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Evaluation Of Category III Overhead Tools Inspection Rig X PT. BMS

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Abstract

Overhead tool inspection is an important process in the oil and gas well drilling and maintenance industry. In harsh and hazardous environments, it is important to regularly monitor the physical condition and functionality of overhead tools. The use of overhead tools in the oil and gas industry has the advantage of lifting and moving heavy loads easily and safely. However, the use of heavy equipment also carries the risk of dangerous work accidents. The methodology in this research involves problem identification, literature review, research design, data collection, interpretation, analysis, and findings. The discussion emphasizes the meticulous inspection required for overhead tools, exemplified through the evaluation of traveling block, hook block, crown block, elevators, and elevator links. Each inspection, guided by API standards, ensures compliance, identifies potential hazards and prevents incidents in the inspection of overhead tools, various methods are used to ensure accurate inspection results and reduce the risk of failure during operation. This inspection involves techniques such as visual inspection and Non-Destructive Test (NDT) to test each overhead tools component which is guided by API SPEC 8A, API RP 8B and also API SPEC 8C. The main objective is to ensure that every aspect of the overhead tools has been carefully inspected and produces accurate inspection results. Thus, the risk of failure when inspecting overhead tools can be significantly reduced.The results indicate that the overhead tools inspected at PT. BSM meets API SPEC 8C standards. However, crucial findings, such as defects in crown block bearings and elevator safety pin issues, underscore the need for immediate attention. The conclusion emphasizes the importance of swift action to maintain safety and prevent further damage.

Keywords:

Inspection, overhead tools, evaluation, visual inspection, non-destructive test.

1 Introduction

The oil andgas industry (oil and gas) is one of the vital and complex economic sectors. Indonesia has many oil and gas fields that have been produced for many years. Duri field, Riau, is one of the state assets under the auspices of PT. PertaminaHuluRokan, has many wells due to the vast reservoir in the area. Various stages of exploration, production, and maintenance of oil and gas wells are involved in the Indonesian oil and gas industry [1].

Workoverand well service is one of the important aspects of oil and gas well maintenance in Indonesia. Workoverwellservice refers to a series of activities carried out on wells that have been drilled or previously produced to maximize or to increase oil and gas production from wells that have been producing or repairing and recovering declining production [2]. PT. BSM Duri, Riau is one of the workoverandwell-service provider companies.

Workoverand well-service activities require a variety of specialized equipment to run efficient and safe operations. One type of equipment used is overhead tools to support workoverandwell-service activities that are run [3]. Overhead tools include traveling blocks, crown blocks, elevators and elevator links. This equipment is alwaysexposed and always used with heavy loads and has high risks related to security and safety. Incidents such as malfunctions and defects can cause serious damage to equipment, threatening the safety of workers [4]. The inspection aims to identify potential hazards, ensure compliance with safety standards, and prevent incidents.

The inspection process on this equipment is a critical step in maintaining security, safety, reliability and operational efficiency in the oil and gas industry. The inspection was prepared by the author to evaluate and ensure that inspection activities against overhead tools at PT. BSM is implemented by established relevant regulations and standards.

This research is an analysis of overhead tools inspection activities at PT. BSM uses standardization and regulation references by the American Petroleum Institute (API), which is guided by API SPEC 8A, API RP 8B and also API SPEC 8C, and also several manuals.

This guidance is stated in the API SPEC 8A, which outlines standards for Drilling and Production Hoisting Equipment, the API RP 8B, which provides recommended procedures for inspecting, maintaining, repairing, and remanufacturing hoisting equipment, and the API SPEC 8C, which details specifications for Drilling and Production Hoisting Equipment (PSL 1 and PSL 2). These documents emphasize that cracks or mechanical damage can lead to and expedite accidents or failures during an operation.

2 Method

The method in this research is identifying the research problems that can occur during the drilling operation.Literature studies were based on standardization and regulation references by the American Petroleum Institute (API).This is guided by API SPEC 8A, API RP 8B and also API SPEC 8C, and also other manuals, research design.Those are to create the workflow of the research according to the timeline and budget, collecting data such as overhead tools data, conducted an interpretation, analysis and the research findings.Finally concluding the inspection method and activity with overhead tools subject rig X PT. BMS evaluation was done.

The inspection method employed is Magnetic Particle Testing (MPI), which involves a multi-step procedure to ensure a thorough examination of the subject material [5]. Initially, the surface is meticulously cleaned to eliminate any contaminants or adhered paint. Following this, a White Contrast Paint (WCP) is applied to establish a distinct color contrast between the particles and the surface of the object under inspection. Subsequently, the surface intended for examination is coated with a liquid penetrant due to the application of the wet method. Then, the yoke is affixed to predetermined points, reapplying the liquid penetrant if the surface becomes dry or depleted, while systematically directing the yoke diagonally across all the predetermined points. In instances where indications of crack findings are present, the criteria for acceptance are based on the standards outlined in AWS D1.1 and ASME Section V Article 7 [6], [7]. Upon completion of the inspection, demagnetization is carried out to ensure the complete elimination of magnetism from the test object. Finally, a meticulous cleansing process is performed to remove all traces of the magnetic particles from the material's surface post-inspection.

Then, the specific method utilized for sheave inspection involves employing sheavegauge and depth gauge tools. These tools serve the purpose of precisely measuring the radius and depth of the sheave grooves, ensuring meticulous detailing in the measurement process [8].

3 Discussion

In this section, we will discuss the inspection and evaluation methods of overhead tools carried out by PT. BSM. This topic is guided by API SPEC 8A specification for Drilling and Production Hoisting Equipment; API RP 8B recommended practice for procedures for inspections, maintenance, repair, and remanufacture of hoisting equipment; and also API SPEC 8C specification for Drilling and Production Hoisting Equipment (PSL 1 and PSL 2) which explains that cracks or mechanical damage can cause and accelerate accidents or failures in an operation. Therefore, to detect, identify, and evaluate overhead tools with high accuracy, careful inspection is required.

3.1 Travelling Block and Hook Block Inspection

Visual inspection of the traveling block (Fig. 1) is first carried out before all components are dismantled. Then to carry out a more thorough inspection,is carried out when all components are dismantled (as shown in the red arrow Fig. 2) where a more accurate inspection will be carried out by the inspector.

Fig. 1. Traveling block andhook block visual inspection.

Then proceed with sheave gauge inspection to measure the radius or diameter of three sheaves on this traveling block. Table 1 is the inspection data on the radius of the sheave groove.

Table 1. Measurement results of traveling block sheave groove radius

Minimum radius (mm)	Maximum radius (mm)	Actual size (mm)
0.530	0.550	0.543
0.530	0.550	0.537
0.530	0.550	0.536

$$\text{Sheave radius condition (\%)} = \left(\frac{\text{Actual size}}{\text{Max. radius}}\right) \times 100$$

$$\text{Sheave 1} = \left(\frac{0.543}{0.530}\right) \times 100 = 99.64\%$$

$$\text{Sheave 2} = \left(\frac{0.537}{0.530}\right) \times 100 = 97.63\%$$

$$\text{Sheave 3} = \left(\frac{0.536}{0.530}\right) \times 100 = 97.45\%$$

Based on the recommendations contained in API SPEC 8C for the use of 1-inch wire rope, there is information about the maximum radius (0.550 inches or 13.97 mm) and minimum radius (0.530 inches or 13.46 mm) of the groove radius, or equivalent to 96% of the maximum radius [9]. Taking into account these recommendations, it can be concluded that the sheave groove the depth has met the requirements set at 99.64%; 97.63%; and 97.45%. This is because the radius does not exceed the minimum and maximum limits recommended in the SPEC 8C API.

The continuation of the inspection process on the sheave traveling block is the inspection process using depth gauge. Because when measuring the radius of the sheave groove, previously found a reduction in the diameter of the sheave groove from the size regulated in the API SPEC 8C regulation [9] even though it was still within the tolerance limit. Likewise, the depth of the sheave groove can increase due to the friction of the steel rope through the sheave. Table 2shows the data from measuring the depth of the sheave groove.

Table 2. Traveling block sheave groove depth measurement results

Minimum depth (mm)	Maximum depth (mm)	Actual depth (mm)
33.78	44.45	44.33
33.78	44.45	43.42
33.78	44.45	43.32

$$\text{Sheave depth condition (\%)} = \left(\frac{\text{Actual depth}}{\text{Max. depth}}\right) \times 100$$

$$\text{Sheave 1} = \left(\frac{44.33}{44.45}\right) \times 100 = 99.73\ \%$$

$$\text{Sheave 2} = \left(\frac{43.42}{44.45}\right) \times 100 = 97.68\ \%$$

$$\text{Sheave 3} = \left(\frac{43.32}{44.45}\right) \times 100 = 97.46\ \%$$

Magnetic particle inspection is also carried out on all components of the traveling block (Fig. 2), this inspection process aims to find defects or defects that are more accurate to the components of the traveling block using magnetic fields [10]. The results of this inspection state that all components of the traveling block are in good condition or no defects are found, and indicate that the traveling block is suitable for use.

Fig. 2. Traveling block andhook block magnetic particle inspection.

3.2 Crown Block Inspection

Visual inspection of crown blocks is different from that done in traveling blocks. This inspection was carried out with the position of the crown block components dismantled [11]. The components inspected on the crown block are not too many and complex. There are findings of defects (damaged) in crown block (as shown in the red arrow Fig. 3) bearings that occur due to friction in the bearing when the crown block is operated [12]. Therefore, the action that must be taken is to replace the bearing so that unwanted incidents do not occur in the next crown block operation.

Fig. 3. Crown block visual inspection.

4 sheaves on the crown block are also carried out sheave gauge inspection to measure radius or diameter, just like sheave on traveling blocks. Table 3 is the inspection data on the radius of the sheave groove.

Table 3. Crown block sheave groove radius measurement results

Minimum radius (mm)	Maximum radius (mm)	Actual size (mm)
0.530	0.550	0.546
0.530	0.550	0.534
0.530	0.550	0.537
0.530	0.550	0.531

$$\text{Sheave radius condition (\%)} = \left(\frac{\text{Actual size}}{\text{Max. radius}}\right) \times 100$$

$$\text{Sheave 1} = \left(\frac{0.543}{0.530}\right) \times 100 = 99.27\ \%$$

$$\text{Sheave 2} = \left(\frac{0.534}{0.530}\right) \times 100 = 97.09\ \%$$

$$\text{Sheave 3} = \left(\frac{0.537}{0.530}\right) \times 100 = 97.64\ \%$$

$$\text{Sheave 4} = \left(\frac{0.531}{0.530}\right) \times 100 = 96.55\ \%$$

Based on the guidelines contained in API SPEC 8C for the use of wire rope with a size of 1 inch, there is information about the maximum radius (0.550 inches or 13.97 mm) and minimum radius (0.530 inches or 13.46 mm) of the groove radius, which is equivalent to 96% of the maximum radius. Taking into account these recommendations, it can be concluded that the sheave groove depth has met the requirements set at 99.27%; 97.09%; 97.64%; and 96.55%. This is because the radius does not exceed the minimum and maximum limits recommended in the SPEC 8C API [9].

The subsequent inspection of the sheave on the crown block involves the use of a depth gauge. This is due to findings when measuring the radius of the sheave groove before, where there was a reduction in the diameter of the sheave groove, although it was still within the tolerance limit. Table 4 is the data from the sheave groove depth measurement.

Table 4. Crown block sheave groove depth measurement results

Minimum depth (mm)	Maximum depth (mm)	Actual depth (mm)
33.78	44.45	42.39
33.78	44.45	39.74
33.78	44.45	39.08
33.78	44.45	38.84

$$\text{Sheave depth condition (\%)} = \left(\frac{\text{Actual depth}}{\text{Max. depth}}\right) \times 100$$

$$\text{Sheave 1} = \left(\frac{42.39}{44.45}\right) \times 100 = 95.37\ \%$$

$$\text{Sheave 2} = \left(\frac{39.74}{44.45}\right) \times 100 = 89.40\ \%$$

$$\text{Sheave 3} = \left(\frac{38.08}{44.45}\right) \times 100 = 87.41\ \%$$

$$\text{Sheave 4} = \left(\frac{38.84}{44.45}\right) \times 100 = 87.38\ \%$$

Based on the recommendations listed in API SPEC 8C in Fig. 4, the maximum value for sheave groove depth is 1.75 inches or 44.45 mm, while the minimum value is 1.33 inches or 33.78 mm (75% of max depth). Taking this into consideration, it can be concluded that the depth of the sheaves groove has met the requirements with percentages of 95.37%; 89.40%; 87.41%; and 87.38%. This is because the depth does not exceed the minimum and maximum limits recommended in the SPEC 8C API. However, there was a drop in depth below 90% in sheave number 2, number 3, and number 4, caused by the use of crown blocks.

A magnetic inspection process is also carried out on this crown block with the aim of more accurately identifying any defects or defects in the components of the crown block. The results of this inspection stated that the components contained in the crown block were declared to be in good condition without any defects (as shown in the red arrow Fig. 4), thus confirming that the crown block can be used safely and properly, with a record of repairs to parts found during previous visual inspections.

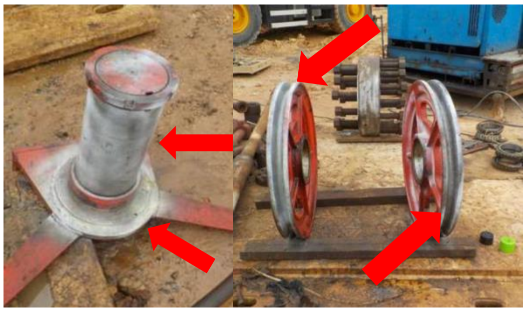

Fig. 4. Crown blockmagnetic particle inspection.

3.3 Elevators Inspection

The process is simply cleaning the outer surface of the elevator and then conducting a visual inspection and using the magnetic particle inspection method to ensure optimal and accurate results[13]. After the cleaning process is complete, a visual inspection of the elevator is carried out. This visual inspection aims to detect cracks, deformations, corrosion, or wear on elevator surfaces

In addition to visual inspection, magnetic particle inspection methods are also used to improve inspection accuracy. This method is very effective in detecting internal damage that may not be visually visible [14], [15]. When the inspection process was carried out, it was found that there were no safety pins installed on bolt tubing elevators (as shown in the red arrow Fig. 5) measuring 2-3/8" and 3-1/2", as well as on DP elevators measuring 2-7/8". When the safety pin is not installed, there is a potential that the elevator bolt tubing or DP elevator will not lock securely and under control during use.

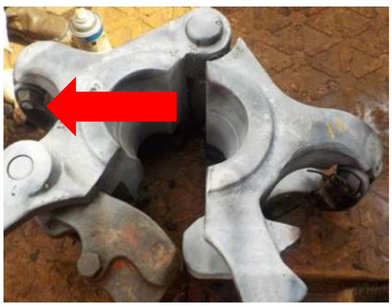

Fig. 5. No safety pin on tubing and DP elevatorbolts.

This may result in uncontrolled movement or possible detachment of the drill pipe from the elevator during operation. This risk can lead to serious accidents, equipment damage, and even injury or loss of life to the operator or surrounding personnel. Therefore, it is important to ensure that the safety pin is properly installed on the elevator bolt tubing.

Furthermore, a very serious problem was found, namely a crack in the pin lock tubing elevator door 2-7/8". The finding of cracks in the elevator door pin lock indicates significant structural damage to the elevator (as shown in the red arrow in Fig. 6).

Such cracks may indicate excessive pressure or wear and tear that could potentially result in mechanical failure or loss of safety when the elevator is in use. Therefore, by API RP 8B [16] replacing elevator units with new ones is considered the most appropriate step to ensure operational reliability and safety.

Fig. 6. Crack on pin lock tubing elevator door 2-7/8".

This deficiency in elevator inspection is not disassembly, which should be done to ensure that all elevator components are in good condition, referring to API SPEC 8C. By not involving the disassembly process, there is the potential that some problems that may occur in the internal components of the elevator cannot be detected precisely. While visual inspection and inspection of outside surfaces can provide important information, the disassembly process provides a higher level of accuracy in evaluating elevator condition and reliability

3.4 Elevator Link Inspection

The elevator link is a crucial component within the elevator system utilized in drilling operations or maintenance of oil or gas wells. It takes the form of a rounded iron with two eyes on each end, functioning as a connector between the elevator and the traveling block to be lifted or lowered.

The inspection process carried out on elevator links involves a careful visual inspection of the physical condition of the components. Inspectors inspect each part of the elevator link to make sure there are no cracks, deformations, or other signs of damage that could reduce its strength and reliability. In addition, magnetic particle tests are also performed to detect small defects or cracks that may not be visually visible. This method allows for more accurate identification of potential internal damage to weak points in elevator links.

The results of the inspection process concluded that the elevator link was in good condition and showed no indication of any problems or risks that could endanger operations (as shown in the red arrow Fig. 7). This means that such link elevators can be used with confidence that their performance will meet safety standards and can withstand the loads and stresses associated with drilling operations.

In this context, the decision to use elevator links is based on the results of a comprehensive inspection. These results assure that the component has met safety requirements and can be relied upon for use in operation. However, it is important to continue to conduct regular monitoring and inspection of elevator links to ensure that their feasibility and reliability are maintained during long-term use.

Fig. 7. Elevator link inspection.

4 Conclusion

The results of the evaluation and inspection of tool overhead, concluded that reduction or increase in sheave groove size is still within good tolerance limits, both in terms of diameter and depth of the sheave groove. This shows that the dimensions of the component are still by the established standards. The components of overhead tools that have been evaluated by the author are by the regulations contained in API SPEC 8C, which is the relevant standard for this equipment. The inspection results of the traveling block showed very good quality because there were no problems found in the components of the traveling block or hook block that could threaten the safety or performance of the equipment. Then findings on the elevator tubing size 2-3/8"; 3-1/2" and drill pipe elevator 2-7/8" that do not have a safety pin on the bolt that must be immediately installed safety pin by each elevator, cracks (cracks) in the elevator tubing size 2-7/8" which must be immediately followed up also by replacing a new elevator unit, according to the standards contained in API SPEC 8C. Therefore, it is important to ensure that the elevator inspection process is carried out by API SPEC 8C recommendations, including the disassembly process. It has been confirmed in the inspection results, that the elevator link can be used to operate because it has passed and meets the specified standards.

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