AN EXTENSIVE INSPECTION OF THE FORKLIFT FB25-77 IN THE MANUFACTURING SECTOR BASED ON INDONESIAN MINISTRY OF LABOUR REGULATION

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Abstrak

Kecelakaan di tempat kerja dapat timbul dari berbagai faktor seperti elemen manusia, kondisi lingkungan, peralatan, mesin, proses kerja, sifat tugas, dan metodologi kerja. Forklift, yang diklasifikasikan sebagai peralatan angkat dan pengangkut, sering digunakan di lingkungan industri untuk pemindahan material. Untuk mengurangi risiko kecelakaan kerja dan memastikan keselamatan serta kesesuaian forklift untuk penggunaan operasional, proses pemeriksaan dan pengujian secara sistematis sangat penting. Biasanya dilakukan pada interval reguler, setiap dua tahun sekali, dan setiap tahun untuk penggunaan rutin, proses ini menilai berbagai aspek peralatan angkat dan pengangkut, termasuk forklift. Penelitian ini bertujuan untuk mengevaluasi kesesuaian hasil pemeriksaan untuk forklift tipe FB25-77 dengan standar yang diuraikan dalam Peraturan Menteri Ketenagakerjaan No. 8 tahun 2020. Dengan menggunakan metode analisis deskriptif, penelitian ini melibatkan perbandingan kondisi aktual forklift di lapangan terhadap semua persyaratan yang dijelaskan dalam Permenaker No. 8 tahun 2020, meliputi pemeriksaan visual konstruksi, pengukuran dimensi, pengujian non-destruktif (NDT), pengujian fungsional, dan pengujian beban. Berdasarkan prosedur pemeriksaan dan pengujian yang komprehensif, terbukti bahwa peralatan tersebut memenuhi persyaratan Keselamatan dan Kesehatan Kerja (K3), sehingga membenarkan penerbitan sertifikat oleh Dinas Tenaga Kerja Provinsi.

***Kata Kunci**: Forklifts, Annual Inspection (Riksa Uji), Kemenaker.*

Abstract

Workplace accidents can arise from various factors such as human elements, environmental conditions, equipment, machinery, work processes, the nature of tasks, and work methodologies. Forklifts which is classified under lifting and transporting equipment, are frequently utilized in industrial settings for material movement. To mitigate the risk of work-related accidents and ensure the safety and suitability of a forklift for operational use, a systematic inspection and testing process are essential. Typically conducted at regular intervals, every two years, and annually for regular use, this process assesses various aspects of lift and transport equipment, including forklifts. This study aims to evaluate the conformity of the examination results for a FB25-77 type forklift with the standards outlined in Minister of Manpower Regulation No. 8 of 2020. Employing a descriptive analysis method, the study involves comparing the actual condition of forklifts in the field against all the specified requirements in Permenaker No. 8 of 2020, encompassing visual inspection of construction, dimensional measurements, non-destructive testing (NDT), functional testing, and load testing. Based on the comprehensive inspection and testing procedures, it was ascertained that the equipment meets the Occupational Health and Safety (OHS) requirements, thereby warranting the issuance of a certificate by the Provincial Manpower Service.

***Keywords**: Forklifts, Annual Inspection (Riksa Uji), Minister of Manpower Regulation.*

INTRODUCTION

The annual inspection protocol is implemented to preserve and scrutinize a device, prioritizing employee safety and averting potential risks [1]. Periodic assessments are conducted on lifting and transporting equipment, aligning with the Minister of Manpower standards outlined in Regulation Number 08 of 2020, with a specific focus on regulations governing lift and transport equipment [2]. Lift equipment encompasses machinery designed for lifting, lowering, adjusting, and holding workpieces or loads, exemplified by overhead cranes, chain blocks, and wall jib cranes. Conversely, transport equipment is engineered for the horizontal, vertical, or diagonal movement of objects, payloads, or individuals, utilizing methods such as rudders or machinery like forklifts, lift trucks, and excavators [3].

Inspection entails visually examining and measuring critical areas of a tool to gather precise technical data, while testing involves subjecting a tool to alterations to evaluate its resilience in performing functions. Regular inspections are imperative to minimize workplace accidents stemming from machine malfunctions [4] or the failure of safety devices [5], [6]. Neglecting these routine checks and tests increases the risk of workplace accidents [7].

PT. XXX specializes in the domain of testing and certification, with a key focus on the examination and testing of lifting and transport equipment [8]. The study is designed to carry out meticulous inspections and tests on a specific transport apparatus, namely the FB25-77 forklift. This endeavor is in strict accordance with the regulations delineated in Minister of Manpower standard No. 8 of 2020, specifically addressing Occupational Health and Safety (OHS) concerns. Baharudin emphasizes that forklifts play a pivotal role in the material lifting process within a company's production activities. The inspection and testing processes conducted at PT. XXX are deemed essential for ensuring the seamless operation of work activities and safeguarding the well-being of operators and workers in the vicinity of the forklift [9].

The principal objective of this culminating research initiative is to conduct a thorough examination and assessment of a Nichiyu Forklift Model FB25-77, identified by Serial Number 257C02643. The research is focused on discerning the overall performance of the forklift, which has been actively in operation for an estimated duration of four years. This mandatory scrutiny is in accordance with the regulations established by the Minister of Labor of the Republic of Indonesia through Regulation Number 08 of 2020, explicitly detailed in Chapter 7, Article 176, Paragraph 1. The stipulations of this regulation mandate the execution of inspection tests for lifting and transport equipment, not exceeding two years after the initial inspection and subsequently on an annual basis.

RESEARCH METHOD

The research methodology applied in examining the FB25-77 type forklift employed a descriptive analysis approach. This investigation included an assessment of the forklift's actual condition in the field, comparing it against all the specified requirements detailed in Minister of Manpower Regulation No. 8 of 2020. The evaluation process involved visual inspection of construction, dimensional measurements, non-destructive testing (NDT), functional testing, and load testing. Through the comprehensive execution of these examination and testing procedures, the research findings indicated compliance with Occupational Safety and Health (OSH) requirements for the forklift. Consequently, the issuance of a certificate by the Provincial Manpower Service is considered valid.

The inspection process involves a systematic and thorough completion of all steps, with a specific emphasis on critical elements of the forklift responsible for bearing loads, commonly referred to as the critical area. As specified in Minister of Manpower Regulation Number 08 of 2020, Chapter 176, Paragraph 3, the critical area encompasses the fork, hydraulic pressure system, and chain. The research methods employed in this study are delineated as follows.

Inspection document

Document verification encompasses the collection of technical data pertinent to the tool under examination, including the compilation of reports and data on previous year's test outcomes in accordance with the stipulations of Minister of Manpower Regulation No. 08 of 2022.

Visual Inspection

Visual inspection constitutes a direct scrutiny of the tool's structural integrity without the utilization of supplementary tools, involving the assessment of its overall condition, verification of safety device presence, and identification of potential material deformations across diverse forklift components. Commonly evaluated aspects include wear and tear, cracks, and alterations in the tool's construction.

Measurement Technique

Dynamic measurement constitutes an evaluative endeavor concentrating on discerning changes in the dimensions of the tool's structure, a pivotal task to account for potential alterations since the last inspection. Significant deviations are subjected to scrutiny against established standards, considering factors such as fork depletion, which should not surpass a 10% reduction from its original form, as specified in Minister of Manpower Regulation No. 08 of 2020, Chapter 77, Paragraph (4).

Non-Destructive Test

Material testing involves a non-destructive technical examination aimed at

identifying concealed construction defects, often in the form of cracks, without causing structural damage. Employing the magnetic particle inspection (MPI) method ensures a meticulous assessment of the forklift's condition, upholding the integrity of its structure such as:

Administer paint remover to the specified region earmarked for Non-Destructive Testing (NDT), concentrating on the joints and welds located on the mast, as well as the Right Fork, utilizing a brush, and subsequently allow it to undergo a brief period of inactivity such as:

a. Utilize a wire brush to meticulously cleanse the assigned area;
b. Evenly apply chemical white-contrast paint to the designated region, ensuring a uniform coating, and permit it to undergo a drying process;
c. Position the second magnet yoke DC amidst the connections or welds on the mast and the Right Fork;
d. Apply chemical 7HF to the allocated region;
e. Document the dispersion pattern of iron particles present on the surface. The manifestation of black iron particles will serve as an indicative marker for the existence of cracks;
f. Iterate through the aforementioned procedures until the testing process encompasses the entirety of the fork.

Functional Test

Functional testing entails assessing the operational performance of a tool without a load to determine its optimal functionality. Horbery elucidates that this evaluation emphasizes forklift safety, scrutinizing fundamental movements such as forward and backward maneuvers, activation of light signals, and the effectiveness of the horn [10].

Dynamic-Load Test

Dynamic load testing involves the examination of a tool's performance during operation with a load, incrementally raising the load to 100% of the designated safe workload. This testing procedure aligns with the regulatory provisions delineated in Minister of Manpower No. 08 of 2020, Chapter 176 (3f).

Burden-Static Test

Static load testing entails the evaluation of a tool's performance during operation with a load, wherein the load is lifted to approximately 900 kg and held stationary for a duration of 5-10 minutes.

The seven consecutive stages of the inspection process necessitate thorough execution, with a particular focus on the essential components of forklifts responsible for bearing loads, commonly identified as the critical area. In accordance with Minister of Manpower No. 08 of 2020, Article 7, Paragraph 2, the pivotal elements of the forklift tasked with bearing the load

encompass the chain, hydraulic system, and forks.

Throughout the execution of inspection and testing tasks, researchers are mandated to employ specific instruments and tools, imperative for the effective implementation of the work and subsequent analytical procedures. These encompass various categories of items:

a. Personal protective equipment, encompassing safety essentials such as a safety helmet, safety shoes, safety glasses, hand gloves, and a wear pack.
b. Work tools, inclusive of items such as a period shovel, laser meter, yoke, chemical magnetic testing agents (white-contrast paint and 7HF), paint remover, and brushes.
c. Supporting instruments, such as a checklist tailored for inspecting forklifts and documentation from Minister of Manpower No. 08 of 2020.

RESULTS AND DISCUSSION

Following the formulation of the prescribed strategy, researchers and inspectors will undertake its practical implementation in the field, guided by the "Riksa Uji" outlined in Minister of Manpower No. 08 of 2020, specifically addressing Lifting and Transporting equipment in Chapter 7, Section 176, Paragraph 3. The execution strictly follows delineated procedures to guarantee optimal outcomes. Subsequently, a comprehensive discussion on the analysis of the data derived from the testing and inspection procedures is presented.

Inspection document

Adhering to Article 5(4) of Minister of Manpower Regulation No. 08 of 2020, the documentation related to this equipment adheres to prescribed requirements, including manuals, certificates from periodic inspections, and technical instructions for usage and maintenance. Table 1 provides a summary. Due to limitations in sharing specific document details, the author offers a general overview of the tools subjected to inspection and testing.

Visual Inspection

The components subjected to visual inspection are deemed essential and critical for maintaining optimal functioning. This examination involves the observation of key components within the forklift equipment. Several elements are scrutinized during this inspection, encompassing the steering system, wheels, clutch, differential, brakes, transmission, support pillars, and lifting chain. In addition to these components, the visual inspection encompasses the verification of the presence of safety devices on the forklift. The findings of the inspection affirm the availability of safety devices on the forklift.

In accordance with the information presented in Table 2, the data pertains to the components and items of forklifts that are operating effectively.

Table 1. Data General Tool Forklift

Forklift Specification Data	
Owner / location	PT. ABCD
Type tool	*Forklift*
Factory Maker	NICHIYU Forklift
Model / type	FB25-77
Number Series	257C02643
Year Making	2019
Capacity	2,5 tons

Resource: The machine inventory data of PT. ABCD

Table 2. Inspection Visual Checklist

Inspection Component	**Items**	**Condition**	
		Fulfil Condition	**No Fulfil Condition**
System rudder	Wheel Steering	✓	-
	Stem rudder	✓	-
	Tooth Box / *Gearbox*	✓	-
	Modifier motion / *pitman*	✓	-
	Stem Pull / *Drag Link*	✓	-
	tires Rod	✓	-
	lubrication	✓	-
Wheel (Wheels*)*	*Front* (Wheel mover)	✓	-
	Rear wheel (Wheel rudder)	✓	-
	Fixing bolt	✓	-
	Drum / Hubs	✓	-
	lubrication	✓	-
Clutch (Clutch*)*	Equipment Mechanical	✓	-
	Clutch House	✓	-
	Condition Clutch	✓	-
	Lubricants / oil transmission	✓	-
	Leakage Transmission	✓	-
	Axis Liaison	✓	-
Guard (Differential*)*	Equipment Mechanical	✓	-
	House guard	✓	-
	Guard Condition	✓	-
	Lubricants / Gardan oil	✓	-
	Leakage guard	✓	-
	Axis Liaison	✓	-
Brake (Brakes*)*	Condition Brake Main	✓	-
	Condition Brake Hand	✓	-
	Condition Brake Emergency	✓	-
	Leakage	✓	-
Transmission	Component Mechanical	✓	-
	House Transmission	✓	-
	Lubricants / oil transmission	✓	-
	Leakage Transmission	✓	-
	Equipment Mechanical	✓	-

Measurement Technique

In the technical measurements and dimensions conducted in this study, precision measuring instruments such as calipers and a meter are employed. The specific dimensions subject to examination include chain thickness, length from pin to pin, pin diameter, fork length, fork thickness, and fork width. According to Minister of Manpower regulations outlined in Chapter 36, Paragraph (1), significant alterations in the length exceeding 5% of the original chain length and wear exceeding 10% of the return chain diameter are considered noteworthy.

Additionally, the study emphasizes that forklift forks should not experience thinning exceeding 10% and should not exhibit a height difference surpassing 3% from the length of the fork if double forks are utilized, in accordance with the specified regulations.

1. Chain Section

As stipulated by Permenaker No. 08 of 2020, as outlined in Article 36, paragraph 1 (c2), it is specified that the wear of the initial link should not exceed 10% (ten percent) of the original diameter. This criterion is assessed through the measurement of the chain length from pin to pin, which is 23 mm, and the pin diameter, which is 7 mm, aligning with the practical conditions observed in the field.

Figure 1 illustrates the accurate measurement of the chain thickness, while Table 3 provides a detailed explanation of the results obtained from measuring the thickness of the forklift chain. Drawing from the information in Table 3, the tabulated data outlines the dimensional measurements for the years 2022 and 2023. It is noteworthy that there is no discernible alteration in the results over the course of one year.

Table 3. Forklift chain-thickness measurement data

(Original) Thickness Chain	Year of Measurement				Defect		Condition Max 10%	
	2022		2023		Yes	No		
269.0 mm	pitches	23mm	pitches	23mm	-	✓	pitches	10%
	Pin	7mm	Pin	7mm	-	✓	Pin	10%

Figure 1. Forklift chain-thickness measurement.

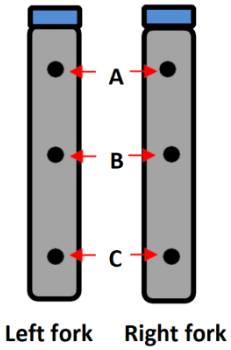
In accordance with the stipulations outlined in Permenaker No. 08 of 2020, Article 36, paragraph 1 (c2), it is prescribed that the wear of the initial link must not exceed 10% (ten percent) of the original diameter. This assessment involves measuring the chain thickness from pin to pin, resulting in a measurement of 23 mm, and considering pin diameters of 7 mm, in alignment with the authentic field conditions.

2. Fork Section

Figure 2 demonstrates precise measurements of the forklift fork length and thickness, complemented by an elaborate elucidation of the obtained results for the fork's length and thickness in Table 4.

In accordance with Minister of Manpower Regulation No. 08 of 2020, specifically outlined in Chapter 77, paragraphs 1 (b, d, f), compliance mandates that Fork No should not undergo a deflection surpassing 1/33 (one-third) times its length (b), avoid thinning of the fork by more than 10% (ten percent) (d), and ensure that there is no height difference exceeding 3% (three percent). Additionally, for forklifts utilizing a double fork (f), the specified length criteria must be adhered to.

Table 4. Forklift fork-section measurement data

Sketch	**Technical Data**				
	Fork's Position	Thickness (mm)		Measurement Results (mm)	
		Point	Spec	Point	actual
	Left	A	-	A	39
		B	-	B	30
		C	-	C	16
	Right	A	-	A	39
		B	-	B	30
		C	-	C	16
	Fork's Position	Dimensions (cm)		Twist Conditions	
		Length	Wide	Yes	No
	Left	107	12	-	✓
	Right	107	12	-	✓
	Fork's Deflection= 1/33 x fork's length 1/33 x 107 = 3.24 mm				

(a) (b)

Figure 2. Forklift's fork section measurement; (a) Fork length, (b) Fork thickness.

Non-Destructive Test

The non-destructive testing (NDT) method employed in this study is Magnetic Particles Inspection (MPI). The specific component of the forklift undergoing examination for potential non-destructive damage is the fork, constructed from iron. The MPI method utilized is a magnetic test, recognized as a non-destructive evaluation technique applicable to objects composed of magnetic materials such as iron, nickel, and cobalt. Subsequently, the ensuing section provides the pertinent parameters of the yoke utilized in this testing procedure.

Table 5 and Figure 3 delineate the utilization of the Non-Destructive Testing (NDT) method for scrutinizing the fork connection/welding region. The outcomes from the NDT process reveal the absence of any defects or cracks, thereby confirming the favorable condition of the fork.

Table 5. NDT Parameter

Parameter	**Description**
Strength magnetic force	Intensity or strength magnetic field which generated by yoke tool
Yoke distance	Distance between end tool yoke distance 5 cm on that surface in test check
Orientation yoke	Yoke tool orientation, using longitudinal studies, this type of research is deliberately used for long-term research.
Time application magnetic force	The time for applying the yoke tool to the surface of the workpiece is 3-5 minutes.
Position from movement	The position and movement applied to the surface of the workpiece are in accordance with the effectiveness of the inspection.

(a) (b) (c)

Figure 3. NDT on a fork's welding connection (a) HAZ area, (b) Pin's location, and (c) Specified HAZ point

Functional Test

Figure 4 and Table 6 illustrate the comprehensive process of functional testing for forklifts, including the completion of a detailed checklist. This procedure involves evaluating the operational aspects of the forklift while the engine is running, with a close examination of individual components. The results from the functional tests confirm the effective performance of the forklift, indicating compliance with established standards. Components that fail to meet the specified criteria are identified in the checklist and marked for necessary remediation. All findings must be addressed within one month; otherwise, the inspection result will not be considered passed.

(a) (b)

Figure 4. Forklifts functional-drive test, (a) Vertical lifting movement, and (b) Forklifts cockpit.

Table 6. Inspection check-list parameter

Inspection list	Condition		Remarks
	Passed	Failed	
Dynamo starter	-	✓	Need Repair
Work instrument/indicator	✓	-	Good
Work equipment electricity (Spark plug, rotor, etc.)	-	✓	Need Repair
Leakage:			
- *oil machine*	-	✓	Need Repair
- *material burn*	-	✓	Need Repair
- *water cooler*	-	✓	Need Repair
- *oil hydraulics*	✓	-	Good
- *oil transmission*	✓	-	Good
- *oil finals drives*	✓	-	Good
- *brake fluid*	✓	-	Good
Work clutch	✓	-	Good
Work gear (proceed backwards)	✓	-	Good
Work brake hand and foot	✓	-	Good
Work horn signals alarm	✓	-	Good
Work the lights (brake, dim, signal, etc.)	✓	-	Good
Motor Hydraulics/systems Hydraulic	✓	-	Good
Work cylinder stir/ power steering wheel	✓	-	Good
Work cylinder lifter and equipment	✓	-	Good
Work cylinder leverage and equipment	✓	-	Good
Condition exhaust gas	-	✓	Need Repair
Work all levers control	✓	-	Good
Voice noisy from machine	-	✓	Need Repair
Voice noisy from turbocharger	-	✓	Need Repair

Dynamic-Load Test

Dynamic load testing uses the same method as functional testing, the only difference is that the forklift is given a load. The load lifted is the daily load of the forklift, namely the boxes / components they produce. This test is carried out when the forklift raises, lowers, or lifts and moves the load gradually up to 100% of the forklift's safe working load.

The prescribed safe working load for this examination is established at 900 kg, deliberately avoiding the forklift's maximum capacity of 2.5 tons, as mutually agreed upon by PT. ABCD. The principal purpose of the dynamic load test is to evaluate the forklift's efficacy in lifting and transporting loads. Furthermore, the test seeks to verify the non-activation of the alarm system, indicating the absence of technical malfunctions or overload conditions. The outcomes derived from the dynamic load testing are subsequently presented in detail in Table 7.

Burden-Static Test

In the static load testing procedure, it is imperative to employ measuring tools, such as a meter and a laser distance device. Both instruments serve the same purpose, with the distinction being that the meter requires manual reading, whereas the laser distance device provides digital readings. The sequential stages of the static load testing process include:

a. Elevating the fork to a height of 775 mm
b. Gradually applying loads at 50%, 75%, and 100%
c. Observing a 2 mm decline in the height of the burden after 5 minutes
d. Recording the final load fork height at 773 mm.

Static load testing serves a dual role in appraising the strength and capacity of forklifts, alongside determining the deflection value of the fork. Deflection, indicating a modification in the fork's shape under a given load, is regulated by specific guidelines outlined in Permenaker No. 08 of 2020, Article 77, Paragraph 1(b), which prescribes that deflection should not exceed 1/33 (One by three twenty-three) times the length of the fork.

Through the computation, where Maximum Deflection is calculated as 1/33 times the fork's length (107mm), resulting in 3.24mm, and the Actual Deflection is determined as the difference between the initial height and the final height (775mm – 773mm = 2mm), it is evident that the actual deflection is below the maximum permissible deflection. This computation affirms the alignment of the fork with the specified conditions.

Table. 7 The dynamic test data for the applied load.

Test load	Hoist	traveling	Information
50 %	1.2 tons	Good	Fulfil condition
75 %	1.8 tonnes	Good	Fulfil condition
100 %	2.5 tons	Good	Fulfil condition

CONCLUSION

Following the completion of the inspection and testing procedures at PT. XXX, it is evident that no significant damages were identified, as the equipment remains in compliance with the regulations and standards outlined in Minister of Manpower Regulation No. 08 of 2020 regarding the Lifting and Transporting of equipment. The findings primarily consist of minor discrepancies, which, although noticeable, do not impede the operational efficacy of the tool. Specifically, variations in fork measurements exhibit slight discrepancies between early and subsequent assessments, yet the final values fall within the permissible range, aligning with the OHS requirements and warranting inclusion in the recommendation results of the inspection and testing process, particularly in components responsible for load-bearing, namely the fork and chain.

Based on the comprehensive evaluations conducted, it is discernible that any tool seeking operational usage must acquire a certification permit from the Department of Labor for occupational safety and health. Consequently, the conclusion can be drawn that the tool is in a satisfactory condition, meeting the OHS requirements as delineated in Minister of Manpower Regulation No. 08 of 2020 concerning Lifting and Transporting of equipment. In the subsequent steps, PT. XXX will compile a detailed report on the inspection and testing of forklifts and submit it to the labor service department to obtain the necessary certification and operational permits, ensuring the safe use of the tool.

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