

AD-A054 892

ARINC RESEARCH CORP ANNAPOLIS MD
RELIABILITY RECORD FOR GASOLINE-ENGINE-DRIVEN FORK-LIFT TRUCK F--ETC(U)
JAN 71

F/G 13/6

DAAK01-70-D-4142

NL

UNCLASSIFIED

B01-01-1-1095

1 of 1

AD A054892

END

DATE

FILMED

7-78

DDC

FOR FURTHER TRAN

Handwritten circled 'Q'

Handwritten 'R'

R

AD A 054892

**RELIABILITY RECORD FOR
GASOLINE-ENGINE-DRIVEN FORK-LIFT TRUCK FAMILY**

January 1971

Prepared in accordance with AMCR-702-8 for
U.S. ARMY MOBILITY EQUIPMENT COMMAND
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MISSOURI 63120

AD No. *1*
DDG FILE COPY


DDC
RECEIVED
JUN 6 1978
F

This document has been approved
for public release and sale; its
distribution is unlimited.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|-----------------------|---|
| 1. REPORT NUMBER 14 B01-01-1-1095 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) 6 RELIABILITY RECORD FOR GASOLINE-ENGINE-DRIVEN FORK-LIFT TRUCK FAMILY | | 5. TYPE OF REPORT & PERIOD COVERED |
| 7. AUTHOR(s) Not Listed | | 6. PERFORMING ORG. REPORT NUMBER B01-01-1-1095 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS ARINC Research Corporation 2551 Riva Road Annapolis, Maryland 21401 | | 8. CONTRACT OR GRANT NUMBER(s) 15 DAAK01-70-D-4142 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS U.S. ARMY MOBILITY EQUIPMENT COMMAND 4300 GOODFELLOW BOULEVARD ST. LOUIS, MISSOURI 63120 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) U.S. ARMY MOBILITY EQUIPMENT COMMAND 4300 GOODFELLOW BOULEVARD ST. LOUIS, MISSOURI 63120 | | 12. REPORT DATE 11 January 1971 |
| 16. DISTRIBUTION STATEMENT (of this Report) UNCLASSIFIED/UNLIMITED | | 13. NUMBER OF PAGES SE 12 720 |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) | | 15. SECURITY CLASS. (of this report) UNCLASSIFIED |
| 18. SUPPLEMENTARY NOTES | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) | | |

400 247 

**RELIABILITY RECORD
FOR GASOLINE-ENGINE-DRIVEN
FORK-LIFT TRUCK FAMILY**

Prepared in accordance with AMCR 702-8
for U.S. Army Mobility Equipment Command
4300 Goodfellow Boulevard
St. Louis, Missouri 63120
under Contract DAAK01-70-D-4142

January 1971



by
ARINC Research Corporation
a Subsidiary of Aeronautical Radio, Inc.
2551 Riva Road
Annapolis, Maryland 21401
Publication B01-01-1-1095

R

This document has been approved
for public release and sale; its
distribution is unlimited.

Copyright © 1970

ARINC Research Corporation

Prepared under Contract DAAK01-70-D-4142
which grants to the U.S. Government a license
to use any material in this publication for
Government purposes.

FOREWORD

This document is one of three prepared under Contract DAAK01-70-D-4142, Delivery Order 0001:

Reliability Record for 6000-Pound Gasoline-Engine-Driven Fork-Lift Truck

Reliability Record for Gasoline-Engine-Driven Fork-Lift Truck Family

Failure Modes and Effects Analysis for Gasoline-Engine-Driven Fork-Lift Truck Family

These reports were the result of a six-month review and evaluation of fork-lift truck operation, including data collection and analysis.

| | |
|---------------------------------|---|
| ACCESSION for | |
| NTIS | White Section <input checked="" type="checkbox"/> |
| DDC | Buff Section <input type="checkbox"/> |
| UNANNOUNCED | <input type="checkbox"/> |
| JUSTIFICATION | |
| BY | |
| DISTRIBUTION/AVAILABILITY CODES | |
| Dis. | SPECIAL |
| A | |

CONTENTS

| | Page |
|--|------|
| FOREWORD | iii |
| 1. Purpose | 1 |
| 2. Scope | 1 |
| 3. Description of the Truck | 1 |
| 4. Description of System Functions | 2 |
| 5. Mission Profile | 2 |
| 6. Failure Definition | 8 |
| 7. List of Documents Used | 8 |
| 8. Reliability Block Diagrams | 8 |
| 9. Reliability Calculations | 9 |
| 9.1 Basic Data | 9 |
| 9.2 Component Accumulated Hours | 9 |
| 9.3 Component Failure Rates | 9 |
| 9.4 Component Reliability | 10 |
| 9.5 Subsystem/Assembly Reliability | 10 |
| 9.6 System Reliability | 10 |
| 9.7 Function Reliability | 10 |
| 9.8 Mission Reliability | 11 |
| APPENDIX A: COMPONENT MISSION PROFILE MATRIX | A-1 |
| APPENDIX B: COMPONENT RELIABILITY AND MAINTAINABILITY DATA | B-1 |

RELIABILITY RECORD FOR GASOLINE-ENGINE-DRIVEN FORK-LIFT TRUCK FAMILY

1. PURPOSE

This record is a compilation of reliability information pertaining to the family of gasoline-engine-driven fork-lift trucks used in warehousing operations. The record serves as the primary management-control tool for the truck's reliability.

2. SCOPE

The reliability record includes:

- A general description of the gasoline-engine-driven fork-lift truck
- A general profile of functions that must be performed by the truck and its systems
- A description of a typical mission for the truck, indicating the percentages of time the various systems function during the mission
- A definition of "failure" in terms of its effects on the accomplishment of the mission
- A list of documents used in the preparation of this reliability record
- Reliability block diagrams depicting the relationships between the reliability of the truck and its major systems and subsystems/assemblies

3. DESCRIPTION OF THE TRUCK

The family of gasoline-engine-driven fork-lift trucks to which this reliability record applies consists of nontactical fork-lift trucks designed for handling and warehousing of materials. They are used for transporting loads from one area to another and for depositing and stacking loads, both indoors and outdoors. The trucks are self-contained rider-type and capable of handling loads up to 20,000 pounds, depending on the load rating of the particular truck. The load rating indicates the maximum load that the truck can lift when its load center (center of gravity) is 24 inches from the face of the forks at the specified lift height.

The truck is powered by an internal combustion, piston-driven engine usually equipped to eliminate radio interference. Materials handling is accomplished by a two-pronged fork on an upright boom lift powered for lifting and tilting by an engine-mounted hydraulic pump. (The hydraulic pump also serves the truck's power steering.) The boom can be tilted forward or backward (the maximum tilt varying with the model) as required by the nature of the load or operation. The speed of the truck is usually limited by an engine governor. An overhead guard is provided to protect the operator from falling objects.

Table 1 lists the manufacturers, Federal Stock Numbers, and descriptive data for the fork-lift trucks that were included in the sample from which the reliability data presented in this record were collected.

4. DESCRIPTION OF SYSTEM FUNCTIONS

Seventeen systems are used in the truck family to perform various functions in the accomplishment of the mission; some models do not employ all the systems. The systems and brief descriptions of their functions are listed in Table 2.

5. MISSION PROFILE

Use of the truck generally involves: starting the engine, allowing the engine to warm up by idling, performing several operating cycles, and then stopping the engine. This procedure is repeated numerous times during an eight-hour shift. An operating cycle consists of (a) a drive function, in which the truck moves toward and maneuvers in on a load; (b) a tilting/lifting function, in which the truck picks up the load (transmission in neutral position and the handbrake engaged); (c) a transport function, in which the truck transports the load to another position; and (d) a deposit function in which the truck deposits the load (again with the transmission in neutral position and the handbrake engaged).

Observation of operations at several Depot warehouses disclosed that a single warehousing operation (i.e., transferring one load from one point to another) does not typify the mission of the truck. The mission is more aptly described by a full day's operation, involving numerous starts and stops and the transporting of numerous loads of different weights over different distances. Therefore, the mission profile selected describes the operation of the truck throughout an eight-hour shift.

The initial segment of a typical shift is as follows: (a) the operator performs daily preventive-maintenance tasks, such as checking oil level, coolant level, battery condition, belt condition, and lights; (b) he starts the truck and allows it to idle until the engine reaches operating temperature, (c) he proceeds through several cycles of driving to, lifting, transporting, and depositing a load, (d) he stops the engine and "parks" the truck. Such an initial segment is illustrated in Figure 1a. In addition to the final stop at the end of the shift, the vehicle is stopped for a morning break, a meal break, an afternoon break, and an average of four other times for various reasons during the shift. Engine warm-up occurs only at the beginning of the shift and after the meal break. The typical complete shift described above is illustrated in Figure 1b.

The time values shown in Figure 1 were derived from field observations and examination of vehicle-use data covering 515 trucks over the period December 1968 to August 1970.* In Table 3, the durations and frequencies of occurrence of the various functions are listed and converted to percentages of total operating time. The total operating time of 4.66 hours for the 8-hour mission was rounded to 5 hours in the subsequent reliability-assessment computations.

*The records were obtained at three Depots: The Atlanta Army Depot, Forest Park, Georgia; the Red River Army Depot, Texarkana, Texas; and the Defense General Supply Center, Richmond, Virginia.

Table 1. DESCRIPTION OF GASOLINE-ENGINE-DRIVEN FORK-LIFT TRUCK FAMILY

| Manufacturer | FSN | Capacity* (lbs.) | Lift Height (inches) | Type of Tires | Location Distribution | | | |
|------------------------------|----------------|---------------------|----------------------------|---------------------|-----------------------|------|------|----|
| | | | | | ATAD | RRAD | DGSC | |
| Clark | 3930-956-0094 | 4,000 | 144 | Solid rubber | | | 14 | |
| Minneapolis-Moline | 3930-724-3570 | 4,000 | 144 | Pneumatic | | 4 | | |
| Minneapolis-Moline | 3930-064-5868 | 4,000 | 144 | Pneumatic | 3 | 25 | | |
| Minneapolis-Moline | 3930-064-6564 | 4,000 | 144 | Solid rubber | 9 | | 2 | |
| Yale & Towne | 3930-271-1449 | 2,000 | 130 | Solid rubber | 1 | | 5 | |
| Towmotor | 3930-292-1100 | 6,000 | 127 | Solid rubber | | | 6 | |
| Towmotor | 3930-292-1098 | 6,000 | 168 | Solid rubber | 3 | | | |
| Clark | 3930-542-2175 | 4,000 | 100 | Solid rubber | 7 | | | |
| Clark | 3930-542-2176 | 4,000 | 144 | Solid rubber | 10 | | | |
| Baker | 3930-738-5938 | 6,000 | 168 | Pneumatic | 5 | | 2 | |
| Clark | 3930-781-3857 | 2,000 | 100 | Solid rubber | 3 | | | |
| Clark | 3930-965-0093 | 4,000 | 100 | Solid rubber | | | 2 | |
| Clark | 3930-915-0093 | 4,000 | 100 | Solid rubber | | | 2 | |
| Clark | 3930-954-9311 | 4,000 | 100 | Solid rubber | 12 | 6 | | |
| Clark | 3930-954-1303 | 4,000 | 144 | Solid rubber | 21 | 22 | 6 | |
| Allis Chalmers | 3930-958-3684 | 6,000 | 168 | Pneumatic | 17 | 9 | | |
| Baker | 3930-879-6870 | 6,000 | 168 | Pneumatic | | | 4 | |
| Minneapolis-Moline | 3930-064-5869 | 6,000 | 168 | Pneumatic | | | 1 | |
| Towmotor | 3930-781-3856 | 4,000 | 100 | Solid rubber | | 5 | 1 | |
| Towmotor | 3930-781-3855 | 4,000 | 144 | Solid rubber | 91 | 12 | 25 | |
| Towmotor | 3930-073-9222 | 4,000 | 144 | Pneumatic | | 8 | | |
| Service-Caster | 3930-214-1025 | 4,000 | 180 | Solid rubber | 1 | | | |
| Clark | 3930-J02-2113 | 4,000 | 212 | Solid rubber | | | 1 | |
| Clark | 3930-266-8955 | 4,000 | 144 | Pneumatic | | | 6 | |
| Towmotor | 3930-P00-8120 | 3,000 | 130 | Solid rubber | | 1 | | |
| Allis Chalmers | 3930-203-2842 | 2,000 | 130 | Pneumatic | | 3 | | |
| Clark | 3930-203-2842 | 2,000 | 130 | Pneumatic | | 3 | | |
| Clark | 3930-266-8961 | 4,000 | 144 | Solid rubber | | | 1 | |
| Towmotor | 3930-752-9464 | 4,000 | 144 | Solid rubber | | 55 | | |
| Automatic Transportation | 3930-679-4457 | 10,000 | 100 | Solid rubber | | 3 | | |
| Hyster | 3930-J28-0598 | 15,000 | 100 | Pneumatic | | 1 | | |
| Hyster | 3930-897-4632 | 15,000 | 210 | Pneumatic | 5 | 7 | 2 | |
| Clark | FSC-3930-NFN | 20,000 | 210 | Pneumatic | | 1 | | |
| Allis Chalmers | 3930-1208-3242 | 5,000 | 144 | Pneumatic | | 2 | | |
| Towmotor | 3930-678-9917 | 4,000 | 100 | Solid rubber | | | 10 | |
| White | 3930-P00-9608 | 4,000 | 100 | Solid rubber | | 16 | | |
| White | 3930-P00-9607 | 6,000 | 136 | Pneumatic | | 15 | | |
| B.B. Lift Corporation | 3930-209-2841 | 6,000 | 168 | Pneumatic | | 1 | | |
| Gerlinger | 3930-514-3477 | 15,000 | 210 | Pneumatic | | 1 | | |
| Towmotor | 3930-273-8225 | 4,000 | 144 | Solid rubber | | | 3 | |
| Yale | 3930-214-1026 | 4,000 | 144 | Solid rubber | | | 5 | |
| Hyster | 3930-238-4411 | 10,000 | 210 | Pneumatic | | | 1 | |
| Hyster | 3930-038-4410 | 10,000 | — | — | | 1 | | |
| Baker-York | 3930-209-3242 | 6,000 | — | — | | 1 | | |
| *Rated with 24" load center. | | | | | Total | 188 | 202 | 99 |

Table 2. FUNCTIONAL DESCRIPTIONS OF THE TRUCK'S SYSTEMS

| Name | Functional Description |
|-----------------------|---|
| Engine System | Provides motive power for propelling the fork-lift truck and for driving accessory subsystems, such as the generator assembly, water pump, and hydraulic pump |
| Fuel System | Delivers fuel and air mixture to the engine proportional to the vehicle's power demand |
| Exhaust System | Transports the products of combustion away from the engine |
| Cooling System | Maintains a constant and uniform engine temperature |
| Electrical System | Generates, regulates, and delivers electrical power for engine ignition and operation of electrical subsystems |
| Transmission System | Transmits engine power and regulates the power torque/speed characteristic in response to vehicle demand and operator set point |
| Propeller System | Transmits motive power from the transmission to the differential |
| Front Axle System | Transmits motive power from the propeller shaft to the front wheels |
| Rear Axle System | Transmits steering force to the rear wheels |
| Brakes System | Reduces vehicle speed by converting vehicle kinetic energy to heat energy and holds vehicle immobile when stopped |
| Wheels System | Supports vehicle weight and provides for vehicle rolling motion and braking action |
| Steering System | Controls the direction of vehicle motion in response to operator set point |
| Frame System | Provides primary vehicle structural support for systems and operator |
| Body System | Provides enclosure for vehicle systems and operator |
| Suspension System | Dampen vibrations transmitted to operator and load during movement of vehicle |
| Clutch System | Permits engagement of transmission gearing to permit forward or reverse vehicle motion in response to operator signal |
| Hydraulic Lift System | Generates, regulates and delivers hydraulic power for lifting and tilting the load |

Table 3. DISTRIBUTION OF TIME, BY FUNCTION, DURING ONE MISSION

| Function | Duration per Occurrence (minutes) | Frequency of Occurrence | Total Time (minutes) | Percentage of Operating Time |
|---|--|--------------------------------|-----------------------------|-------------------------------------|
| Start | 0.25 | 8 | 2.0 | 0.7 |
| Idle | 5.00 | 2 | 10.0 | 3.6 |
| Drive | 0.75 | 89 | 66.7 | 23.8 |
| Lift | 0.75 | 89 | 66.7 | 23.8 |
| Transport | 0.75 | 89 | 66.7 | 23.8 |
| Deposit | 0.75 | 89 | 66.7 | 23.8 |
| Stop | *0.16 | 8 | 1.3 | 0.5 |
| Total Operating Time | | | 280.1 | 100.00 |
| Operating Time | | | **4.66 hours | |
| Non Operating Time | | | 3.34 hours | |
| Mission Time | | | 8.00 hours | |
| <p>*Assumed value. **Rounded to 5 hours for the reliability-assessment computations.</p> | | | | |

The number of cycles (loads moved) during the typical 8-hour shift was computed as follows:

given: Total start time = 2 minutes
 Total idle time = 10 minutes
 Total stop time = 1.3 minutes
 Total operating time = 280.1 minutes (4.66 hours)
 Drive/lift/transport/deposit cycle = 3 minutes

then

$$\begin{aligned} \text{Number of loads} &= \frac{t_{\text{op. time}} - (t_{\text{start}} + t_{\text{idle}} + t_{\text{stop}})}{(t_{\text{drive}} + t_{\text{lift}} + t_{\text{transport}} + t_{\text{deposit}})} \\ &= \frac{[280.1 - (2 + 10 + 1.3)]}{3} \\ &= 89 \end{aligned}$$

The mission-time profile was developed by use of the matrix presented in Appendix A.

The environment in which the truck works depends on the nature of the operation it supports. In the warehousing environment typical to the Continental United States (CONUS) — for which the vehicle is designed and in which our data were gathered — the vehicle generally drives and transports across relatively flat and smooth surfaces in a moderate temperature and humidity range. The aisle widths required by MIL-STD-268C for maneuvering the vehicle are shown in Table 4.

| Table 4. AISLE-WIDTH REQUIREMENTS | | |
|-----------------------------------|-----------------------------|---------------------------------|
| Capacity (lbs.) | Width in Feet | |
| | For Trucks With Solid Tires | For Trucks With Pneumatic Tires |
| 2,000 | 10 | 12 |
| 4,000 | 12 | 15 |
| 6,000 | 14 | 18 |
| 8,000 | 14 | 20 |
| 10,000 | — | 22 |
| 15,000 | — | 25 |
| 20,000 | — | 28 |

The truck is designed to facilitate ready adjustment, servicing, or replacement of fan belt, ignition assemblies and parts, carburetor and components, fuel pump and components, oil filter and components, clutch, starter, generator, generator regulator, battery, wearing parts of the steering assembly, tires, wheels, lights, and horn. In a typical CONUS Army Depot, all such work is performed by the motor pool's maintenance shop (i.e., depot level of maintenance). Any maintenance at the user location is performed by a roving mechanic from this shop. Operators do not perform any maintenance.

6. FAILURE DEFINITION

There are no QMRS, SDRs, or specific performance specifications available from which established performance limits for the gasoline-engine-driven fork-lift truck might be extracted. Furthermore, the TAERS/TAMMS data that were collected for reliability analysis do not record instances of marginal performance detrimental to the mission. Consequently, it was not feasible to define failure in the quantitative terms of performance criteria. As the best alternative, failure was defined as *any incident that deadlines* the vehicle during operation or that results in an unscheduled replacement or repair action.*

7. LIST OF DOCUMENTS USED

The following documents were used in preparing this reliability record:

- AMCR 702-8: Quality Assurance Reliability Record and Status Report
- TB-750-93-1: Functional Grouping Codes: Combat Tactical, and Support Vehicle and Special Purpose Equipment
- MIL-T-21870: Military Specification Trucks, Lift, Fork, Gasoline; General Specifications For
- TM 10-3930-622-14: Technical Manual Operation, Service, Maintenance Instructions or Truck, Fork, Lift, Gasoline Engine Driven, Pneumatic Rubber Tires. 6,000 Pound Capacity, Baker Model FJF-060, Army Model MHE-210

Additionally, several Technical Manuals containing listings of repair parts and special tools (-35P and -20P manuals) were used to identify parts, FSNs, and nomenclatures appearing on the maintenance-action forms from which the failure data were extracted.

8. RELIABILITY BLOCK DIAGRAMS

Reliability block diagrams for the family of gasoline-engine-driven fork-lift trucks are presented in Figures 2 through 20. Figure 2 is an overall reliability block diagram for the truck. Figure 3 is a function reliability diagram showing the systems that are required to operate to accomplish a given function and the relationships of the systems to one another. In all cases, the simple serial relationships are apparent. Each block is identified by the name of the system and contains (1) the Functional Grouping Code for the system, assigned in accordance with TB-250-93-1, (2) a space for inserting the probability, R, that the system will perform successfully for the time the vehicle operates in the specified function during the eight-hour mission, (3) the percentage, t, of the total operating time that the system operates in the specified function.

*Inoperative due to damage, malfunctioning, or necessary repairs.

Figures 4 through 20 are reliability block diagrams for the seventeen systems of the truck. These diagrams show the reliability relationship of the major subsystems/assemblies of each system and of the major components of each subsystem/assembly. The reliability relationships of the subsystems/assemblies are represented vertically to the left of the double line; those of the components of the subsystems/assemblies are represented horizontally to the right of the double line. In all cases, the simple serial relationships are apparent. Each block in the diagrams is identified by the name of the subsystem/assembly or component and contains (1) the Functional Group Code for the subsystem/assembly or component, (2) a space for inserting the failure rate, λ , in the case of the subsystem/assembly blocks and the failure rate itself in the case of the component blocks, and (3) the percentage, t , of the total operating time that the subsystem/assembly or component operates. A "phantom" component, with failure rate λ' , is included for each subsystem/assembly to account for the failures ascribed to the subsystem/assembly as a whole.

9. RELIABILITY CALCULATIONS

9.1 Basic Data

The failure rates for the components of the fork-lift truck family were based on data extracted from approximately 24,000 maintenance records covering the period from December 1968 through August 1970 on a truck sample size of 515. The data were analyzed by computer to determine total operating hours on each component, number of failures for each component, maintenance manhours and mean maintenance manhours for each component, and component reliability. Appendix B documents the results of this analysis in tabular form.

Table 1 of Section 3 listed the various trucks included in the sample. Table 5 shows the distribution of the sample by lifting capacity. The preponderance of the trucks were in the 4000-pound class and 6000-pound class. In this analysis, all the data collected from this

| Capacity (lbs.) | Number of Trucks | Percent of Truck Inventory |
|-----------------|------------------|----------------------------|
| 2000 | 17 | 3.30 |
| 3000 | 1 | .19 |
| 4000 | 406 | 78.83 |
| 5000 | 2 | .39 |
| 6000 | 65 | 12.62 |
| 10000 | 6 | 1.17 |
| 15000 | 16 | 3.11 |
| 16000 | 1 | .19 |
| 20000 | 1 | .19 |
| Total | 515 | 100.00 |

sample population were used in calculating component failure rates. No attempt was made to evaluate the statistical correlation between component failure rate and such factors as truck capacity, truck age, depot location, and truck manufacturer.

9.2 Component Accumulated Hours

The Depot records disclosed that approximately 783,290 hours were accumulated by the 515 trucks during the period January 1969 to June 1970. Component accumulated times were determined by multiplying these hours by the percentage, t , of total time during the mission that each component was determined to operate. For example, the components of the engine assembly (Group Code 0100) were determined to operate in all functions except the stop function (see matrix in Appendix A), i.e., during 99.5 percent of the operating time. Therefore, accumulated time for the engine-assembly components = $0.995 \times 783,290 = 779,374$ hours. Accumulated times for the other components of the truck were computed similarly, except for two deviations that were necessary for computing the hours for the generator and alternator assemblies. Very few trucks in the sample were equipped with alternators; the total hours for these trucks amounted to 3,051. Therefore, the accumulated time for the generator assembly and its associated parts was computed to be $783,290 - 3,051 = 780,239$.

9.3 Component Failure Rates

Component failure rates were computed simply by dividing the observed number of failures of the component by the accumulated hours. For example, for the Accessory Drive (Group Code 01005) of the Engine Assembly, 25 failures were recorded. Therefore:

$$\begin{aligned}\lambda_{01005} &= 25 \text{ failures}/779,374 \text{ hours} \\ &= 0.032 \times 10^{-3} \text{ failures/hour}\end{aligned}$$

The failure rate for components of which there is more than one in the subsystem/assembly represents the rate for that component group in the subsystem/assembly.

9.4 Component Reliability

The reliability (probability of completing the mission) of each component was computed as follows:

$$R_c = e^{-\lambda_c T_c}$$

where

- R_c - component reliability
- λ_c - component failure rate
- T_c - component operating time during the mission
- truck operating time during the mission $\times t$

Therefore, for the Accessory Drive component:

$$\begin{aligned} R_{01005} &= e^{-\lambda_{01005} T_{01005}} \\ &= e^{-(0.032 \times 10^{-3}) \times 4.98} \\ &= 0.99984 \end{aligned}$$

9.5 Subsystem/Assembly Reliability

The failure rates for the subsystems/assemblies are not inserted on the reliability block diagrams because the components that comprise the subsystems/assemblies vary with the truck model. The reliability value may be computed either by (1) summing the failure rates of the constituent components (being sure to include the rate for the "phantom" component representing the failure ascribed to the subsystem/assembly as a whole — i.e. λ') and converting to a probability value by the exponential expression $R = e^{-\lambda T}$, or by (2) taking the product of the component reliabilities computed as described in Section 9.4 (again, being sure to include the reliability value — R' — for the "phantom" component). The latter method must be used when operating times for components within the subsystem/assembly differ. As an example of the second method, the computation for the Engine Assembly (group code 0100), assuming all of the components listed in the diagram, is as follows:

$$\begin{aligned} R_{0100} &= R'_{0100} \times R_{01001} \times R_{01002} \times \dots \times R_{01009} \\ &= 0.99930 \times 0.99991 \times 0.99925 \times \dots \times 0.99987 \\ &= 0.99710 \end{aligned}$$

9.6 System Reliability

The reliability for a given system is the product of the reliability values for the subsystems/assemblies comprising that system, as shown to the left of the double line in the system reliability block diagrams.

9.7 Function Reliability

The reliability of each of the truck's seven functions is the product of the probabilities that the systems required for that function will operate successfully in that function for the entire mission. This is expressed mathematically as follows (the start function is used for demonstration):

$$R_{\text{start}} = e^{-\lambda_{06} T_{06\text{start}}} \times e^{-\lambda_{01} T_{01\text{start}}} \times e^{-\lambda_{03} T_{03\text{start}}}$$

where

- λ_{06} - Failure rate of the electrical system*
- λ_{01} - Failure rate of the engine system*
- λ_{03} - Failure rate of the fuel system*

*Summation of failure rates for the constituent components and the phantom component.

- $T_{06\text{start}}$ = Operating time of the electrical system in the start function
- $T_{01\text{start}}$ = Operating time of the engine system in the start function
- $T_{03\text{start}}$ = Operating time of the fuel system in the start function

9.8 Mission Reliability

The probability of the truck's completing the mission successfully, then, is the product of the seven function reliability values. This is expressed mathematically as follows:

$$R_{\text{mission}} = R_{\text{start}} \times R_{\text{idle}} \times R_{\text{drive}} \times R_{\text{lift}} \times R_{\text{transport}} \times R_{\text{deposit}} \times R_{\text{stop}}$$

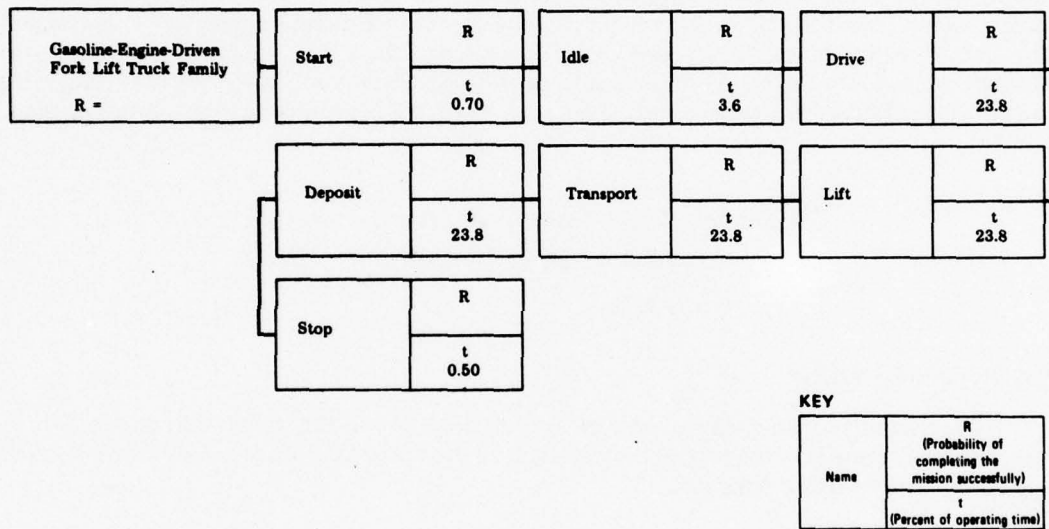


Figure 2. TRUCK RELIABILITY BLOCK DIAGRAM

FUNCTION

| | | | | | | | | | | | | | | |
|-------------------|----|---|---|-----|---------------|----|---|---|-----|-------------|----|---|---|-----|
| Electrical System | 06 | R | t | .70 | Engine System | 01 | R | t | .70 | Fuel System | 03 | R | t | .70 |
|-------------------|----|---|---|-----|---------------|----|---|---|-----|-------------|----|---|---|-----|

1. Start

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----|---|---|-----|-------------------|----|---|---|-----|-------------|----|---|---|-----|----------------|----|---|---|-----|----------------|----|---|---|-----|---------------|----|---|---|-----|
| Engine System | 01 | R | t | 3.6 | Electrical System | 06 | R | t | 3.6 | Fuel System | 03 | R | t | 3.6 | Cooling System | 05 | R | t | 3.6 | Exhaust System | 04 | R | t | 3.6 | Brakes System | 12 | R | t | 3.6 |
|---------------|----|---|---|-----|-------------------|----|---|---|-----|-------------|----|---|---|-----|----------------|----|---|---|-----|----------------|----|---|---|-----|---------------|----|---|---|-----|

2. Idle

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----|---|---|------|-------------|----|---|---|------|----------------|----|---|---|------|----------------|----|---|---|------|-------------------|----|---|---|------|---------------------|----|---|---|------|
| Engine System | 01 | R | t | 23.8 | Fuel System | 03 | R | t | 23.8 | Exhaust System | 04 | R | t | 23.8 | Cooling System | 05 | R | t | 23.8 | Electrical System | 06 | R | t | 23.8 | Transmission System | 07 | R | t | 23.8 |
|---------------|----|---|---|------|-------------|----|---|---|------|----------------|----|---|---|------|----------------|----|---|---|------|-------------------|----|---|---|------|---------------------|----|---|---|------|

3. Drive

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|----|---|---|------|-----------------|----|---|---|------|---------------|----|---|---|------|-----------|----|---|---|------|------------|----|---|---|------|------------------|----|---|---|------|
| Frame | 15 | R | t | 23.8 | Steering System | 14 | R | t | 23.8 | Brakes System | 12 | R | t | 23.8 | Rear Axle | 11 | R | t | 23.8 | Front Axle | 10 | R | t | 23.8 | Propeller System | 09 | R | t | 23.8 |
|-------|----|---|---|------|-----------------|----|---|---|------|---------------|----|---|---|------|-----------|----|---|---|------|------------|----|---|---|------|------------------|----|---|---|------|

| | | | | | | | | | | | | | | | | | | | |
|------|----|---|---|------|--------|----|---|---|------|------------------|----|---|---|------|---------------|----|---|---|------|
| Body | 18 | R | t | 23.8 | Wheels | 13 | R | t | 23.8 | Hydraulic System | 24 | R | t | 23.8 | Clutch System | 25 | R | t | 23.8 |
|------|----|---|---|------|--------|----|---|---|------|------------------|----|---|---|------|---------------|----|---|---|------|

KEY

| | | |
|------|---|--|
| Name | R | (Probability of completing the mission successfully) |
| | t | (Percent of operating time) |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----|---|---|------|-------------------|----|---|---|------|-------------|----|---|---|------|----------------|----|---|---|------|----------------|----|---|---|------|
| Engine System | 01 | R | t | 23.8 | Electrical System | 06 | R | t | 23.8 | Fuel System | 03 | R | t | 23.8 | Cooling System | 05 | R | t | 23.8 | Exhaust System | 04 | R | t | 23.8 |
|---------------|----|---|---|------|-------------------|----|---|---|------|-------------|----|---|---|------|----------------|----|---|---|------|----------------|----|---|---|------|

4. Lift

| | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|----|---|---|------|--------------|----|---|---|------|-------------|----|---|---|------|--------------|----|---|---|------|--------|----|---|---|------|
| Hydraulic System | 24 | R | t | 23.8 | Brake System | 12 | R | t | 23.8 | Body System | 18 | R | t | 23.8 | Frame System | 15 | R | t | 23.8 | Wheels | 13 | R | t | 23.8 |
|------------------|----|---|---|------|--------------|----|---|---|------|-------------|----|---|---|------|--------------|----|---|---|------|--------|----|---|---|------|

Figure 3 FUNCTION RELIABILITY BLOCK DIAGRAMS (Sheet 1 of 2)

Function

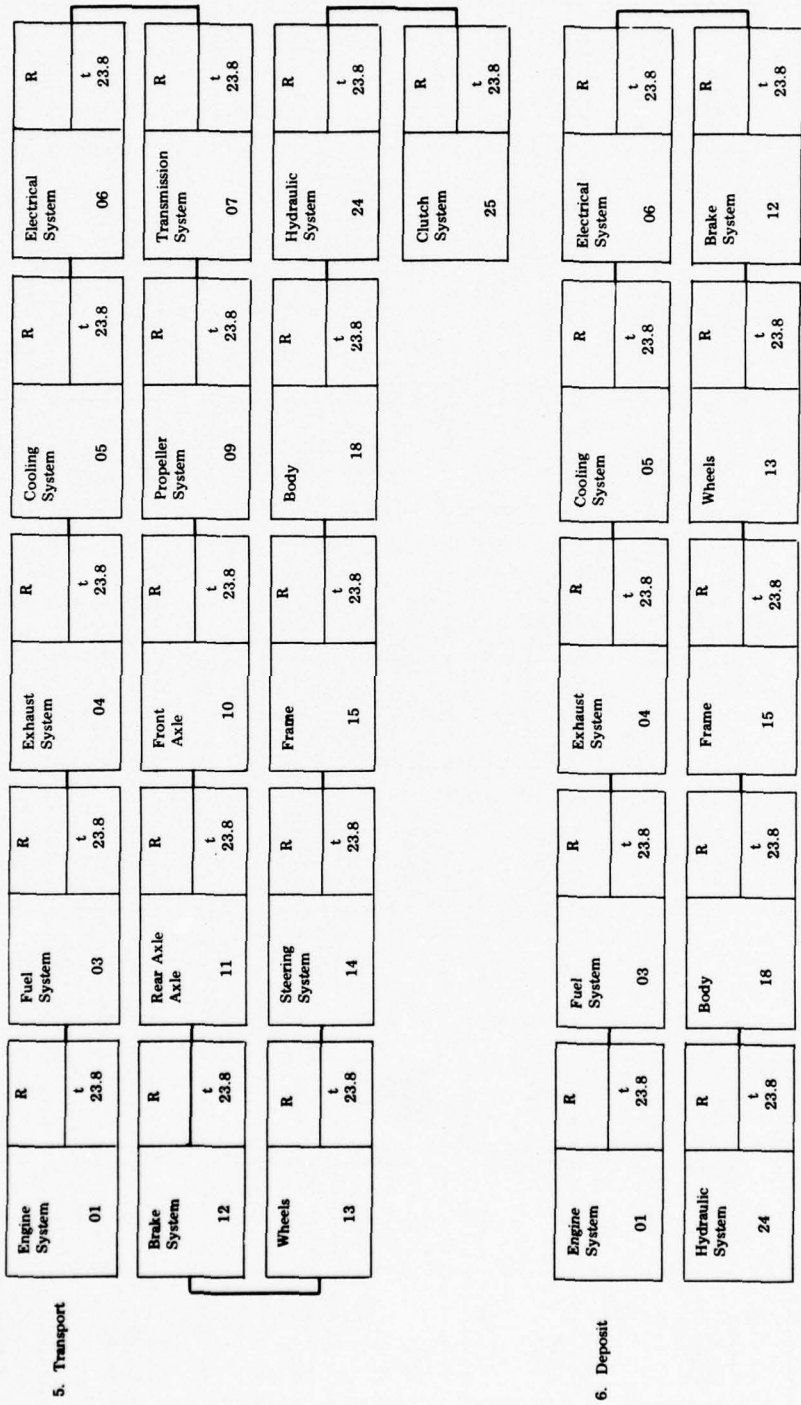


Figure 3. (Sheet 2 of 2)

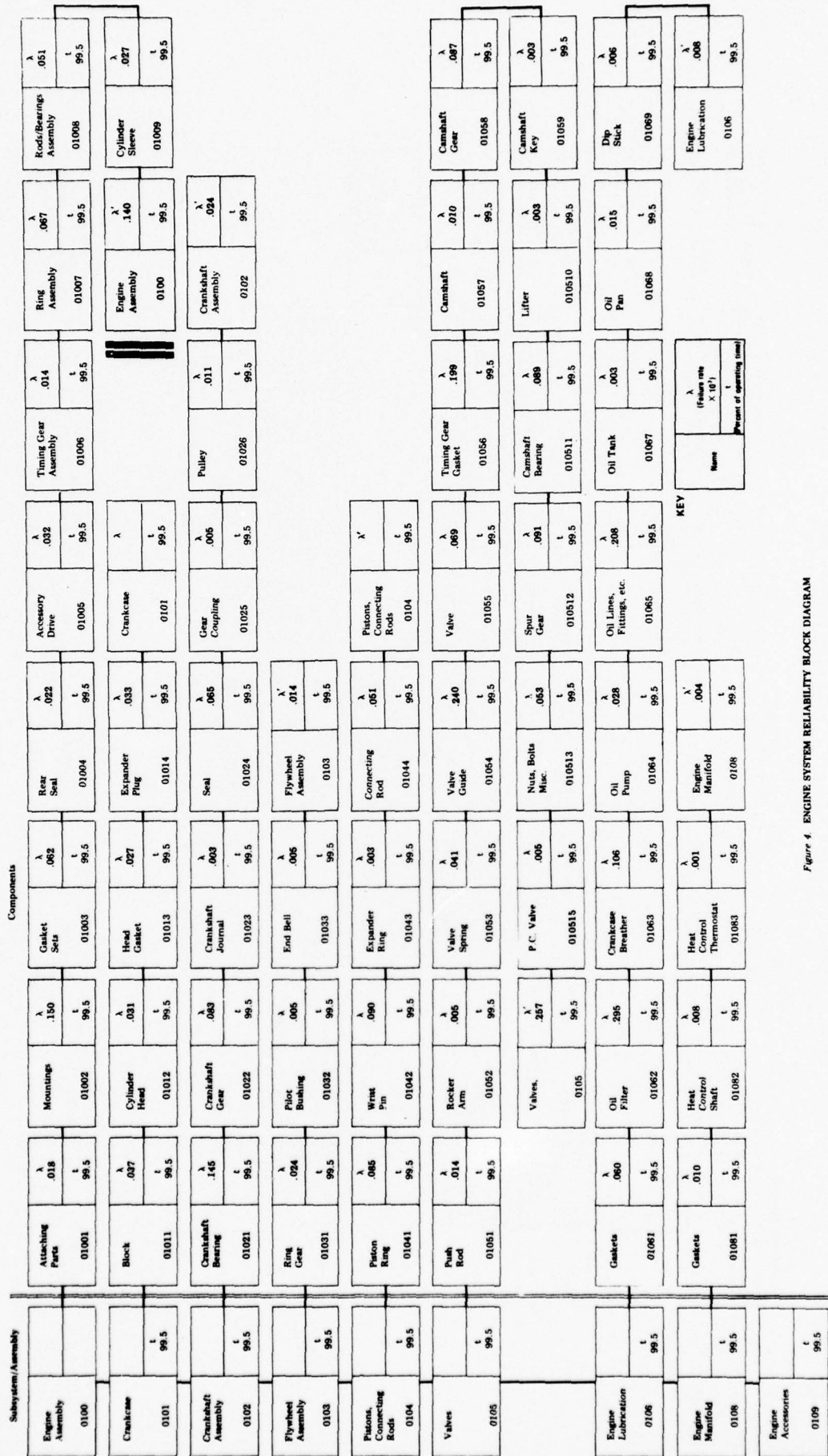


Figure 4 ENGINE SYSTEM RELIABILITY BLOCK DIAGRAM

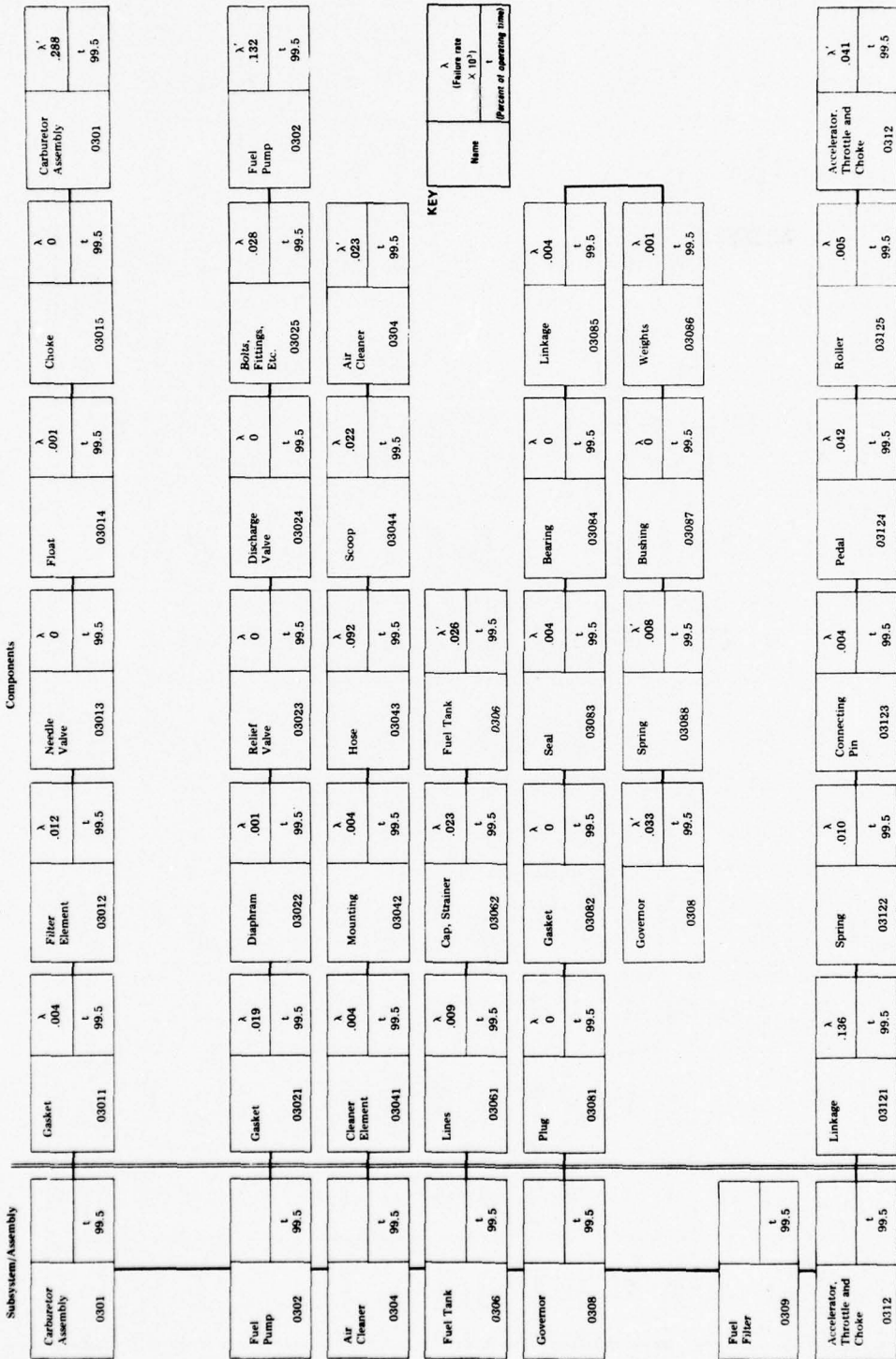


Figure 5. FUEL SYSTEM RELIABILITY BLOCK DIAGRAM

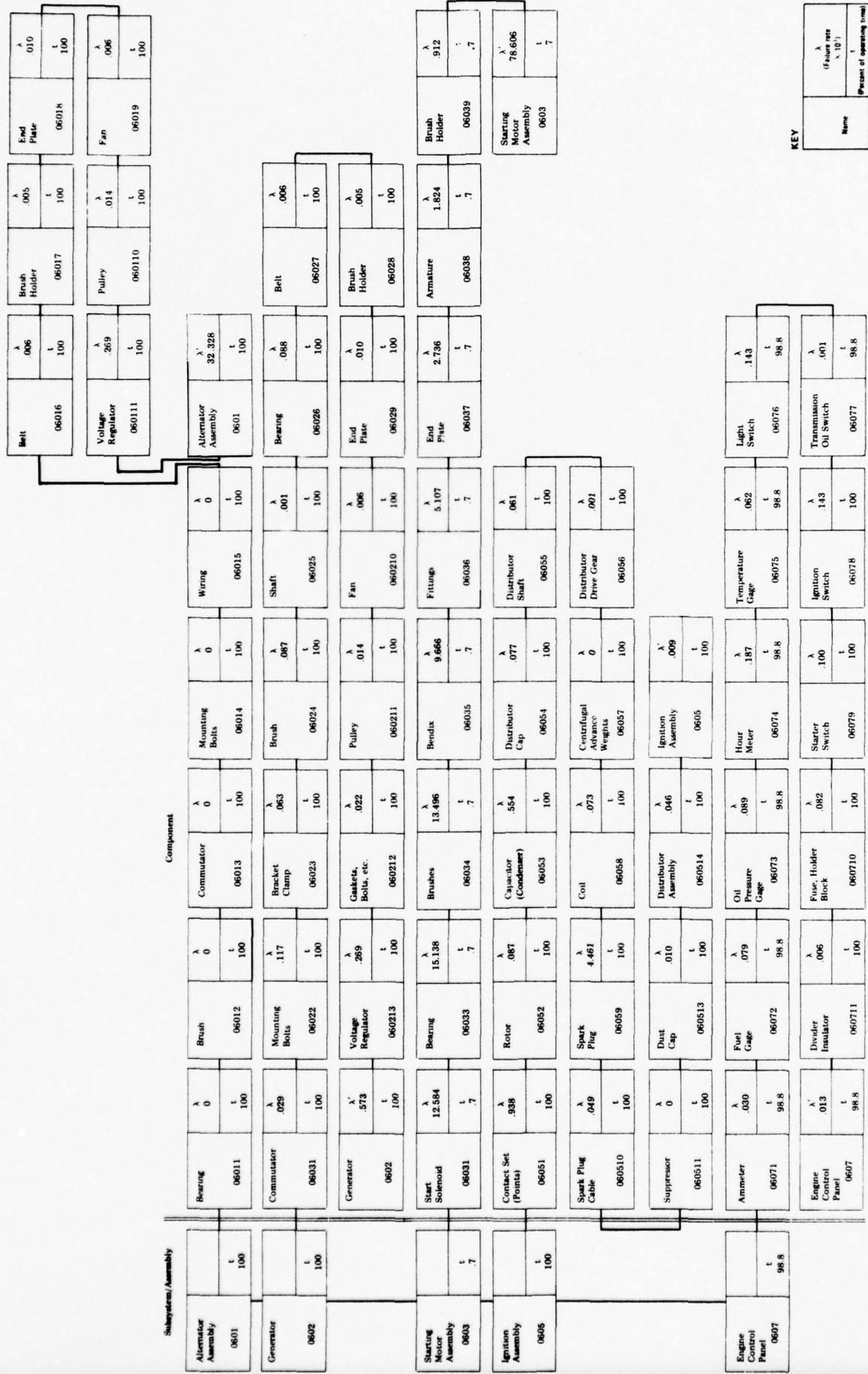


Figure 8 ELECTRICAL SYSTEM RELIABILITY BLOCK DIAGRAM (Sheet 1 of 2)



Figure 9 TRANSMISSION SYSTEM RELIABILITY BLOCK DIAGRAM

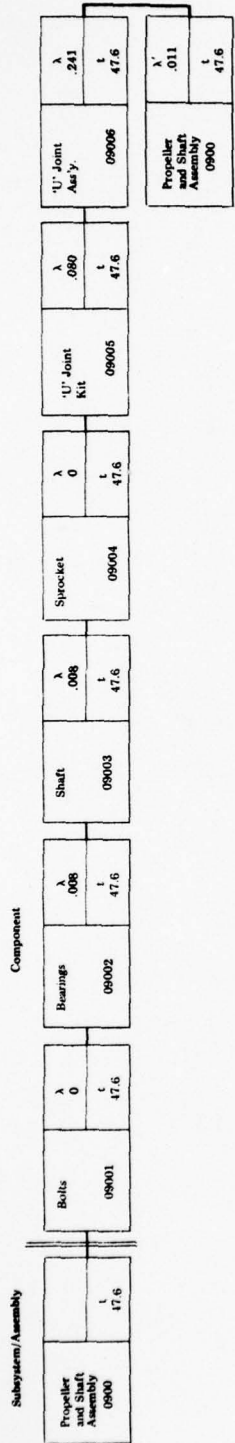


Figure 10. PROPELLER AND SHAFT SYSTEM RELIABILITY BLOCK DIAGRAM

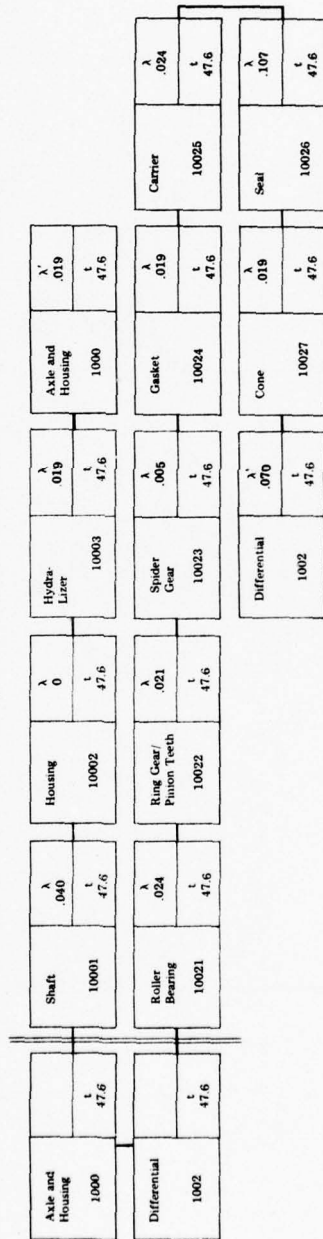


Figure 11. FRONT AXLE SYSTEM RELIABILITY BLOCK DIAGRAM

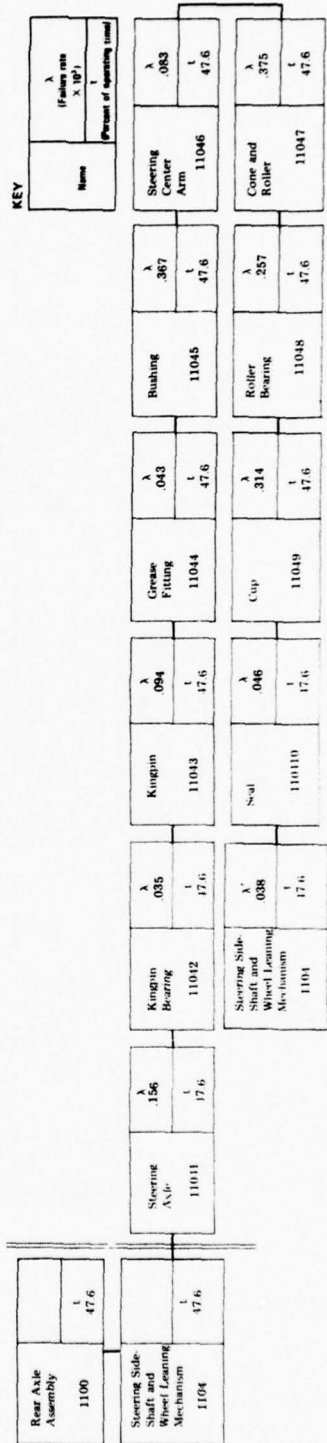


Figure 12. REAR AXLE SYSTEM RELIABILITY BLOCK DIAGRAM

KEY

| | | |
|------|---|-----------------------------------|
| Name | λ | (Failure rate × 10 ⁶) |
| | t | (Percent of operating time) |

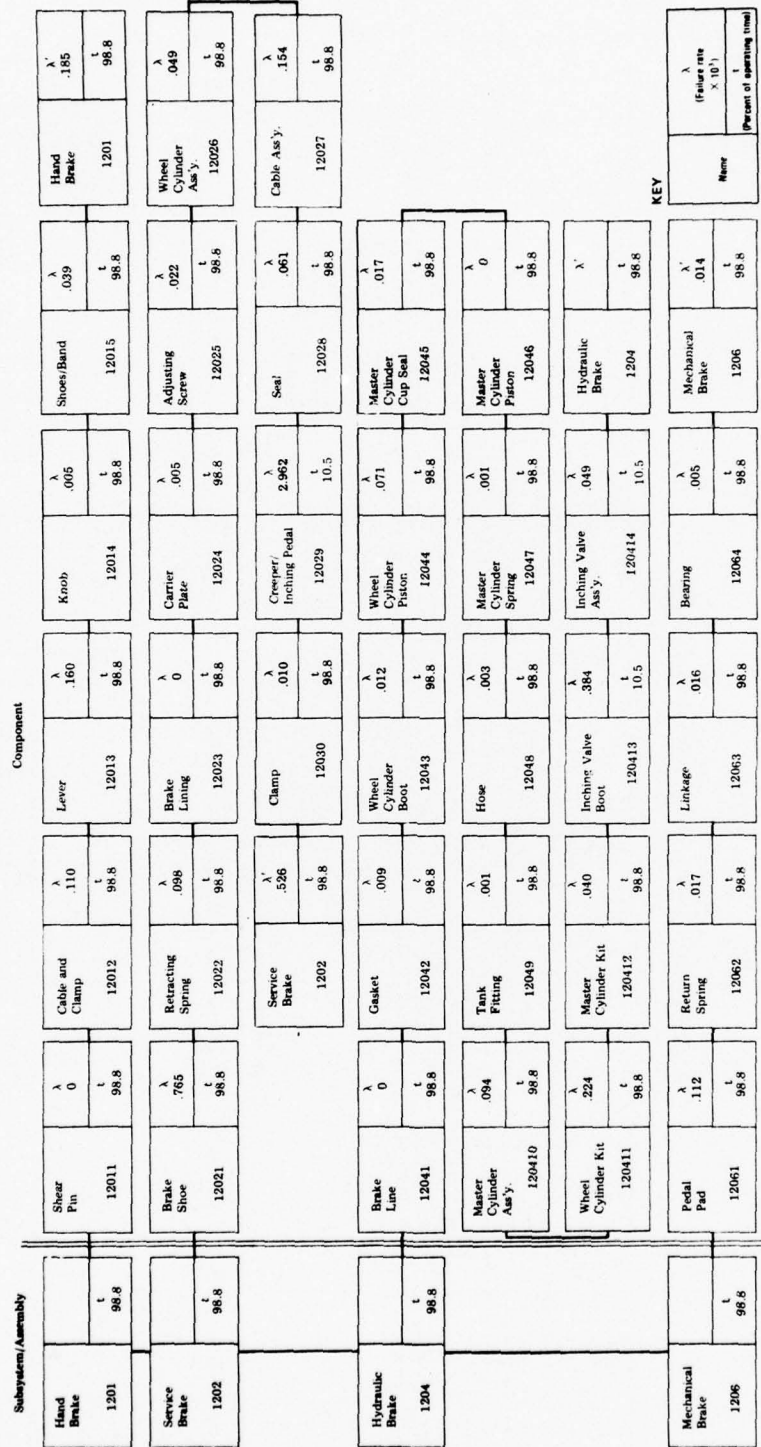


Figure 13 BRAKE SYSTEM RELIABILITY BLOCK DIAGRAM

| Subsystem/Assembly | | Component |
|--------------------|------|-----------|
| Frame Assembly | | |
| | 1501 | t 95.2 |
| Counterweight | | |
| | 1502 | t 95.2 |

Figure 16. FRAME SYSTEM RELIABILITY BLOCK DIAGRAM

| | | |
|---------------------|------|-----------|
| Leaf Springs | | |
| | 1601 | t 95.2 |
| Clamps, nuts, bolts | | |
| | 1602 | t 95.2 |

KEY

| | |
|------|--|
| Name | λ (Failure rate $\times 10^{-5}$) |
| | t (Percent of operating time) |

Figure 17. SUSPENSION SYSTEM RELIABILITY BLOCK DIAGRAM

| | | | | | | | | | |
|---------------|------|-----------|-------------------|-----------|-------------------|-----------|-------------------|--------------------|-------------------|
| Body Assembly | | Hinge | λ .004 | Latch | λ .013 | Structure | λ .294 | Floor Board Ass'y. | λ .030 |
| | 1801 | t 95.2 | 18011 | t 95.2 | 18012 | t 95.2 | 18013 | 180.5 | t 95.2 |
| Seats | | | | | | | | Body Assembly | λ .012 |
| | 1806 | t 100 | | | | | | | 1801 |

Figure 18. BODY SYSTEM RELIABILITY BLOCK DIAGRAM

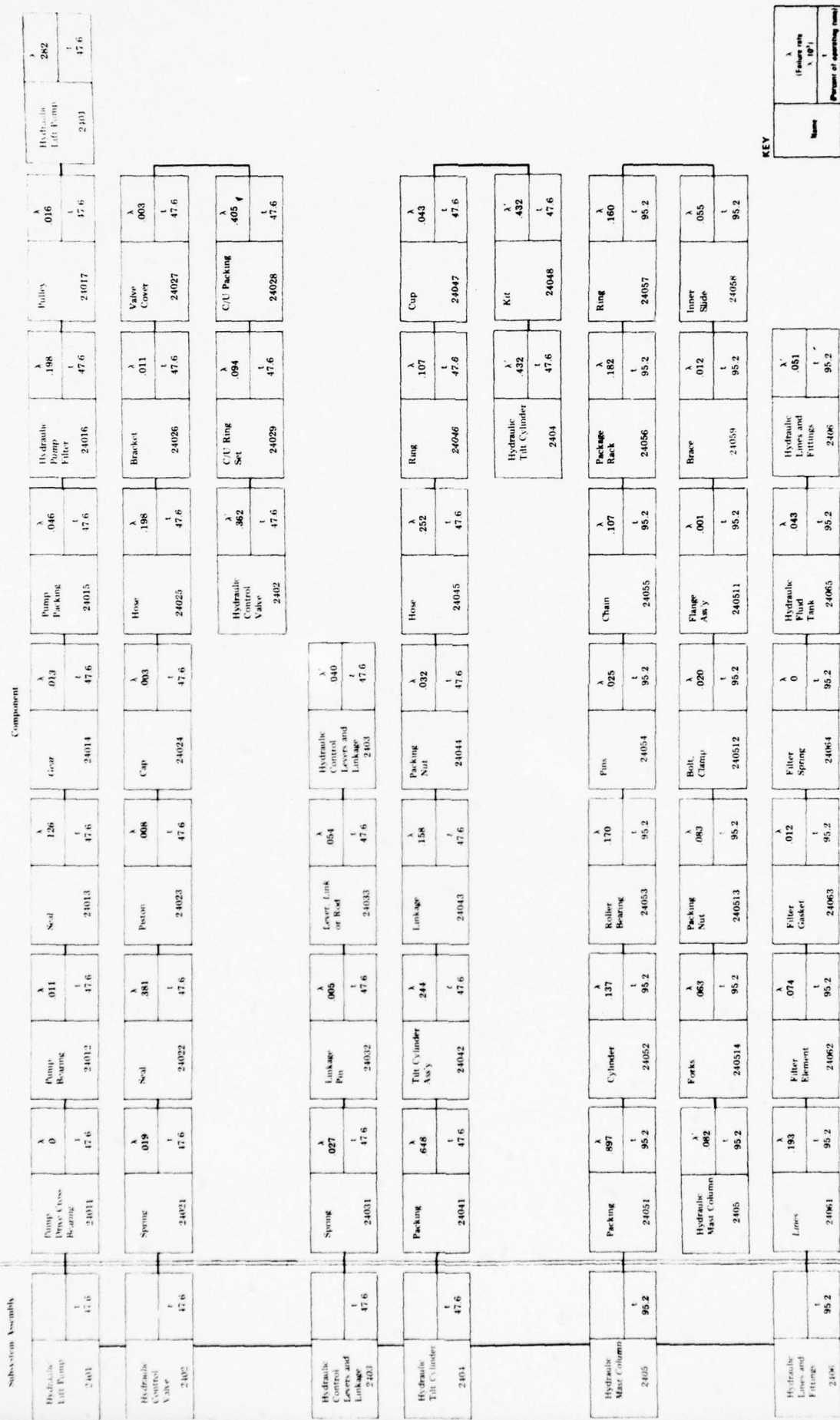


Figure 19 HYDRAULIC LIFT SYSTEM RELIABILITY BLOCK DIAGRAM

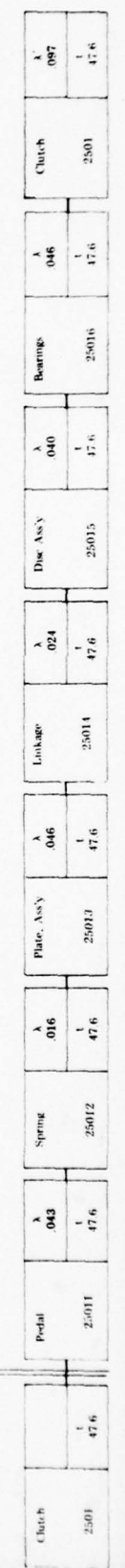


Figure 20 CLUTCH SYSTEM RELIABILITY BLOCK DIAGRAM

KEY

| | | |
|------|---|------------------------------------|
| Name | λ | (Failure rate X 10 ⁻⁷) |
| | t | (Percent of operating time) |

APPENDIX A

COMPONENT MISSION PROFILE MATRIX

This appendix presents the matrix from which the mission profile for the gasoline-engine-driven fork-lift truck was developed. It indicates the function or functions for which each component, identified by its Function Group Code, is required to operate. In compiling the matrix, we made assumptions concerning mission time for some components, as follows:

1. The lights and associated accessories are required to operate 25 percent of the total mission time.
2. The horn and its associated accessories are required to operate 2.1 percent of the total mission time.
3. The components associated with the creeping/inching function are used 22 percent of the time during the lift and deposit functions.

These assumptions are based upon the observations made of the operation of the trucks.

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 0100 | X | X | X | X | X | X | X |
| 01001 | X | X | X | X | X | X | X |
| 01002 | X | X | X | X | X | X | X |
| 01003 | X | X | X | X | X | X | X |
| 01004 | X | X | X | X | X | X | X |
| 01005 | X | X | X | X | X | X | X |
| 01006 | X | X | X | X | X | X | X |
| 01007 | X | X | X | X | X | X | X |
| 01008 | X | X | X | X | X | X | X |
| 01009 | X | X | X | X | X | X | X |
| 0101 | X | X | X | X | X | X | X |
| 01011 | X | X | X | X | X | X | X |
| 01012 | X | X | X | X | X | X | X |
| 01013 | X | X | X | X | X | X | X |
| 01014 | X | X | X | X | X | X | X |
| 0102 | X | X | X | X | X | X | X |
| 01021 | X | X | X | X | X | X | X |
| 01022 | X | X | X | X | X | X | X |
| 01023 | X | X | X | X | X | X | X |
| 01024 | X | X | X | X | X | X | X |
| 01025 | X | X | X | X | X | X | X |
| 01026 | X | X | X | X | X | X | X |

Component Mission Profile

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 0103 | X | X | X | X | X | X | |
| 01031 | X | X | X | X | X | X | |
| 01032 | X | X | X | X | X | X | |
| 01033 | X | X | X | X | X | X | |
| 0104 | X | X | X | X | X | X | |
| 01041 | X | X | X | X | X | X | |
| 01042 | X | X | X | X | X | X | |
| 01043 | X | X | X | X | X | X | |
| 01044 | X | X | X | X | X | X | |
| 0105 | X | X | X | X | X | X | |
| 01051 | X | X | X | X | X | X | |
| 01052 | X | X | X | X | X | X | |
| 01053 | X | X | X | X | X | X | |
| 01054 | X | X | X | X | X | X | |
| 01055 | X | X | X | X | X | X | |
| 01056 | X | X | X | X | X | X | |
| 01057 | X | X | X | X | X | X | |
| 01058 | X | X | X | X | X | X | |
| 01059 | X | X | X | X | X | X | |
| 010510 | X | X | X | X | X | X | |
| 010511 | X | X | X | X | X | X | |
| 010512 | X | X | X | X | X | X | |
| 010513 | X | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|--|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 010515 | X | X | X | X | X | X | X | |
| 0106 | X | X | X | X | X | X | X | |
| 01061 | X | X | X | X | X | X | X | |
| 01062 | X | X | X | X | X | X | X | |
| 01063 | X | X | X | X | X | X | X | |
| 01064 | X | X | X | X | X | X | X | |
| 01065 | X | X | X | X | X | X | X | |
| 01066 | X | X | X | X | X | X | X | |
| 01067 | X | X | X | X | X | X | X | |
| 01068 | X | X | X | X | X | X | X | |
| 01069 | X | X | X | X | X | X | X | |
| 0108 | X | X | X | X | X | X | X | |
| 01081 | X | X | X | X | X | X | X | |
| 01082 | X | X | X | X | X | X | X | |
| 01083 | X | X | X | X | X | X | X | |
| 0109 | X | X | X | X | X | X | X | |
| 0301 | X | X | X | X | X | X | X | |
| 03011 | X | X | X | X | X | X | X | |
| 03012 | X | X | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 03013 | X | X | X | X | X | X | |
| 03015 | X | X | X | X | X | X | |
| 03016 | X | X | X | X | X | X | |
| 0302 | X | X | X | X | X | X | |
| 03021 | X | X | X | X | X | X | |
| 03022 | X | X | X | X | X | X | |
| 03023 | X | X | X | X | X | X | |
| 03024 | X | X | X | X | X | X | |
| 03025 | X | X | X | X | X | X | |
| 0304 | X | X | X | X | X | X | |
| 03041 | X | X | X | X | X | X | |
| 03042 | X | X | X | X | X | X | |
| 04043 | X | X | X | X | X | X | |
| 03044 | X | X | X | X | X | X | |
| 0306 | X | X | X | X | X | X | |
| 03061 | X | X | X | X | X | X | |
| 03062 | X | X | X | X | X | X | |
| 0308 | X | X | X | X | X | X | |
| 03081 | X | X | X | X | X | X | |
| 03082 | X | X | X | X | X | X | |
| 03083 | X | X | X | X | X | X | |
| 03084 | X | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|--|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 03085 | X | X | X | X | X | X | | |
| 03086 | X | X | X | X | X | X | | |
| 03087 | X | X | X | X | X | X | | |
| 03088 | X | X | X | X | X | X | | |
| 0309 | X | X | X | X | X | X | | |
| 0312 | X | X | X | X | X | X | | |
| 03121 | X | X | X | X | X | X | | |
| 03122 | X | X | X | X | X | X | | |
| 03123 | X | X | X | X | X | X | | |
| 03124 | X | X | X | X | X | X | | |
| 03125 | X | X | X | X | X | X | | |
| 0401 | | X | X | X | X | X | | |
| 04011 | | X | X | X | X | X | | |
| 04012 | | X | X | X | X | X | | |
| 04013 | | X | X | X | X | X | | |
| 04014 | | X | X | X | X | X | | |
| 04015 | | X | X | X | X | X | | |
| 04016 | | X | X | X | X | X | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 0501 | | X | X | X | X | X | |
| 05011 | | X | X | X | X | X | |
| 05012 | | X | X | X | X | X | |
| 05013 | | X | X | X | X | X | |
| 05014 | | X | X | X | X | X | |
| 0503 | | X | X | X | X | X | |
| 05031 | | X | X | X | X | X | |
| 05032 | | X | X | X | X | X | |
| 05033 | | X | X | X | X | X | |
| 05034 | | X | X | X | X | X | |
| 05035 | | X | X | X | X | X | |
| 0504 | | X | X | X | X | X | |
| 05041 | | X | X | X | X | X | |
| 05042 | | X | X | X | X | X | |
| 05043 | | X | X | X | X | X | |
| 05044 | | X | X | X | X | X | |
| 0505 | | X | X | X | X | X | |
| 05051 | | X | X | X | X | X | |
| 05052 | | X | X | X | X | X | |
| 05053 | | X | X | X | X | X | |
| 05054 | | X | X | X | X | X | |
| 05055 | | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|---|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 0601 | X | X | X | X | X | X | X | X |
| 06011 | X | X | X | X | X | X | X | X |
| 06012 | X | X | X | X | X | X | X | X |
| 06013 | X | X | X | X | X | X | X | X |
| 06014 | X | X | X | X | X | X | X | X |
| 06015 | X | X | X | X | X | X | X | X |
| 06016-06011 | X | X | X | X | X | X | X | X |
| 0602 | X | X | X | X | X | X | X | X |
| 06021 | X | X | X | X | X | X | X | X |
| 06022 | X | X | X | X | X | X | X | X |
| 06023 | X | X | X | X | X | X | X | X |
| 06024 | X | X | X | X | X | X | X | X |
| 06025 | X | X | X | X | X | X | X | X |
| 06026 | X | X | X | X | X | X | X | X |
| 06027 | X | X | X | X | X | X | X | X |
| 06028 | X | X | X | X | X | X | X | X |
| 06029 | X | X | X | X | X | X | X | X |
| 060210 | X | X | X | X | X | X | X | X |
| 060211 | X | X | X | X | X | X | X | X |
| 060212 | X | X | X | X | X | X | X | X |
| 060213 | X | X | X | X | X | X | X | X |
| 0603 | X | | | | | | | |
| 06031 | X | | | | | | | |
| 06033 | X | | | | | | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 06034 | X | | | | | | |
| 06035 | X | | | | | | |
| 06036 | X | | | | | | |
| 06037 | X | | | | | | |
| 06038 | X | | | | | | |
| 06039 | X | | | | | | |
| 0605 | X | X | X | X | X | X | X |
| 06051 | X | X | X | X | X | X | X |
| 06052 | X | X | X | X | X | X | X |
| 06053 | X | X | X | X | X | X | X |
| 06054 | X | X | X | X | X | X | X |
| 06055 | X | X | X | X | X | X | X |
| 06056 | X | X | X | X | X | X | X |
| 06057 | X | X | X | X | X | X | X |
| 06058 | X | X | X | X | X | X | X |
| 06059 | X | X | X | X | X | X | X |
| 060510 | X | X | X | X | X | X | X |
| 060511 | X | X | X | X | X | X | X |
| 060513 | X | X | X | X | X | X | X |
| 060514 | X | X | X | X | X | X | X |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|---------------------------|-------|------|-----------|---------|------|--|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 0607 | | X | X | X | X | X | | |
| 06071 | | X | X | X | X | X | | |
| 06072 | | X | X | X | X | X | | |
| 06073 | | X | X | X | X | X | | |
| 06074 | | X | X | X | X | X | | |
| 06075 | | X | X | X | X | X | | |
| 06076 | | X | X | X | X | X | | |
| 06077 | | X | X | X | X | X | | |
| 06078 | X | X | X | X | X | X | X | |
| 06079 | X | X | X | X | X | X | X | |
| 060710 | X | X | X | X | X | X | X | |
| 060711 | X | X | X | X | X | X | X | |
| 0609 | | | | | | | | |
| 06091 | | | | | | | | |
| 06092 | | | | | | | | |
| 06093 | | | | | | | | |
| 06094 | | | | | | | | |
| 06095 | | | | | | | | |
| 06096 | | | | | | | | |
| | | 25% of Total Mission Time | | | | | | |
| 0610 | | X | X | X | X | X | X | |
| 06101 | | X | X | X | X | X | X | |
| 06102 | | X | X | X | X | X | X | |
| 06103 | | X | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|---|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 06104 | | X | X | X | X | X | | |
| 06105 | | X | X | X | X | X | | |
| 06106 | | X | X | X | X | X | | |
| 06107 | | X | X | X | X | X | | |
| 0611 | | | | | | | | |
| 06111 | | | | | | | | |
| 06112 | | | | | | | | |
| 06113 | | | | | | | | |
| 06114 | | | | | | | | |
| 06115 | | | | | | | | |
| 06117 | | | | | | | | |
| | | | | | | | | |
| 0612 | X | X | X | X | X | X | X | X |
| 06121 | X | X | X | X | X | X | X | X |
| 06122 | X | X | X | X | X | X | X | X |
| 06123 | X | X | X | X | X | X | X | X |
| 06124 | X | X | X | X | X | X | X | X |
| 06125 | X | X | X | X | X | X | X | X |
| 0613 | X | X | X | X | X | X | X | X |
| 06131 | X | X | X | X | X | X | X | X |
| 06132 | X | X | X | X | X | X | X | X |

2.1% of Total Mission Time

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 0708 | | | X | | X | | |
| 07081 | | | X | | X | | |
| 07082 | | | X | | X | | |
| 07083 | | | X | | X | | |
| 07084 | | | X | | X | | |
| 07085 | | | X | | X | | |
| 07086 | | | X | | X | | |
| 07087 | | | X | | X | | |
| 07088 | | | X | | X | | |
| 07089 | | | X | | X | | |
| 0710 | | | X | | X | | |
| 07101 | | | X | | X | | |
| 07102 | | | X | | X | | |
| 07103 | | | X | | X | | |
| 07104 | | | X | | X | | |
| 07105 | | | X | | X | | |
| 07106 | | | X | | X | | |
| 07107 | | | X | | X | | |
| 07108 | | | X | | X | | |
| 07109 | | | X | | X | | |
| 071010 | | | X | | X | | |
| 0713 | | | X | | X | | |
| 07131 | | | X | | X | | |
| 07132 | | | X | | X | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 07133 | | | X | | X | | |
| 07134 | | | X | | X | | |
| 07135 | | | X | | X | | |
| 0714 | | | X | | X | | |
| 07141 | | | X | | X | | |
| 07142 | | | X | | X | | |
| 07143 | | | X | | X | | |
| 07144 | | | X | | X | | |
| 07145 | | | X | | X | | |
| 07146 | | | X | | X | | |
| 07147 | | | X | | X | | |
| 07148 | | | X | | X | | |
| 07149 | | | X | | X | | |
| 0721 | | | X | | X | | |
| 07211 | | | X | | X | | |
| 07212 | | | X | | X | | |
| 07213 | | | X | | X | | |
| 07214 | | | X | | X | | |
| 07215 | | | X | | X | | |
| 07216 | | | X | | X | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 0900 | | | X | | X | | |
| 09001 | | | X | | X | | |
| 09002 | | | X | | X | | |
| 09003 | | | X | | X | | |
| 09004 | | | X | | X | | |
| 09005 | | | X | | X | | |
| 09006 | | | X | | X | | |
| 1000 | | | X | | X | | |
| 10001 | | | X | | X | | |
| 10002 | | | X | | X | | |
| 10003 | | | X | | X | | |
| 1002 | | | X | | X | | |
| 10021 | | | X | | X | | |
| 10022 | | | X | | X | | |
| 10023 | | | X | | X | | |
| 10024 | | | X | | X | | |
| 10025 | | | X | | X | | |
| 10026 | | | X | | X | | |
| 10027 | | | X | | X | | |
| 1100 | | | X | | X | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 1104 | | | X | | X | | |
| 11041 | | | X | | X | | |
| 11042 | | | X | | X | | |
| 11043 | | | X | | X | | |
| 11044 | | | X | | X | | |
| 11045 | | | X | | X | | |
| 11046 | | | X | | X | | |
| 11047 | | | X | | X | | |
| 11048 | | | X | | X | | |
| 11049 | | | X | | X | | |
| 110410 | | | X | | X | | |
| 1204 | X | X | X | X | X | X | X |
| 12041 | X | X | X | X | X | X | X |
| 12042 | X | X | X | X | X | X | X |
| 12043 | X | X | X | X | X | X | X |
| 12044 | X | X | X | X | X | X | X |
| 12045 | X | X | X | X | X | X | X |
| 12046 | X | X | X | X | X | X | X |
| 12047 | X | X | X | X | X | X | X |
| 12048 | X | X | X | X | X | X | X |
| 12049 | X | X | X | X | X | X | X |
| 120410 | X | X | X | X | X | X | X |
| 120411 | X | X | X | X | X | X | X |
| 120412 | X | X | X | X | X | X | X |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 120413 | | | | X | | X | |
| 120414 | | | | X | | X | |
| 1206 | | X | X | X | X | X | |
| 12061 | | X | X | X | X | X | |
| 12062 | | X | X | X | X | X | |
| 12063 | | X | X | X | X | X | |
| 12064 | | X | X | X | X | X | |
| 1201 | | X | X | X | X | X | |
| 12011 | | X | X | X | X | X | |
| 12012 | | X | X | X | X | X | |
| 12013 | | X | X | X | X | X | |
| 12014 | | X | X | X | X | X | |
| 12015 | | X | X | X | X | X | |
| 1202 | | X | X | X | X | X | |
| 12021 | | X | X | X | X | X | |
| 12022 | | X | X | X | X | X | |
| 12023 | | X | X | X | X | X | |
| 12024 | | X | X | X | X | X | |
| 12025 | | X | X | X | X | X | |
| 12026 | | X | X | X | X | X | |
| 12027 | | X | X | X | X | X | |
| 12028 | | X | X | X | X | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | | |
|------------------------|----------|------|-------|--------|-----------|---------|------|--|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop | |
| 12029 | | | | X x22% | | X x22% | | |
| 12030 | | X | X | X | X | X | | |
| 1311 | | | X | X | X | X | | |
| 13112 | | | X | X | X | X | | |
| 13113 | | | X | X | X | X | | |
| 13114 | | | X | X | X | X | | |
| 13115 | | | X | X | X | X | | |
| 13118 | | | X | X | X | X | | |
| 13131 | | | X | X | X | X | | |
| 13132 | | | X | X | X | X | | |
| 1401 | | | X | | X | | | |
| 14011 | | | X | | X | | | |
| 14012 | | | X | | X | | | |
| 14013 | | | X | | X | | | |
| 14014 | | | X | | X | | | |
| 14015 | | | X | | X | | | |
| 14017 | | | X | | X | | | |
| 14018 | | | X | | X | | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 1410 | | | X | | X | | |
| 14101 | | | X | | X | | |
| 14102 | | | X | | X | | |
| 14103 | | | X | | X | | |
| 14104 | | | X | | X | | |
| 14105 | | | X | | X | | |
| 14106 | | | X | | X | | |
| 14107 | | | X | | X | | |
| 14108 | | | X | | X | | |
| 1411 | | | X | | X | | |
| 1412 | | | X | | X | | |
| 14121 | | | X | | X | | |
| 14122 | | | X | | X | | |
| 14123 | | | X | | X | | |
| 14124 | | | X | | X | | |
| 1414 | | | X | | X | | |
| 14141 | | | X | | X | | |
| 14142 | | | X | | X | | |
| 14143 | | | X | | X | | |
| 14144 | | | X | | X | | |
| 14145 | | | X | | X | | |
| 14146 | | | X | | X | | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 1501 | | | X | X | X | X | |
| 1502 | | | X | X | X | X | |
| 1601 | | | X | X | X | X | |
| 1602 | | | X | X | X | X | |
| 1801 | | | X | X | X | X | |
| 18011 | | | X | X | X | X | |
| 18012 | | | X | X | X | X | |
| 18013 | | | X | X | X | X | |
| 18015 | | | X | X | X | X | |
| 18062 | X | X | X | X | X | X | X |
| 2401 | | | | X | | X | |
| 24011 | | | | X | | X | |
| 24012 | | | | X | | X | |
| 24013 | | | | X | | X | |
| 24014 | | | | X | | X | |
| 24015 | | | | X | | X | |
| 24016 | | | | X | | X | |
| 24017 | | | | X | | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 2402 | | | | X | | X | |
| 24021 | | | | X | | X | |
| 24022 | | | | X | | X | |
| 24023 | | | | X | | X | |
| 24024 | | | | X | | X | |
| 24025 | | | | X | | X | |
| 24026 | | | | X | | X | |
| 24027 | | | | X | | X | |
| 24028 | | | | X | | X | |
| 24029 | | | | X | | X | |
| 2403 | | | | X | | X | |
| 24031 | | | | X | | X | |
| 24032 | | | | X | | X | |
| 24033 | | | | X | | X | |
| 2404 | | | | X | | X | |
| 24041 | | | | X | | X | |
| 24042 | | | | X | | X | |
| 24043 | | | | X | | X | |
| 24044 | | | | X | | X | |
| 24045 | | | | X | | X | |
| 24046 | | | | X | | X | |
| 24047 | | | | X | | X | |
| 24048 | | | | X | | X | |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 2405 | | | X | X | X | X | X |
| 24051 | | | X | X | X | X | X |
| 24053 | | | X | X | X | X | X |
| 24054 | | | X | X | X | X | X |
| 24055 | | | X | X | X | X | X |
| 24056 | | | X | X | X | X | X |
| 24057 | | | X | X | X | X | X |
| 24058 | | | X | X | X | X | X |
| 24059 | | | X | X | X | X | X |
| 240510 | | | X | X | X | X | X |
| 240511 | | | X | X | X | X | X |
| 240512 | | | X | X | X | X | X |
| 240513 | | | X | X | X | X | X |
| 240514 | | | X | X | X | X | X |
| 2501 | | | X | X | X | X | X |
| 25011 | | | X | X | X | X | X |
| 25012 | | | X | X | X | X | X |
| 25013 | | | X | X | X | X | X |
| 25014 | | | X | X | X | X | X |
| 25015 | | | X | X | X | X | X |
| 25016 | | | X | X | X | X | X |

Component Mission Profile Matrix

| Component/ Assembly | Function | | | | | | |
|------------------------|----------|------|-------|------|-----------|---------|------|
| | Start | Idle | Drive | Lift | Transport | Deposit | Stop |
| 2406 | | | X | X | X | X | X |
| 24061 | | | X | X | X | X | X |
| 24062 | | | X | X | X | X | X |
| 24063 | | | X | X | X | X | X |
| 24064 | | | X | X | X | X | X |
| 24065 | | | X | X | X | X | X |

APPENDIX B

COMPONENT RELIABILITY AND MAINTAINABILITY DATA

NOTE

The values marked by an asterisk are for the "phantom" component that represents failures ascribed to the subsystem/assembly as a whole. This rate must be added to the other appropriate component failure rates to determine the failure rate of the subsystem/assembly.

The failure rates shown for the components represent the rate of failure for that component group in the subsystem/assembly of which it is a part. For example, the failure rate for spark plugs is the spark-plug group rate rather than a single spark-plug rate.

THIS PAGE IS BEST QUALITY PRACTICE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

Page 1 of 18

| Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|----------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0100 Engine Assembly | 779374 | 109 | .140* | 1132.9 | 13.99 | 81 | 4.98 | .99930 |
| 01001 Attaching Parts | 779374 | 14 | .018 | 7.0 | .88 | 8 | | .99991 |
| 01002 Mountings | 779374 | 117 | .150 | 106.10 | 1.23 | 86 | | .99925 |
| 01003 Gasket Sets | 779374 | 48 | .062 | 50.00 | 2.94 | 17 | | .99969 |
| 01004 Rear Seal | 779374 | 17 | .022 | 34.20 | 2.44 | 14 | | .99989 |
| 01005 Accessory Drive | 779374 | 25 | .032 | 28.00 | 1.87 | 15 | | .99984 |
| 01006 Timing Gear Assembly | 779374 | 11 | .014 | 79.00 | 9.87 | 8 | | .99993 |
| 01007 Ring Assembly | 779374 | 52 | .067 | 29.50 | 2.46 | 12 | | .99967 |
| 01008 Rods/Bearing Ass'y | 779374 | 40 | .051 | 19.50 | 1.77 | 11 | | .99975 |
| 01009 Cylinder Sleeve | 779374 | 21 | .027 | --- | --- | 0 | | .99987 |
| 0101 Crankcase | --- | --- | --- | --- | --- | --- | 4.98 | 1.0000 |
| 01011 Block | 779374 | 29 | .037 | 60.70 | 4.05 | 15 | | .99982 |
| 01012 Cylinder Head | 779374 | 24 | .031 | 38.70 | 2.58 | 15 | | .99985 |
| 01013 Head Gasket | 779374 | 21 | .027 | 12.00 | 2.00 | 6 | | .99987 |
| 01014 Expander Plug | 779374 | 12 | .015 | 6.40 | 0.53 | 12 | | .99992 |
| 0102 Crankshaft Ass'y | 779374 | 19 | .024* | 7.50 | 1.50 | 5 | 4.98 | .99988 |
| 01021 Crankshaft Bearing | 779374 | 113 | .145 | 70.00 | 2.92 | 24 | | .99928 |
| 01022 Crankshaft Gear | 779374 | 65 | .083 | 57.90 | 1.48 | 39 | | .99959 |
| 01023 Crankshaft Journal | 779374 | 2 | .003 | 4.00 | 2.00 | 2 | | .99998 |
| 01024 Seal | 779374 | 51 | .065 | 66.50 | 2.02 | 33 | | .99968 |
| 01025 Gear Coupling | 779374 | 4 | .005 | 2.20 | 1.10 | 2 | | .99997 |
| 01026 Pulley | 779374 | 9 | .011 | 10.50 | 1.50 | 7 | | .99994 |
| 0103 Flywheel Assembly | 779374 | 11 | .014* | 12.90 | 1.43 | 9 | 4.98 | .99993 |
| 01031 Ring Gear | 779374 | 19 | .024 | 65.00 | 3.82 | 17 | | .99988 |
| 01032 Pilot Bushing | 779374 | 4 | .005 | 2.00 | 0.50 | 4 | | .99997 |
| 01033 End Bell | 779374 | 4 | .005 | 4.50 | 1.12 | 4 | | .99997 |

* See important note on Appendix Cover Sheet

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

Page 2 of 18

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|--------------------------|-------------------|--------------------|-----------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0104 | Pistons | 779374 | 120 | .154* | 56.50 | 1.49 | 38 | 4.98 | .99923 |
| 01041 | Piston Rings | 779374 | 66 | .085 | 17.50 | 1.35 | 13 | | .99958 |
| 01042 | Wrist Pin | 779374 | 70 | .090 | 15.50 | 0.60 | 26 | | .99955 |
| 01043 | Expander Ring | 779374 | 2 | .003 | --- | --- | 0 | | .99998 |
| 01044 | Connecting Rod | 779374 | 40 | .051 | 7.00 | 0.35 | 20 | | .99975 |
| 0105 | Valves | 779374 | 200 | .257* | 61.00 | 1.33 | 46 | 4.98 | .99872 |
| 01051 | Push Rods | 779374 | 11 | .014 | 0.50 | 0.50 | 1 | | .99993 |
| 01052 | Rocker Arm | 779374 | 4 | .005 | 1.50 | 0.38 | 4 | | .99997 |
| 01053 | Valve Spring | 779374 | 32 | .041 | 5.50 | 0.50 | 11 | | .99980 |
| 01054 | Valve Guide | 779374 | 187 | .240 | 40.00 | 1.03 | 39 | | .99880 |
| 01055 | Valve Cover | 779374 | 54 | .069 | 30.30 | 0.62 | 49 | | .99966 |
| 01056 | Gasket | 779374 | 155 | .199 | 106.80 | 1.00 | 107 | | .99901 |
| 01057 | Camshaft | 779374 | 8 | .010 | 3.00 | 3.00 | 1 | | .99995 |
| 01058 | Camshaft Gear | 779374 | 68 | .087 | 67.90 | 1.66 | 41 | | .99957 |
| 01059 | Camshaft Key | 779374 | 2 | .003 | 1.00 | 0.50 | 2 | | .99998 |
| 010510 | Lifter | 779374 | 2 | .003 | --- | --- | 0 | | .99998 |
| 010511 | Camshaft Bearing | 779374 | 69 | .089 | 12.00 | 0.63 | 19 | | .99956 |
| 010512 | Spur Gear | 779374 | 71 | .091 | 81.70 | 1.60 | 51 | | .99955 |
| 010513 | Nuts, Bolts, Misc. | 779374 | 42 | .053 | 23.00 | 1.28 | 18 | | .99974 |
| 010515 | P.C. Valve | 779374 | .4 | .005 | 2.50 | 1.25 | 2 | | .99997 |
| 0106 | Engine Lubrication | 779374 | 6 | .008* | 3.20 | 0.80 | 4 | 4.98 | .99996 |
| 01061 | Gaskets | 779374 | 47 | .060 | 52.20 | 1.21 | 43 | | .99970 |
| 01062 | Oil Filter | 779374 | 230 | .295 | 148.80 | 0.71 | 209 | | .99853 |
| 01063 | Crankcase Breather | 779374 | 83 | .106 | 36.10 | 0.54 | 67 | | .99947 |
| 01064 | Oil Pump | 779374 | 22 | .028 | 14.70 | 1.63 | 9 | | .99986 |
| 01065 | Oil Lines, Fittings etc. | 779374 | 162 | .208 | 99.80 | 0.71 | 141 | | .99896 |
| 01067 | Oil Tank | 779374 | 2 | .003 | --- | --- | 0 | | .99996 |
| 01068 | Oil Pan | 779374 | 12 | .015 | 7.00 | 0.58 | 12 | | .99992 |
| 01069 | Dip Stick | 779374 | 5 | .006 | 2.00 | 0.67 | 3 | | .99997 |

*See important note on Appendix cover sheet

| Component Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Failure |
|----------------|-------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0108 | Engine Manifold | 779374 | 3 | .004* | 2.20 | 0.73 | 3 | 4.98 | .99999 |
| 01081 | Gasket | 779374 | 8 | .010 | 8.00 | 1.33 | 6 | | .99999 |
| 01082 | Heat Control Shaft | 779374 | 6 | .008 | 3.30 | 0.55 | 6 | | .99999 |
| 01083 | Heat Control Thermostat | 779374 | 1 | .001 | 1.00 | 1.00 | 1 | | .99999 |
| 0109 | Engine Accessories | 779374 | 1 | .001* | 0.50 | 0.50 | 1 | 4.98 | .99999 |
| 0301 | Carburetor Assembly | 779374 | 224 | .288* | 170.90 | 0.90 | 189 | 4.98 | .99857 |
| 03011 | Gasket | 779374 | 3 | .004 | 1.00 | 1.00 | 1 | | .99998 |
| 03012 | Filter Element | 779374 | 9 | .012 | 3.80 | 0.47 | 8 | | .99994 |
| 03013 | Needle Valve | 779374 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 03014 | Float | 779374 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 |
| 03105 | Choke | 779374 | 13 | 0.017 | 15.00 | 1.67 | 9 | | .99991 |
| 0302 | Fuel Pump | 779374 | 103 | .132* | 112.60 | 1.37 | 82 | 4.98 | .99934 |
| 03021 | Gasket | 779374 | 15 | .019 | 8.90 | 0.68 | 13 | | .99990 |
| 03022 | Diaphragm | 779374 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 |
| 03023 | Relief Valve | 779374 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 03024 | Discharge Valve | 779374 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 03025 | Bolts, Fittings, etc | 779374 | 22 | .028 | 12.20 | 0.55 | 22 | | .99986 |
| 0304 | Air Cleaner | 779374 | 18 | .023* | 50.30 | 3.59 | 14 | 4.98 | .99989 |
| 03041 | Cleaner Element | 779374 | 3 | .004 | 1.00 | 0.50 | 2 | | .99998 |
| 03042 | Mounting | 779374 | 3 | .004 | 2.90 | 0.97 | 3 | | .99998 |
| 03043 | Hose | 779374 | 72 | .092 | 30.10 | 0.53 | 57 | | .99954 |
| 03044 | Scoop | 779374 | 17 | .022 | 3.70 | 0.46 | 8 | | .99989 |

THIS PAGE IS BEST QUALITY PRACTICABLE

FORM COPY FURNISHED TO DDC

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0306 | Fuel Tank | 779374 | 20 | .026* | 62.00 | 3.44 | 18 | 4.98 | .99987 |
| 03061 | Lines | 779374 | 7 | .009 | 5.50 | 0.79 | 7 | | .99995 |
| 03062 | Cap, Strainer | 779374 | 18 | .023 | 3.50 | 0.29 | 12 | | .99989 |
| 0308 | Governor | 779374 | 26 | .033* | 39.20 | 1.96 | 20 | 4.98 | .99984 |
| 03081 | Plug | 779374 | 0 | 0.0 | 0.0 | 0.00 | 0 | | 1.0000 |
| 03082 | Gasket | 779374 | 0 | 0.0 | 0.0 | 0.00 | 0 | | 1.0000 |
| 03083 | Seal | 779374 | 3 | .004 | 0.20 | 0.20 | 1 | | .99998 |
| 03084 | Bearing | 779374 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 03085 | Linkage | 779374 | 34 | .004 | 27.40 | 0.81 | 34 | | .99978 |
| 03086 | Weights | 779374 | 1 | .001 | 1.00 | 1.00 | 1 | | .99999 |
| 03087 | Bushing | 779374 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 03088 | Spring | 779374 | 6 | .008 | 1.00 | 0.25 | 4 | | .99996 |
| 0309 | Fuel Filter | 779374 | 0 | 0.0* | 0.0 | 0.0 | 0 | 4.98 | 1.0000 |
| 0312 | Accelerator | 779374 | 32 | .041* | 19.40 | 0.88 | 22 | 4.98 | .99980 |
| 03121 | Throttle & Choke | 779374 | 106 | .136 | 64.90 | 0.84 | 77 | | .99932 |
| 03122 | Linkage | 779374 | 8 | .010 | 2.80 | 0.70 | 4 | | .99995 |
| 03123 | Spring | 779374 | 3 | .004 | 2.00 | 0.67 | 3 | | .99998 |
| 03124 | Connecting Pin | 779374 | 33 | .042 | 13.20 | 0.57 | 23 | | .99979 |
| 03125 | Pedal | 779374 | 4 | .005 | 1.50 | 0.75 | 2 | | .99997 |
| 0401 | Muffler and Pipe | 773891 | 19 | .025* | 16.00 | 0.94 | 17 | 4.94 | .99988 |
| 04011 | Assembly | 773891 | 24 | .031 | 15.80 | 0.88 | 18 | | .99985 |
| 04012 | Gasket | 773891 | 41 | .053 | 62.80 | 1.85 | 34 | | .99974 |
| 04013 | Muffler | 773891 | 127 | .164 | 99.40 | 0.92 | 108 | | .99919 |
| 04014 | Pipe | 773891 | 10 | .013 | 8.20 | 0.91 | 9 | | .99994 |
| 04015 | Elbow | 773891 | 76 | .098 | 21.80 | 0.56 | 39 | | .99952 |
| 04016 | Clamp | 773891 | 15 | .019 | 7.20 | 0.65 | 11 | | .99991 |
| 04016 | Fittings | 773891 | 15 | .019 | 7.20 | 0.65 | 11 | | .99991 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|--------------------|-------------------|--------------------|-----------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0501 | Radiator Assembly | 773891 | 310 | .401* | 664.70 | 2.43 | 274 | 4.94 | .99802 |
| 05011 | Radiator Cap | 773891 | 28 | .036 | 10.80 | 0.54 | 20 | | .99982 |
| 05012 | Core | 773891 | 55 | .071 | 35.40 | 0.64 | 55 | | .99965 |
| 05013 | Overflow Pipe | 773891 | 17 | .022 | 16.00 | 0.94 | 17 | | .99989 |
| 05014 | Fittings | 773891 | 98 | .127 | 48.90 | 0.65 | 75 | | .99937 |
| 0503 | Water Manifold | 773891 | 1 | .001* | 1.00 | 1.00 | 1 | 4.94 | .99999 |
| 05031 | Fittings | 773891 | 17 | .022 | 4.80 | 0.37 | 13 | | .99989 |
| 05032 | Hose | 773891 | 251 | .324 | 161.50 | 0.86 | 187 | | .99840 |
| 05033 | Thermostat | 773891 | 26 | .034 | 18.00 | 1.06 | 17 | | .99983 |
| 05034 | Gasket | 773891 | 11 | .014 | 6.90 | 0.86 | 8 | | .99993 |
| 05035 | Thermostat Housing | 773891 | 2 | .003 | 1.00 | 0.50 | 2 | | .99998 |
| 0504 | Water Pump | 773891 | 142 | .184* | 234.20 | 2.17 | 108 | 4.94 | .99909 |
| 05041 | Gasket | 773891 | 42 | .054 | 28.10 | 0.80 | 35 | | .99973 |
| 05042 | Bearing | 773891 | 15 | .019 | 21.00 | 1.50 | 14 | | .99991 |
| 05043 | Shaft | 773891 | 65 | .084 | 89.60 | 1.91 | 47 | | .99958 |
| 05044 | Hub | 773891 | 1 | .001 | 1.50 | 1.50 | 1 | | .99999 |
| 0505 | Fan Assembly | 773891 | 28 | .036* | 45.10 | 1.73 | 26 | 4.94 | .99982 |
| 05051 | Blade | 773891 | 45 | .058 | 40.70 | 1.27 | 32 | | .99971 |
| 05052 | Belt | 773891 | 577 | .746 | 278.50 | 0.63 | 440 | | .99631 |
| 05053 | Pulley | 773891 | 52 | .067 | 67.30 | 1.50 | 45 | | .99967 |
| 05054 | Bearing | 773891 | 19 | .025 | 24.50 | 1.88 | 13 | | .99988 |
| 05055 | Fittings | 773891 | 14 | .018 | 4.30 | 0.36 | 12 | | .99991 |

*See important note on Appendix cover sheet

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|----------------------|-------------------|--------------------|-----------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0601 | Alternator Assembly | 3051 | 1 | 0.328* | 2.00 | 2.00 | 1 | 5.00 | .99999 |
| 06011 | Bearing | 3051 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06012 | Brush | 3051 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06013 | Commutator | 3051 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06014 | Mounting Bolts | 3051 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06015 | Wiring | 3051 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| * * | | | | | | | | | |
| 0602 | Generator | 780239 | 447 | .573* | 630.30 | 1.68 | 376 | 5.00 | .99713 |
| 06021 | Commutator | 780239 | 23 | .029 | 11.00 | 1.22 | 9 | | .99985 |
| 06022 | Mounting Bolts | 780239 | 91 | .117 | 66.90 | 0.77 | 87 | | .99941 |
| 06023 | Bracket, Clamp | 780239 | 49 | .063 | 55.20 | 1.20 | 46 | | .99968 |
| 06024 | Brush | 780239 | 68 | .087 | 30.90 | 0.94 | 33 | | .99956 |
| 06025 | Shaft | 780239 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 |
| 06026 | Bearing | 780239 | 69 | .088 | 26.50 | 1.20 | 22 | | .99956 |
| * * 06027 | Belt | 780239 | 5 | .006 | 2.50 | 0.50 | 5 | | .99997 |
| * * 06028 | Brush Holder | 780239 | 4 | .005 | 1.00 | 0.33 | 3 | | .99997 |
| * * 06029 | End Plate | 780239 | 8 | .010 | 3.30 | 0.82 | 4 | | .99995 |
| * * 060210 | Fan | 780239 | 5 | .006 | 2.30 | 1.15 | 2 | | .99997 |
| * * 060211 | Pulley | 780239 | 11 | .014 | 6.90 | 0.86 | 8 | | .99993 |
| 060212 | Gaskets, Bolts, Etc. | 780239 | 17 | .022 | 2.90 | 0.41 | 7 | | .99989 |
| * * 060213 | Voltage Regulator | 780239 | 211 | .269 | 117.30 | 0.97 | 182 | | .99865 |
| 0603 | Starter Assembly | 5483.04 | 431 | 78.606* | 675.10 | 1.77 | 362 | .035 | .99725 |
| 06031 | Start Solenoid | 5483.04 | 69 | 12.584 | 47.40 | 1.03 | 46 | | .99956 |
| 06033 | Bearings | 5483.04 | 83 | 15.138 | 46.00 | 1.44 | 32 | | .99947 |
| 06034 | Brushes | 5483.04 | 74 | 13.496 | 35.70 | 1.19 | 30 | | .99953 |
| 06035 | Bendix | 5483.04 | 53 | 9.666 | 26.00 | 1.37 | 19 | | .99966 |
| 06036 | Fittings | 5483.04 | 28 | 5.107 | 19.50 | 0.89 | 22 | | .99982 |
| 06037 | End Plate | 5483.04 | 15 | 2.736 | 5.10 | 1.70 | 3 | | .99990 |
| 06038 | Armature | 5483.04 | 10 | 1.824 | 4.50 | 0.90 | 5 | | .99994 |
| 06039 | Brush Holder | 5483.04 | 5 | .912 | 0.50 | 0.50 | 1 | | .99997 |

*See important note on Appendix cover sheet

* * These items also make up an Alternator Assembly

Page 7 of 18 FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliat. |
|-----------------------|--------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0605 | Ignition Assembly | 783290 | 7 | .009* | 7.50 | 1.50 | 5 | 5.00 | .99995 |
| 06051 | Contact Set | 783290 | 735 | .938 | 295.50 | 0.57 | 523 | | .99931 |
| 06052 | Rotor | 783290 | 68 | .087 | 18.40 | 0.42 | 44 | | .99956 |
| 06053 | Capacitor (condenser) | 783290 | 434 | .554 | 145.40 | 0.49 | 296 | | .99923 |
| 06054 | Distributor Cap | 783290 | 60 | .077 | 23.90 | 0.66 | 36 | | .99961 |
| 06055 | Distributor Shaft | 783290 | 48 | .061 | 25.20 | 0.52 | 48 | | .99969 |
| 06056 | Distributor Drive Gear | 783290 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 |
| 06057 | Centrifugal Adv. Weights | 783290. | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06058 | Coil | 783290 | 57 | .073 | 25.20 | 0.66 | 38 | | .99963 |
| 06059 | Spark Plug | 783290 | 931 | 1.189 | 392.30 | 0.16 | 2397 | | .99581 |
| 060510 | Spark Plug Cable | 783290 | 38 | .049 | 10.70 | 0.75 | 14 | | .99975 |
| 060511 | Suppressor | 783290 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 060513 | Dust Cap | 783290 | 8 | .010 | 2.70 | 0.34 | 8 | | .99995 |
| 060514 | Distributor Assembly | 783290 | 36 | .046 | 29.80 | 1.03 | 29 | | .99977 |
| 0607 | Engine Control Panel | 773891 | 10 | .013* | 5.70 | 0.57 | 10 | 4.94 | .99940 |
| 06071 | Ammeter | 773891 | 23 | .030 | 16.00 | 0.94 | 17 | | .99985 |
| 06072 | Fuel Gage | 773891 | 61 | .079 | 32.50 | 0.76 | 43 | | .99961 |
| 06073 | Oil Pressure Gage | 773891 | 69 | .089 | 33.70 | 0.65 | 52 | | .99956 |
| 06074 | Hour-Meter | 773891 | 145 | .187 | 80.70 | 0.86 | 94 | | .99908 |
| 06075 | Temperature Gage | 773891 | 48 | .062 | 29.30 | 0.81 | 36 | | .99969 |
| 06076 | Light Switch | 773891 | 111 | .143 | 48.80 | 0.65 | 75 | | .99929 |
| 06077 | Transmission Oil Switch | 773891 | 1 | .001 | 0.50 | 0.50 | 1 | 5.00 | .99999 |
| 06078 | Ignition Switch | 783290 | 112 | .143 | 81.50 | 0.88 | 93 | | .99928 |
| 06079 | Starter Switch | 783290 | 78 | .100 | 53.10 | 0.86 | 62 | | .99950 |
| 060710 | Fuse, Holder, Block | 783290 | 64 | .082 | 18.40 | 0.32 | 57 | | .99959 |
| 060711 | Divider (Insulator) | 783290 | 5 | .006 | 2.00 | 1.00 | 2 | | .99997 |

*See important note on Appendix cover sheet

Page 8 of 18 FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|---------------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0609 | Lights | 195822 | 57 | .291* | 33.50 | 0.73 | 46 | 1.25 | .99964 |
| 06091 | Headlight | 195822 | 437 | 2.232 | 236.70 | 0.64 | 369 | | .99721 |
| 06092 | Tail Light | 195822 | 411 | 2.099 | 241.10 | 0.66 | 365 | | .99738 |
| 06093 | Wiring | 195822 | 19 | .097 | 6.40 | 0.38 | 17 | | .99988 |
| 06094 | Mountings | 195822 | 14 | .071 | 5.70 | 0.47 | 12 | | .99991 |
| 06095 | Seal Beam | 195822 | 196 | 1.001 | 62.00 | 0.60 | 104 | | .99875 |
| 06096 | Bulbs | 195822 | 448 | 2.287 | 71.00 | 0.51 | 140 | | .99714 |
| 0610 | Sending Units | | | | | | | | |
| 06101 | Hour-Meter | 773891 | 15 | .019* | 7.30 | 0.73 | 10 | 4.94 | .99991 |
| 06102 | Oil Pressure SU | 773891 | 56 | .072 | 25.50 | 0.62 | 41 | | .99964 |
| 06103 | Water Temperature SU | | | | | | | | |
| 06104 | Fuel Gage SU | 773891 | 33 | .043 | 15.00 | 0.75 | 20 | | .99979 |
| 06105 | Transmission Oil Warning Light | 773891 | 35 | .045 | 17.20 | 0.78 | 22 | | .99978 |
| 06106 | Fuel Tank SU | 773891 | 4 | .005 | 1.50 | 0.75 | 2 | | .99997 |
| 06107 | Transmission Oil Temperature SU | 773891 | 4 | .005 | 1.50 | 0.50 | 3 | | .99997 |
| | | | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 |
| 0611 | Horn Assembly | 16449 | 151 | 9.180* | 85.80 | 0.64 | 135 | .105 | .99904 |
| 06111 | Button Spring | 16449 | 5 | .304 | 1.30 | 0.43 | 3 | | .99997 |
| 06112 | Horn | 16449 | 69 | 4.195 | 32.50 | 0.57 | 57 | | .99956 |
| 06113 | Cable | 16449 | 6 | .365 | 6.00 | 1.00 | 6 | | .99996 |
| 06114 | Button Cover | 16449 | 41 | 2.493 | 108.60 | 0.58 | 39 | | .99974 |
| 06115 | Contact | 16449 | 48 | 2.918 | 20.30 | 0.58 | 35 | | .99969 |
| 06116 | Horn Button Kit | 16449 | 37 | 2.249 | 16.60 | 0.64 | 26 | | .99976 |
| 06117 | Relay | 16449 | 50 | 3.040 | 16.20 | 0.49 | 33 | | .99968 |

*See important note on Appendix cover sheet

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

Page 9 of 18

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|-----------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 0612 | Storage Battery | 783290 | 242 | .309* | 152.50 | 0.93 | 164 | 5.00 | .99845 |
| 06121 | Cell | 783290 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 06122 | Terminal | 783290 | 51 | .065 | 20.90 | 0.60 | 35 | | .99967 |
| 06123 | Cable | 783290 | 80 | .102 | 41.30 | 0.74 | 56 | | .99949 |
| 06124 | Cap | 783290 | 11 | .014 | 2.70 | 0.25 | 11 | | .99993 |
| 06125 | Frame, Fitting, Etc. | 783290 | 16 | .020 | 5.70 | 0.47 | 12 | | .99990 |
| 0613 | Chassis Wiring | 783290 | 14 | .018* | 40.00 | 6.67 | 6 | 5.00 | .99991 |
| 06131 | Harness | 783290 | 14 | .018 | 6.40 | 0.58 | 11 | | .99991 |
| 06132 | Connectors | 783290 | 101 | .128 | 179.10 | 2.04 | 88 | | .99935 |
| 0708 | Torque Converter | 372846 | 20 | .054* | 79.50 | 5.30 | 15 | 2.38 | .99987 |
| 07081 | Gasket | 372846 | 7 | .019 | 0.50 | 0.50 | 1 | | .99995 |
| 07082 | Bearing | 372846 | 7 | .019 | 4.00 | 1.33 | 3 | | .99995 |
| 07083 | Clutch | 372846 | 2 | .005 | --- | --- | 0 | | .99999 |
| 07084 | Shaft | 372846 | 4 | .011 | 1.00 | 1.00 | 1 | | .99997 |
| 07085 | Packing | 372846 | 18 | .048 | 4.00 | 0.80 | 5 | | .99989 |
| 07086 | Pump | 372846 | 1 | .003 | --- | --- | 0 | | .99999 |
| 07087 | Relief Valve | 372846 | 1 | .003 | --- | --- | 0 | | .99999 |
| 07088 | Housing | 372846 | 4 | .011 | 8.00 | 8.00 | 1 | | .99997 |
| 07089 | Shoes | 372846 | 3 | .008 | 1.00 | 0.50 | 2 | | .99998 |
| 0710 | Transmission Assembly | 372846 | 82 | .220* | 438.50 | 6.18 | 71 | 2.38 | .99948 |
| 07101 | Gears | 372846 | 5 | .013 | 4.50 | 2.25 | 2 | | .99997 |
| 07102 | Bearing | 372846 | 9 | .024 | 5.00 | 1.67 | 3 | | .99994 |
| 07103 | Seal | 372846 | 64 | .172 | 63.50 | 1.63 | 39 | | .99959 |
| 07104 | Screen | 372846 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 07105 | Gasket | 372846 | 13 | .035 | 6.10 | 0.87 | 7 | | .99992 |
| 07106 | Hoses | 372846 | 24 | .064 | 29.50 | 1.47 | 20 | | .99985 |
| 07107 | Bracket | 372846 | 6 | .016 | 4.50 | 0.75 | 6 | | .99996 |
| 07108 | Retainer Ring | 372846 | 44 | .118 | 4.00 | 1.33 | 3 | | .99972 |

0710 CONTINUED ON NEXT PAGE.
* See important note on Appendix cover sheet

Page 10 of 18 FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|---|--|--|--|---|--|--|--|--------------------------------|--|
| 07109 071010 | Shift Cylinder Neutral Switch | 372846 372846 | 37 35 | .099* .094 | 42.20 22.80 | 1.24 0.79 | 34 29 | 2.38 | .99976 .99978 |
| 0713 07131 07132 07133 07134 07135 | Intermediate Clutch Gears Seal Bearings Piston Clutch Spring | 372846 372846 372846 372846 372846 372846 | 4 2 10 13 4 5 | .011* .005 .027 .035 .011 .013 | ----- 0.30 3.30 3.50 ----- 4.30 | ----- 0.30 1.10 0.35 ----- 1.07 | 0 1 3 10 0 4 | 2.38 | .99997 .99999 .99994 .99992 .99997 .99997 |
| 0714 07141 07142 07143 07144 07145 07146 07147 07148 07149 | Servo Unit Control Knob Linkage Plug Valve Spring Seal Gasket Plunger Valve Tube | 372846 372846 372846 372846 372846 372846 372846 372846 372846 372846 | 11 51 47 2 2 9 10 3 5 1 | .030* .137 .126 .005 .005 .024 .027 .008 .013 .003 | 9.80 23.60 46.30 1.50 2.00 1.40 3.00 1.00 8.50 1.00 | 2.45 0.58 1.05 0.75 1.00 0.28 0.50 1.00 2.12 1.00 | 4 41 44 2 2 5 6 1 4 1 | 2.38 | .99985 .99932 .99937 .99997 .99997 .99988 .99987 .99996 .99993 .99998 |
| 0721 07211 07212 07213 07214 07215 07216 | Coolers, Pumps, Motors Filter Element Gasket Relief Valve Filter Spring Plug Hose, Fittings | 372846 372846 372846 372846 372846 372846 372846 | 17 10 8 1 0 3 68 | .046* .027 .021 .003 0.0 .008 .182 | 6.00 3.90 12.60 0.50 0.0 1.80 40.70 | 1.50 0.56 2.52 0.50 0.0 0.60 1.31 | 4 7 5 1 0 0 3 31 | 2.38 | .99977 .99987 .99989 .99998 1.0000 .99996 .99909 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

Page 11 of 18 FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Component Name | Accumu- lated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|--------------------------------------|---------------------------|--------------------------|-----------------------------------|--------------------|----------------------------|----------------------------------|---|----------------------|
| 0900 Propeller and Shaft Assembly | 372846 | 4 | .011* | 3.00 | 1.50 | 2 | 2.38 | .99994 |
| 09001 Bolts | 372846 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 09002 Bearings | 372846 | 3 | .008 | 2.50 | 0.83 | 3 | | .99996 |
| 09003 Shaft | 372846 | 3 | .008 | 4.00 | 2.00 | 2 | | .99996 |
| 09004 Sprocket | 372846 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 09005 "U" Joint Kit | 372846 | 30 | .080 | 52.00 | 2.00 | 26 | | .99960 |
| 09006 "U" Joint Assembly | 372846 | 90 | .241 | 253.50 | 3.62 | 70 | | .99880 |
| 1000 Axle and Housing | 372846 | 7 | .019* | 29.80 | 4.26 | 7 | 2.38 | .99990 |
| 10001 Shaft | 372846 | 15 | .040 | 26.00 | 2.60 | 10 | | .99980 |
| 10002 Housing | 372846 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 10003 Hydra-Lizer | 372846 | 7 | .019 | 12.00 | 1.71 | 7 | | .99990 |
| 1002 Differential | 372846 | 26 | .070* | 54.70 | 2.38 | 23 | 2.38 | .99965 |
| 10021 Roller Bearing | 372846 | 9 | .024 | 4.50 | 0.90 | 5 | | .99988 |
| 10022 Ring Gear/Pinion Teeth | 372846 | 8 | .021 | 4.00 | 4.00 | 1 | | .99989 |
| 10023 Spider Gear | 372846 | 2 | .005 | --- | --- | 0 | | .99997 |
| 10024 Gasket | 372846 | 7 | .019 | 12.00 | 2.40 | 5 | | .99990 |
| 10025 Carrier | 372846 | 9 | .024 | 1.50 | 0.75 | 2 | | .99988 |
| 10026 Seal | 372846 | 40 | .107 | 58.60 | 1.70 | 31 | | .99947 |
| 10027 Cone | 372846 | 7 | .019 | 8.00 | 4.00 | 2 | | .99990 |
| 1100 Rear Axle Assembly | 372846 | 12 | .032* | 19.50 | 1.77 | 11 | 2.38 | .99984 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

Page 12 of 18

| Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. | |
|--|------------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|--|
| Steering Sideshaft and Wheel Leaning Mechanism | 372846 | 14 | .038* | 13.20 | 1.10 | 12 | 2.38 | .9981 | |
| Steering Axle | 372846 | 58 | .156 | 99.80 | 2.27 | 44 | | .99922 | |
| King Pin Bearing | 372846 | 13 | .035 | 14.70 | 1.13 | 13 | | .9982 | |
| King Pin | 372846 | 35 | .094 | 42.70 | 1.71 | 25 | | .99953 | |
| Fitting | 372846 | 16 | .043 | 17.50 | 1.25 | 14 | | .99979 | |
| Bushing | 372846 | 137 | .367 | 69.40 | 1.02 | 68 | | .99817 | |
| Steering Center Arm | 372846 | 31 | .083 | 55.70 | 2.32 | 24 | | .99959 | |
| Cone and Roller | 372846 | 140 | .375 | 49.50 | 0.66 | 75 | | .99813 | |
| Roller Bearing | 372846 | 96 | .257 | 54.70 | 0.99 | 55 | | .99872 | |
| Cup | 372846 | 117 | .314 | 31.80 | 0.50 | 63 | | .99844 | |
| Seal | 372846 | 17 | .046 | 1.80 | 0.26 | 7 | | .99977 | |
| Hydraulic Brake System | 773891 | 0 | 0.0* | 0.0 | 0.0 | 0 | 4.94 | 1.0000 | |
| Hydraulic Brake Line | 773891 | 7 | .009 | 3.00 | 1.00 | 3 | | .99996 | |
| Gasket | 773891 | 9 | .012 | 5.00 | 0.71 | 7 | | .99994 | |
| Wheel Cylinder Boot | 773891 | 55 | .071 | 29.20 | 0.66 | 44 | | .99965 | |
| Wheel Cyl. Piston | 773891 | 13 | .017 | 14.50 | 2.07 | 7 | | .99992 | |
| Master Cylinder Cup Seal | 773891 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 | |
| Master Cylinder Piston | 773891 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 | |
| Master Cylinder Spring | 773891 | 2 | .003 | 4.00 | 4.00 | 1 | | .99998 | |
| Hose | 773891 | 1 | .001 | 0.50 | 0.50 | 1 | | .99999 | |
| Tank Fitting | 773891 | 73 | .094 | 83.70 | 1.47 | 57 | | .99954 | |
| Master Cylinder Assembly | 773891 | 174 | .224 | 160.50 | 1.24 | 129 | | .99889 | |
| Wheel Cylinder Kit | 773891 | 31 | .040 | 30.00 | 1.36 | 22 | | .99980 | |
| Master Cylinder Kit | 773891 | | | | | | | | |
| 120411 | | | | | | | | | |
| 120412 | | | | | | | | | |
| 1204 | CONTINUED ON NEXT PAGE | | | | | | | | |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Component Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|--|--|--|---|---|--|---|--|--------------------------------|--|
| 120413 120414 | Inching Valve Boot Inching Valve Assembly | 80679 80679 | 31 4 | .384* .049 | 13.70 4.50 | 1.05 1.12 | 13 4 | .525 | .99980 .99997 |
| 1206 12061 12062 12063 12064 | Mechanical Brake Pedal Pad Return Spring Linkage Bearing | 773891 773891 773891 773891 773891 | 11 87 13 12 4 | .014* .112 .017 .016 .005 | 8.00 31.50 7.00 9.90 2.00 | 0.89 0.38 0.58 0.99 1.00 | 9 82 12 10 2 | 4.94 | .99993 .99945 .99992 .99992 .99997 |
| 1201 12011 12012 12013 12014 12015 | Hand Brake Shear Pin Cable and Clamp Lever Knob Shoes/Band | 773891 773891 773891 773891 773891 773891 | 143 0 85 124 4 30 | .185* 0.0 .110 .160 .005 .039 | 191.60 0.0 96.60 110.40 2.00 36.00 | 1.40 0.0 1.38 1.08 0.67 2.77 | 137 0 70 102 3 13 | 4.94 | .99909 1.0000 .99946 .99921 .99997 .99981 |
| 1202 12021 12022 12023 12024 12025 12026 12027 12028 12029 12030 | Service Brake Brake Shoe Retracting Spring Brake Lining Carrier Plate Adjusting Screw Wheel Cylinder Assembly Cable Assembly Seal Creepers/Inching Pedal Clamp | 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 773891 | 407 592 76 0 4 17 38 119 47 239 8 | .526* .765 .098 0.0 .005 .022 .049 .154 .061 2.962 .010 | 598.70 427.10 38.40 0.0 6.00 4.00 40.50 178.30 26.80 227.60 5.50 | 1.58 0.90 0.69 0.0 6.00 1.00 1.50 1.77 0.92 0.98 1.37 | 378 474 56 0 1 4 27 101 29 232 4 | 4.94 | .99740 .99622 .99952 1.0000 .99997 .99989 .99976 .99924 .99970 .99844 .99995 |

* See important note on Appendix cover sheet

Page 14 of 18 FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Functional Group Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-----------------------|------------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 1311 | Wheel Assembly | 745692 | 28 | .038* | 20.50 | 0.98 | 21 | 4.76 | .99982 |
| 13111 | Brake Drum | 745692 | 20 | .027 | 37.00 | 2.18 | 17 | | .99987 |
| 13112 | Wheel Bearing | 745692 | 36 | .048 | 17.50 | 0.83 | 21 | | .99977 |
| 13113 | Cup | 745692 | 19 | .025 | 8.80 | 0.59 | 15 | | .99988 |
| 13114 | Wheel Nuts, Bolts, Lugs | 745692 | 96 | .129 | 84.40 | 1.08 | 78 | | .99939 |
| 13115 | Seal | 745692 | 49 | .066 | 54.70 | 1.33 | 41 | | .99969 |
| 13118 | Spring | 745692 | 2 | .003 | 1.00 | 1.00 | 1 | | .99960 |
| 13131 | Tires | 745692 | 935 | 1.254* | 803.40 | 1.00 | 801 | 4.76 | .99405 |
| 13132 | Tubes | 745692 | 63 | .084 | 50.00 | 1.22 | 41 | | .99960 |
| 1401 | Mechanical Steering Assembly | 372846 | 170 | .456* | 166.60 | 1.02 | 164 | 2.38 | .99891 |
| 14011 | Tie Rod and End Bearing | 372846 | 154 | .413 | 138.00 | 1.23 | 112 | | .99902 |
| 14012 | Bearing | 372846 | 59 | .158 | 56.50 | 1.18 | 48 | | .99962 |
| 14013 | Steering Wheel | 372846 | 29 | .078 | 28.00 | 1.17 | 24 | | .99981 |
| 14014 | Seal | 372846 | 50 | .134 | 21.20 | 0.73 | 29 | | .99968 |
| 14015 | Shaft | 372846 | 19 | .051 | 24.00 | 1.60 | 15 | | .99988 |
| 14017 | Drag Link | 372846 | 100 | .268 | 60.80 | 0.67 | 91 | | .99936 |
| 14018 | Nuts, Bolts, Etc. | 372846 | 125 | .335 | 46.90 | 0.85 | 55 | | .99920 |
| 1410 | Hydraulic Pump | 372846 | 157 | .421* | 286.20 | 2.07 | 138 | 2.38 | .99900 |
| 14101 | Gears | 372846 | 1 | .003 | --- | --- | 0 | | .99999 |
| 14102 | Seal | 372846 | 80 | .215 | 78.20 | 1.40 | 56 | | .99949 |
| 14103 | Bearing | 372846 | 17 | .046 | 13.20 | 0.94 | 14 | | .99989 |
| 14104 | Relief Valve | 372846 | 4 | .011 | 3.20 | 1.07 | 3 | | .99997 |
| 14105 | Gasket | 372846 | 16 | .043 | 10.40 | 0.69 | 15 | | .99990 |
| 14106 | Drive Belt | 372846 | 253 | .679 | 126.10 | 0.61 | 208 | | .99838 |
| 14107 | Shaft | 372846 | 3 | .008 | 1.50 | 0.50 | 3 | | .99998 |
| 14108 | Shaft | 372846 | 9 | .024 | 4.00 | 1.00 | 4 | | .99994 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

| Component Code | Component Name | Accumu- lated Hours | Number of Failures | Failures/ 10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|-------------------|------------------------------|---------------------------|--------------------------|-----------------------------------|--------------------|----------------------------|----------------------------------|---|----------------------|
| 1411 | Hoses, Lines and Fittings | 372846 | 281 | .754* | 274.60 | 1.05 | 262 | 2.38 | .99621 |
| 1412 | Hydraulic Cylinder | 372846 | 102 | .274* | 202.40 | 2.27 | 89 | 2.38 | .99935 |
| 14121 | Seal | 372846 | 21 | .056 | 5.30 | 0.38 | 14 | | .99987 |
| 14122 | Cylinder | 372846 | 4 | .011 | 3.20 | 0.80 | 4 | | .99997 |
| 14123 | Piston | 372846 | 2 | .005 | 4.20 | 2.10 | 2 | | .99999 |
| 14124 | Ball Socket | 372846 | 27 | .072 | 15.50 | 0.86 | 18 | | .99983 |
| 1414 | Steering System | 372846 | 103 | .276* | 169.40 | 2.02 | 84 | 2.38 | .99934 |
| 14141 | Valves | 372846 | 1 | .003 | --- | --- | 0 | | .99999 |
| 14142 | Spool | 372846 | 17 | .046 | 16.90 | 1.41 | 12 | | .99989 |
| 14143 | Seal | 372846 | 2 | .005 | --- | --- | 0 | | .99999 |
| 14144 | Dust Cover | 372846 | 1 | .003 | --- | --- | 0 | | .99999 |
| 14145 | Sleeve | 372846 | 46 | .123 | 34.50 | 0.78 | 44 | | .99971 |
| 14146 | P/S Packing | 372846 | 128 | .343 | 183.30 | 1.68 | 109 | | .99918 |
| 1501 | Frame Assembly | 745692 | 57 | .076* | 93.70 | 1.74 | 54 | 4.76 | .99964 |
| 1502 | Counterweight | 745692 | 7 | .009* | 6.50 | 1.08 | 6 | 4.76 | .99996 |
| 1601 | Leaf Springs | 745692 | 0 | 0.0* | 0.0 | 0.0 | 0 | 4.76 | 1.0000 |
| 1602 | Clamps, Nuts, Bolts | 745692 | 37 | .050* | 8.00 | 0.50 | 16 | 4.76 | .99976 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FORK LIFT TRUCK - RELIABILITY AND MAINTAINABILITY DATA

Page 16 of 18

| Component Code | Component Name | Accumulated Hours | Number of Failures | Failures/10 ³ Hrs. | Maint. Manhours | Mean Maint. Manhours | Actions Reporting Manhours | Mission Operating Time (Hours) | Component Reliab. |
|----------------|---------------------------|-------------------|--------------------|-------------------------------|-----------------|----------------------|----------------------------|--------------------------------|-------------------|
| 1801 | Body Assembly | 745692 | 9 | .012* | 15.10 | 1.68 | 9 | 4.76 | .99994 |
| 18011 | Hinge | 745692 | 3 | .004 | 2.50 | 0.83 | 3 | | .99998 |
| 18012 | Latch | 745692 | 10 | .013 | 4.60 | 0.51 | 9 | | .99994 |
| 18013 | Structure | 745692 | 219 | .294 | 354.50 | 1.82 | 195 | | .99860 |
| 18015 | Floor Board Assembly | 745692 | 22 | .030 | 8.70 | 0.43 | 20 | | .99986 |
| 18062 | Seat Back Rest | 783290 | 81 | .103* | 95.90 | 1.35 | 71 | 5.00 | .99948 |
| 2401 | Hydraulic Lift Pump | 372846 | 105 | .282* | 166.00 | 1.80 | 92 | 2.38 | .99933 |
| 24011 | Pump Drive Cross Bearings | 372846 | 0 | 0.0 | 0.0 | 0.0 | 0 | | 1.0000 |
| 24012 | Pump Bearing | 372846 | 4 | .011 | 1.50 | 1.50 | 1 | | .99997 |
| 24013 | Seal | 372846 | 47 | .126 | 31.50 | 1.21 | 26 | | .99970 |
| 24014 | Gear | 372846 | 5 | .013 | 11.00 | 2.20 | 5 | | .99997 |
| 24015 | Pump Packing | 372846 | 17 | .046 | 33.90 | 2.26 | 15 | | .99989 |
| 24016 | Hydraulic Pump | 372846 | 74 | .198 | 48.00 | 0.67 | 72 | | .99953 |
| 24017 | Filter Pulley | 372846 | 6 | .016 | 6.00 | 1.50 | 4 | | .99996 |
| 2402 | Hydraulic Control | 372846 | 135 | .362* | 195.20 | 1.74 | 112 | 2.38 | .99914 |
| 24021 | Valve | 372846 | 7 | .019 | 6.50 | 1.30 | 5 | | .99995 |
| 24022 | Spring | 372846 | 142 | .381 | 112.70 | 1.27 | 89 | | .99909 |
| 24023 | Seal | 372846 | 3 | .008 | 3.50 | 1.75 | 2 | | .99998 |
| 24024 | Piston | 372846 | 1 | .003 | 1.50 | 1.50 | 1 | | .99999 |
| 24025 | Cap | 372846 | 74 | .198 | 85.10 | 1.20 | 71 | | .99953 |
| 24026 | Hose | 372846 | 4 | .011 | 3.20 | 0.80 | 4 | | .99997 |
| 24027 | Bracket | 372846 | 1 | .003 | 1.00 | 1.00 | 1 | | .99999 |
| 24028 | Valve Cover | 372846 | 151 | .405 | 137.00 | 1.18 | 116 | | .99904 |
| 24029 | C/V Packing | 372846 | 35 | .094 | 27.50 | 1.25 | 22 | | .99978 |

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

Page 17 of 18

| Component Name | Accumu- lated Count | Days of Life | Failure Rate 3 Yrs. | Hours of Life | Hours of Life | Hours of Life | Hours of Life | Hours of Life | Hours of Life | Mission Operating Time (Hours) | Component Reliability |
|---|--|--|---|--|--|---|---------------------|--|---------------------|---|--------------------------|
| 2403 Hydraulic Controls Levers Linkage Spring Linkage Pin Level, Link or Rod | 372846 372846 372846 372846 | 15 10 2 20 | .040* .027 .005 .054 | 16.80 3.00 1.50 18.20 | 1.29 1.00 0.75 1.21 | 13 3 2 15 | 2.38 | .99990 .99994 .99999 .99987 | | | |
| 2404 Hydraulic Tilt Cylinder Packing Tilt Cylinder Assembly Linkage Packing Nut Hose Ring Cup Kit | 372846 372846 372846 372846 372846 372846 372846 372846 | 161 255 91 59 12 94 40 16 60 | .432* .648 .244 .158 .032 .252 .107 .043 .161 | 189.00 258.90 139.60 29.80 5.60 101.70 18.70 11.00 74.50 | 1.24 1.18 1.66 0.52 0.51 1.24 1.25 1.00 1.66 | 153 219 84 57 11 82 15 11 45 | 2.38 | .99897 .99846 .99942 .99962 .99992 .99940 .99974 .999 .99962 | | | |
| 2405 Hydraulic Mast Column Assembly Packing Cylinder Roller Bearings Pins Chain Package Rack Ring Inner Slide Brace | 745692 745692 745692 745692 745692 745692 745692 745692 | 61 669 102 127 19 80 136 119 41 9 | .082* .897 .137 .170 .025 .107 .182 .160 .055 .012 | 61.80 624.20 201.70 93.90 10.00 72.10 143.50 54.20 55.00 4.00 | 1.05 1.10 2.22 1.22 0.71 1.02 1.26 0.82 1.62 0.57 | 59 566 91 77 14 71 114 66 34 7 | 4.76 | .99961 .99573 .99935 .99919 .99988 .99949 .99913 .99924 .99974 .99994 | | | |

2405 CONTINUED ON NEXT PAGE

*See important note on Appendix cover sheet

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

| Component Name | Accumu- lated | 3 | Mission Operating | Component | |
|--------------------------------------|------------------|-----|----------------------|-----------|--------|
| 240511 Flange Assembly | 745692 | 1 | 1.00 | 1 | .99999 |
| 240512 Bolt, Clamp | 745692 | 15 | 7.80 | 15 | .99990 |
| 240513 Packing Nut | 745692 | 62 | 33.90 | 59 | .99960 |
| 240514 Forks | 745692 | 47 | 99.30 | 41 | .99970 |
| 2406 Hydraulic Lines and Fittings | 745692 | 38 | 14.50 | 31 | .99976 |
| 24061 Filter Element | 745692 | 144 | 165.60 | 115 | .99908 |
| 24062 Filter Gasket | 745692 | 55 | 31.20 | 44 | .99965 |
| 24063 Filter Spring | 745692 | 9 | 8.00 | 7 | .99994 |
| 24064 Hydraulic Fluid | 745692 | 0 | 0.0 | 0 | 1.0000 |
| 24065 Tank | 745692 | 32 | 19.10 | 26 | .99980 |
| 2501 Clutch | 372846 | 36 | 118.20 | 31 | .99977 |
| 25011 Pedal | 372846 | 16 | 9.00 | 16 | .99990 |
| 25012 Spring | 372846 | 6 | 3.20 | 5 | .99996 |
| 25013 Plate Assembly | 372846 | 18 | 27.70 | 10 | .99989 |
| 25014 Linkage | 372846 | 9 | 4.50 | 5 | .99994 |
| 25015 Disc Assembly | 372846 | 15 | 42.40 | 8 | .99990 |
| 25016 Bearings | 372846 | 17 | 23.00 | 10 | .99989 |

*See important note on Appendix cover sheet