A semiportable system under the concept of 46 CFR 98.35-30(b). The 100 lb. or larger dry chemical type is recommended.

b. Landing areas with permanent fueling facility. The requirements of Subchapter D shall, in general, apply to those portions of the vessel where fuel is dispensed. The specific features which should be required are:

(1) A certificated tankerman or equivalent.

(2) Areas where portable tanks are to be stored and fueling operations conducted shall be suitably isolated from enclosed spaces or other areas which contain a source of vapor ignition. This storage and handling area should be permanently marked and provided with coamings or similar devices to contain fuel oil spills, and to retain fire extinguishing agents.

(3) Firefighting capability including:

i. A fixed deck type of foam system, consisting of monitors and/or hose streams, to protect the area used for storage and/or fueling. The system should be capable of delivering a foam solution rate of 1.6 gpm per 10 square feet of area encompassed by the coaming. There shall be sufficient foam concentrate for 5 minutes operation at the required rate of flow. The operation of the foam system should not interfere with simultaneous operation of the fire main.

ii. A semiportable system under the concept of 46 CFR 98.35-30(b). The 100 lb. or larger dry chemical type is recommended.

(4) Approved combination nozzles and applicators shall be provided for fire hoses protecting the loading and storage area.

(5) The requirements of Subpart 98.35 shall apply with respect to:

a. Design of tank

b. Mounting and securing arrangements

c. Electric bonding

d. Inspection procedures

VI. Lifesaving Equipment

1. Coast Guard approved inflatable liferafts have been accepted as substitutes for required lifeboats subject to the fitting of an acceptable rescue boat. The high freeboards and unique configurations of the rigs have necessitated that launching arrangements be accepted on a rig by rig basis having due consideration for the conditions under which the rig might have to be abandoned. The abnormal width of drill barges in comparison to conventional craft precludes centerline lifesaving installations and requires mirrored installations on the two major rig sides.

VII. Drydocking

1. Although not directly related to the plan review of drill rigs, the problems involved with drydocking certain rig configurations should be considered early in the design. Some provision must be made for repairs and inspection of the lower portions of the hull. Technical personnel may have an opportunity to point this out to prospective owners and thereby initiate early planning toward this end.

APPENDIX C TO MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Stability

I. General

1. Stability information, furnished by the owner and approved by the Coast Guard, is required to be provided to operating personnel of drilling vessels. This information shall include an indication of operating conditions which must be maintained to assure the safety of the vessel. Special emphasis should be given to requirements imposed by the drilling operation. The data as presented must be compatible with the background of the responsible operating personnel. A deadweight survey (with a conservative estimate of lightship v.c.g.) or a stability test is required unless the basic stability data are available from a sister vessel in which case it must be shown that reliable stability information for the exempted vessel can be obtained from such data. Normally a stability letter based upon an approved trim and stability booklet should be issued. An exception may be made where a stability analysis based upon a deadweight survey, or sistership data, indicates that no marginal stability condition exists (as will be the case for some non-self propelled drill barges). In cases of extremely broad beamed pontoon or column stabilized rigs, both a transverse and longitudinal stability analysis may be appropriate both as regards wind and righting moment and their relative curve characteristics. A load line is required if the vessel is 150 gross tons or over and operating outside of inland waters.

II. Intact Stability

1. The generally accepted criteria is that the vessel be able to withstand a 100 knot beam wind. Involved in the calculations are wind pressure, wind area, and wind lever. The resultant heeling moment is applied to determine the required GM.

a. Wind pressure

(1) Basic equation. The basic equation for the wind pressure used by civil engineers in tower design is,

$$P = \tfrac{1}{2}\rho V^2 \gamma^2 \, Cs \, Ch \quad \text{(in psf)}$$

where

ρ = air density in slugs per cubic foot

γ = gust factor which varies between 1.0 and 1.3

Cs = shape factor

Ch = height correction factor

If V is converted to knots and F is taken at 1.085, the equation reduces to:

$$F = .00[illegible]\ V_k^2\ Cs\ Ch \text{ (psf for standard air density, i.e., } \rho = .00237)$$

This is our standard equation for wind pressure with the addition of the shape and height correction factors.

(2) Shape Factor Cs. For flat surfaces Cs equals 1.0. For cylindrical shapes Cs varies with the L/D ratio between .6 for an L/D of 1 to 1.2 for an L/D of infinity. For an L/D about [illegible], it is close to one. For our purposes, Cs may be taken equal to 1.0 for all wind surfaces.

(3) Height correction Factor Ch. This correction accounts for the decrease in frictional drag with resulting increase in wind velocity as the height above the water surface increases. For derrick towers it becomes significant and should be included.

$$Ch = \left(\frac{h}{30}\right)^{2/7} \quad \text{where h is feet above water surface}$$

Tabulated data for Ch versus h is given in Table C.1. The heights of 30 feet has a Ch of 1.0 due to standard wind [illegible] being measured at a height of 30 feet above the [illegible] sea level.

Table C.1

Height Correction Factor

h (ft.)	30 or less	[illegible]0	60	80	100	120	140	160	180	200
Ch	1.0	1.0[illegible]0	1.220	1.3[illegible]0	1.415	1.[illegible]5	1.550	1.610	1.665	1.710

b. Wind Area

(1) Ship type (conventional hull) rigs

a. The wind area of the tower shall be taken as the projected area of all exposed surfaces on two opposite faces plus the area of the setback. In computing PAh the area should be broken down into suitable blocks and the proper height correction factor applied to each block. Augmentation is not considered necessary unless an unusual amount of closed in platform area becomes exposed to the wind with heel.

b. The PAh values for the remainder of the vessel may be calculated by standard methods.

c. PAh for the entire vessel can be assumed to vary as a cosign function with vessel heel.

(2) Column stabilized drill rigs. The exposed wind area and lever must be calculated on a rational basis. It must also be augmented by the increase in exposed area as the vessel heels. The height correction factor should be applied where it makes an appreciable difference.

c. Required GM

(1) Cross curves should be required. The required GM shall be based on the area under the righting moment curve being equal to 1.4 times the area under the wind heeling moment curve up to the lesser of the angle of second intercept of the curves, or downflooding.

(2) Eventually experience may indicate the required GM may be taken from 46 CFR 74.10-5 with PAh values computed as noted in Sections II.A and II.B above. This is thought to be a more severe requirement.

2. Results of wind tunnel tests may be accepted if conducted by a facility known to be competent in such testing. Actual service data may also be significant. ADDING: DAMAGED STABILITY

III. Ballasting

1. Drill rigs for which a Trim and Stability Booklet is required (see section I) and which possess a significant ballasting capability should be required to include a recommended ballasting and deballasting schedule in the Trim and Stability Booklet. This is particularly important for rigs which undergo radical changes of waterplane area when transitioning from deep to minimum drafts and vice versa.

IV. Subdivision and Damaged Stability BEING REVISED

1. There are no subdivision or damage stability requirements per se, however, there are two areas which should be given special attention.

a. A recent case of a gas blowout indicated forces involved were great enough that water was lifted in a "geyser" against the bottom of the drilling platform and cascaded onto weather decks. The resulting downflooding through open watertight doors and progressive flooding through open interior watertight doors was instrumental in capsizing the vessel. In the above instance, the hull was of the catamaran type, however, all designs should be reviewed with an eye to possible downflooding due to the type of blowout described above. The use of quick acting watertight doors around the well head area and in whatever subdivision bulkheads are provided is appropriate. Standard operating procedures should call for these doors to be kept closed during drilling operations.

b. Research or drilling platforms with large numbers of persons on board including scientists, students and other special category persons, particularly on ocean going self propelled vessels capable of proceeding unassisted; should have some capability to withstand damage built into the vessel. In special cases of this nature, the design may be referred to the Commandant for policy guidance.

2. Pumps and valves which are essential for the safety of the rig (ballasting, dewatering, etc.) should be accessible even though remote operation is provided. In those cases where pumps and valves may not be accessible at all times, it may be necessary to require a damage stability study.

APPENDIX D TO MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Electrical

I. General

1. Electrical installations, electrical equipment and wiring shall comply with the requirements of Electrical Engineering Regulations (CG-259). Particular attention is called to 46 CFR 110.10 which lists reference specifications, standards, and codes such as certain UL and NEMA standards. Compliance with this subpart to the extent specified by the appropriate section of the Regulations should be required. In addition, equipment should be selected from Equipment Lists (CG-190) and Miscellaneous Electrical Equipment List (CG-293). Special equipment or equipment not listed in the above equipment lists will have to be shown to meet the appropriate specification or standard.

2. Specialized equipment associated with the drilling systems will not be required to meet the performance standards or be labeled as specified in the Regulations. Such equipment should be reviewed for safety aspects and general suitability.

II. Hazardous Areas

1. A hazard inherent in drilling operations is the release of explosive gases. Whether the gases are released through or near the drill casing, some distance from the well, or at some point in the mud system; the problem is the same -- i.e., to reduce the likelihood of ignition. The establishment of hazardous areas deals more with the control of gases expected to be present in the mud system or minor gas releases immediately in the area of the well head; rather than an uncontrolled release of gas requiring emergency action (see Appendix A, Section I).

2. Due to the many configurations of drill rigs, it is not feasible to establish firm rules to define hazardous areas; however, the Class-Division concept found in the National Electrical Code and as set forth in the Electrical Engineering Regulations (CG-259) is adaptable to drill rigs. Designers should be required to delineate areas considered to be hazardous on arrangement plans.

a. The following general rules are established:

(1) Gases are considered to be Group D.

(2) Areas within a 50 foot radius of drill well heads should be considered Class I, Division 1.

(3) Areas containing shale-shakers, desanders, mud tanks, degassers, mud pumps, etc., should be considered Class I, Division 1.

a. When the above apparatus are separated from the mud pumps by a vaportight bulkhead, the mud pump room may be considered Class I, Division 2 provided adequate ventilation from a source of clean air and safeguards against ventilation failure are provided.

(4) Where shale-shakers, desanders, mud tanks, degassers, mud pumps, etc., are located in the weather, the ten foot rule of 46 CFR 111.70-10(c)(4) may be applied.

3. Gas detectors should be located on a rational basis with regard not only to the probability of the presence of gas but also to the likelihood of the ambient conditions being such that the gas would be dissipated.

III. Emergency Lighting, Power and Miscellaneous Systems

1. An emergency lighting and power system shall be provided of the type listed in Table 112.05-5(a) for cargo and miscellaneous vessels and barges. The emergency power source should have sufficient capacity to carry the total connected load for the period of time specified in the table. In determining the total connected load, a demand factor of 100% should be used. The emergency source of power should be located so as to comply with the intent of 46 CFR 112.05-5(d) and 46 CFR 112.05-5(e). All cables emanating from the emergency switchboard shall be run so as to avoid machinery spaces in order to comply with the intent of 46 CFR 112.05-5(f).

2. In addition to meeting the above general requirements, the following applies:

a. The concept of the "dead ship" switch (see Appendix A, Section I) requires that:

(1) A means be provided for quick emergency shutoff of all ventilation systems.

(2) Automatic battery operated lights should be provided where necessary for personnel evacuation.

(3) The public address system should be battery powered.

b. The casualty control station concept (see Appendix A, Section IV) requires that:

(1) Sound powered telephones be installed between key points.

(2) The control stations be equipped with a general alarm switch, sound powered phones to key points, and a P.A. system microphone.

IV. D. C. Equipment

1. The D. C. drilling equipment shall be free of any shock or fire hazard.

Although the submission of plans will not be required for the individual components of the D. C. system, the final installation in regard to such matters of safety, proper grounding, guards for rotating equipment, disconnects etc., shall be satisfactory to the cognizant Officer in Charge, Marine Inspection.

V. Aircraft Warning Lights and Navigation Aids

1. For combination rigs, i.e., rigs which drill both in the floating and bottom bearing mode, warning lights and navigation aids should be determined to be satisfactory to the cognizant District Commander.

APPENDIX [illegible] TO MERCHANT MARINE TECHNICAL NOTE NO. 6-66

Machinery

I. General

1. Marine Engineering Regulations (CG-115) generally apply to floating drill rigs in the same manner as conventional floating vessels. Due to the configuration of some drill rigs, alternative arrangements may be appropriate to meet the intent of the Regulations. For example, the remote operation of some valves may not be feasible.

II. Drilling Systems

1. It has generally been unnecessary to give a detailed review to systems which constitute part of the petroleum operation. This policy is based on compliance with applicable industry standards and codes and a willingness to allow a certain amount of latitude in installation and repair practices due to the nature of drilling operations. The American Petroleum Institute (API) publishes specifications, bulletins and recommended practices covering most of the specialized equipment. While designers and operators are expected to comply with these standards, it should be noted that no industry organization has control over whether they are actually used in practice. It is left to the designer in this highly competitive business to select his material, equipment, and set his own quality standards. Our review should recognize this fact by insuring that all systems and components which constitute part of the petroleum operation are designed in accordance with either Coast Guard Regulations, recognized standards or proven industry practice.

2. All compressed air storage tanks should be reviewed and required to meet Coast Guard Regulations. Other pressure vessels and components in the drilling systems may be accepted if built to recognized codes or standards such as those published by ASME, ASA or API. In these cases, inspection, testing and stamping may be omitted. Evidence of construction to a recognized code or standard, such as submission of the manufacturer's data report (Form U-1) and certification of National Board inspection in the case of the ASME Code, should be required. In all cases, suspect areas of the design should be questioned if unsafe practices appear evident.

III. Pumping Capability

1. Many drill rigs have below water pump rooms that contain the ballast and bilge pumps. The bilge pump should be sized by the volume of the space to be pumped. In this respect, the equations in section 5[illegible].10-25 for determining bilge pump suction line size can be used where L = length of space to be pumped and B = width of space to be pumped. An emergency bilge suction should be connected directly to the largest available pump in the pump room. In most cases, this will be the ballast pump. Generally the size

of the line to the ballast pump should be no smaller than that of the main bilge suction. It is not, however, required that the emergency bilge suction line have an area equal to the full suction inlet of the emergency pump to which it is connected.

IV. Miscellaneous

1. The use of eductors in lower hulls for deballasting has been accepted as part of the deballasting capability for some rigs.

2. A manual means for sounding tanks has been accepted as a means for calibrating liquid level gauges.

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26. Mobile Drilling Platforms by Robert H. Macy (SPE 1410)

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