CITIZEN: Jurnal Ilmiah Multidisiplin Indonesia
Vol 2, No. 4, 2022
ISSN: 2807-5994
https://journal.das-institute.com/index.php/citizen-journal

STUDY OF RIG "AB-1" SPECIFICATIONS ON WELLS “BATARA” BASED ON DATA DRAWWORKS, HOOK LOAD AND MUD PUMP

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DOI: 10.53866/jimi.v2i4.136

Abstract

The analysis conducted in this study focuses on the "AB-1" rig's ability to handle calculated loads. Results show that at 1,248 ft MD with 13 3/8" casing, the hook load and drawworks are both 84,864 pounds. At 5,818 ft MD with 9.5/8" casing, these values increase to 273,446 pounds. At 8,463 ft MD using dual 3.1/2 tubing, the load is 159,748.8 pounds. Mud pump power calculations reveal pressures of 681,408 psi for surface sections and 5,632.97 psi for production sections. Casing is a steel pipe inserted into a wellbore to prevent wall collapse, isolate abnormal pressure zones, and provide space for subsurface equipment during hydrocarbon production. This study aims to evaluate the casing load by analyzing hook load, drawworks, and mud pump power. Hook load represents the weight supported by the rig, including the accumulation of pipe weight, casing weight, and drag forces. Drawworks serve as lifting equipment for casing and tubing during drilling operations, while mud pumps circulate drilling fluids to support the process. Based on these findings, the "AB-1" rig is deemed suitable for operations with a hook load and drawworks capacity of up to 500 tons (1,000,000 pounds) and a mud pump pressure limit of 5,787 psi.

Keywords: *Casing, Hook Load, Drawworks, Mud Pump*

Abstrak

Analisis yang dilakukan dalam studi ini berfokus pada kemampuan rig "AB-1" dalam menangani beban yang telah dihitung. Hasil menunjukkan bahwa pada kedalaman 1.248 kaki MD dengan casing 13 3/8", beban kait (hook load) dan drawworks masing-masing mencapai 84.864 pon. Pada kedalaman 5.818 kaki MD dengan casing 9 5/8", nilai tersebut meningkat menjadi 273.446 pon. Pada kedalaman 8.463 kaki MD menggunakan tubing ganda 3 1/2", bebannya mencapai 159.748,8 pon. Perhitungan daya pompa lumpur menunjukkan tekanan sebesar 681.408 psi untuk bagian permukaan dan 5.632,97 psi untuk bagian produksi. Casing merupakan pipa baja yang dimasukkan ke dalam lubang sumur untuk mencegah runtuhnya dinding sumur, mengisolasi zona tekanan abnormal, dan menyediakan ruang bagi peralatan bawah permukaan selama produksi hidrokarbon. Studi ini bertujuan untuk mengevaluasi beban casing dengan menganalisis beban kait, drawworks, dan daya pompa lumpur. Beban kait mewakili berat yang ditopang oleh rig, termasuk akumulasi berat pipa, berat casing, dan gaya gesek. Drawworks berfungsi sebagai alat pengangkat casing dan tubing selama operasi pengeboran, sementara pompa lumpur berperan dalam mensirkulasikan fluida pengeboran untuk mendukung proses tersebut. Berdasarkan temuan ini, rig "AB-1" dinilai layak untuk operasi dengan kapasitas beban kait dan drawworks hingga 500 ton (1.000.000 pon) dan batas tekanan pompa lumpur sebesar 5.787 psi.

Kata kunci: *Casing, Hook Load, Drawworks*, Pompa Lumpur.

1. Introduction

Drilling operations are a critical phase in the exploration and production of hydrocarbons, requiring careful planning and coordination among various disciplines. Before drilling begins, a comprehensive drilling plan is developed by Drilling Engineers, incorporating inputs from geologists and reservoir engineers(Adams, 1985). This plan outlines the well construction and drilling targets based on geological surveys and seismic data(Aly,2021). The primary objective of drilling is to create a wellbore that connects the surface to the targeted reservoir. The wellbore is then reinforced with casing and cement to maintain stability and prevent collapse(Prasetyawati Umar et al., 2022). Geological surveys, including surface, subsurface, and seismic studies, are conducted to identify potential traps or reservoirs. Once a trap is identified, its contents remain uncertain until penetrated by drilling(Rabia,1985). If the identified area is deemed suitable for exploration, preparations are made, including securing permits, building access roads, mobilizing equipment, and erecting the rig(Fadlih & Megawati, n.d.). This study focuses on analyzing the specifications of Rig "AB-1" used in drilling operations at the Batara well(Rivaldi,2018).The research examines critical parameters such as hook load, drawworks, and mud pump power to determine the rig's maximum load capacity(Hussain,2002). Rig "AB-1" has a maximum load capacity of 500 tons (1,000,000 pounds), making it suitable for onshore operations in Kutai Basin, Indonesia. This basin, known for its hydrocarbon potential since the first drilling at Sangasanga in 1897, continues to be a significant area for exploration(Prasetyawati Umar et al., 2022).

The research aims to calculate the hook load for casing sizes 13 3/8", 9 5/8", and tubing size 3 1/2", as well as evaluate drawworks and mud pump power during surface and production phases. These calculations provide insights into the rig's performance capabilities and its suitability for specific drilling operations(Ira Kumalasari et al., n.d.).

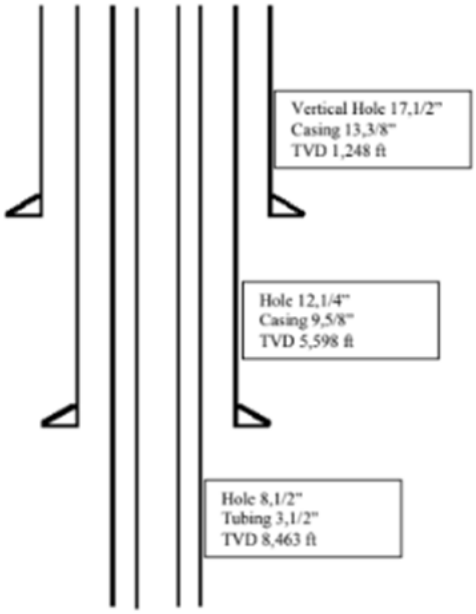
2. Methods

This study investigates the specifications of Rig "AB-1" for drilling operations, focusing on the Batara well within the Gunter Field, located in the onshore Mahakam Block of the Kutai Basin, East Kalimantan, Indonesia. The Kutai Basin, a Miocene-Holocene basin, is a prolific hydrocarbon-producing region with a complex geological history shaped by Paleogene transgression and Neogene regression phases. The stratigraphy of the area is characterized by alternating layers of shale, siltstone, and sandstone, reflecting deposition within a deltaic environment. Understanding the regional geology and stratigraphy is crucial for evaluating the suitability of the drilling rig for the specific well conditions. The methodology centered on evaluating the Rig "AB-1" specifications in relation to the anticipated drilling requirements. Three key parameters were considered: drawworks capacity, hook load capacity, and mud pump horsepower. The hook load and drawwork were calculated by formulas CWD x MD, while the mud pump was calculated by HP = 0,052 × MW × TVD. The calculated loads were then compared to the specified capabilities of the "AB-1" rig to determine its adequacy for the Batara well project. This comparative analysis will enable an assessment of the rig's ability to safely and effectively handle the anticipated loads and operational demands, contributing to informed decision-making in rig selection and drilling planning

3. Result and Discussion

The Batara well in the Palopo field is a horizontal well featuring a 17.1/2" hole with 13.3/8" casing down to 1,248 ft, followed by a 12.1/2" hole with 9.5/8" casing to 5,598 ft, and an 8.1/2" hole with 3.1/2" tubing down to 8,463 ft. The drilling rig is essential for accessing underground reservoirs to extract hydrocarbons. This study focuses on assessing the specifications of Rig "AB-1" based on maximum casing load capacity by calculating drawworks, hook load, and mud pump requirements to determine its suitability for the Batara well. Drawworks are installed on the rig floor, while hook load refers to the weight that the rig must support, which includes the cumulative weight of tubulars and any drag experienced during drilling. By analyzing the values of drawworks, hook load, and mud pump performance, we can ascertain whether Rig "AB-1" is appropriate for use in the Batara well operations.

Figure 1. Well Profile



The Batara well, located in the Palopo field, is a horizontal drilling operation aimed at exploring potential hydrocarbon reserves. A critical aspect of this exploration is the selection of an appropriate drilling rig, which is essential for effectively accessing and extracting hydrocarbons from the subsurface. The rig must be chosen based on the well's capacity, specifically its hook load and drawworks capabilities, which are determined by the well's construction and planned reservoir targets. For the Batara well, the drilling operation utilized a rig with a hook load capacity of 1,000,000 pounds (500 tons), a drawworks capacity of 1,000,000 pounds (500 tons), and a mud pump capacity of 5,787 psi. The well design involved using 13 3/8” casing to a measured depth (MD) of 1,248 ft, followed by 9 5/8” casing to 5,818 ft MD, and finally, dual 3 1/2” tubing down to 8,682 ft MD.

To assess the rig's suitability for these operations, calculations were performed to determine the hook load for each casing type based on its weight multiplied by the depth. The results indicated that at 1,248 ft MD with 13 3/8” casing, the hook load was calculated to be 84,864 pounds. At a depth of 5,818 ft MD with 9 5/8” casing, the hook load increased to 273,446 pounds. Finally, at a depth of 8,682 ft MD using dual tubing of size 3 1/2”, the hook load was determined to be 159,748 pounds. Additionally, drawworks capacity was calculated similarly by considering the weight of the casing multiplied by the measured depth. The results confirmed that at all depths analyzed—1,248 ft MD (84,864 pounds), 5,818 ft MD (273,446 pounds), and 8,682 ft MD (159,749 pounds)—the drawworks requirements were within the operational limits of Rig "AB-1". Furthermore, mud pump performance was evaluated by calculating hydraulic horsepower (HP) for both surface and production sections. The surface section required a maximum HP of approximately 681.408 psi, while the production section required about 5,632.97 psi. Given that Rig "AB-1" has a mud pump capacity of 5,787 psi, it is adequately equipped to handle the hydraulic demands throughout the drilling process.

3.1. Well Data

Table 1. Well Data

Casing Inch	Tubing Inch	MD ft	TVD Ft	CWD ppf	TWD ppf	MW ppg
13 3/8”	-	1248	1248	68	-	10.5
9 5/8”	-	5818	5598	47	-	10.9
-	3 1/2"	8682	8463	-	9.2	12.8

3.2. Analysis Results

The Batara field exploration involves selecting an appropriate rig to ensure safe and efficient drilling operations. Rig "AB-1" was evaluated based on its ability to withstand the calculated loads from drill pipe and casing, as well as its mud pump capacity for both surface and production sections. This analysis aimed to confirm whether Rig "AB-1" meets the operational requirements of the Batara well. The hook load was calculated by multiplying the weight of the casing or tubing with the measured depth (MD). For 13 3/8” casing at 1,248 ft MD, the hook load was determined to be 84,864 pounds. At 5,818 ft MD with 9 5/8” casing, the hook load increased to 273,446 pounds. Finally, at 8,682 ft MD using dual tubing of size 3 1/2”, the hook load was calculated as 159,748 pounds. These values were then compared to Rig "AB-1"'s maximum hook load capacity of 1,000,000 pounds (500 tons), confirming that the rig can safely support these loads. Similarly, drawworks capacity was assessed using the same calculation method. The results showed that at all depths analyzed—1,248 ft MD (84,864 pounds), 5,818 ft MD (273,446 pounds), and 8,682 ft MD (159,749 pounds)—the required drawworks capacity was well within Rig "AB-1"'s limit of 1,000,000 pounds.

Mud pump capacity was calculated for surface and production sections using mud weight (MW) and true vertical depth (TVD). The surface section required a pressure of 681.408 psi, while the production section necessitated a higher pressure of 5,632.97 psi. With a mud pump capacity of 5,787 psi, Rig "AB-1" was found to be suitable for both sections.

4. Conclussion

The evaluation included detailed calculations of hook load requirements at various depths, which are critical for ensuring the rig's capability to safely support the weight of the drill pipe and casing. Specifically, the hook load for 13 3/8” casing at a measured depth (MD) of 1,248 ft was calculated to be 84,864 pounds (42.4 tons). As drilling progresses to a depth of 5,818 ft with 9 5/8” casing, the hook load increases significantly to 273,446 pounds (136.7 tons). Furthermore, at a depth of 8,682 ft using dual tubing of size 3 1/2”, the calculated hook load is 159,748.8 pounds (79.9 tons). These values are all comfortably within Rig "AB-1"'s maximum hook load capacity of 1,000,000 pounds (500 tons), indicating that the rig can adequately handle the anticipated loads throughout the drilling process. In addition to hook load calculations, drawworks capacity was assessed using similar methodologies. The required drawworks capacities were found to match the hook load values: 84,864 pounds for the casing at 1,248 ft MD, 273,446 pounds for the casing at 5,818 ft MD, and 159,748.8 pounds for dual tubing at 8,682 ft MD. Rig "AB-1" again demonstrated its suitability with a maximum drawworks capacity also reaching up to 1,000,000 pounds. The analysis further included an evaluation of mud pump performance necessary for maintaining efficient drilling operations. The calculated pressures indicate that the surface section requires approximately 681.408 psi while the production section necessitates around 5,632.97 psi. Given that Rig "AB-1" is equipped with a mud pump capable of delivering pressures up to 5,787 psi, it is clear that this rig can effectively manage the hydraulic demands associated with both sections of drilling.

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