97. 1.30 Republic of the Philippines 01-12-22 DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS **OFFICE OF THE SECRETARY** Manila 5 JAN 2016 **DEPARTMENT ORDER** SUBJECT:) **PREVENTIVE MAINTENANCE OF**) ALL DPWH **MULTI-PURPOSE** NO.) **AMPHIBIOUS DREDGES** Series of 2016 -01.12.16)

In order to lessen maintenance costs, increase the reliability and availability of all the Multi-Purpose Amphibious Dredges (MPAD) of this Department, as well as reduce hazard to both personnel and equipment in the practice of Preventive Maintenance (PM), the *Multi-Purpose Amphibious Dredge Preventive Maintenance Manual (MPADPMM)* as herein attached to form part of this Department Order, is hereby issued to all concerned personnel and offices to serve as a guide in the planning, execution and control of the dredges' maintenance programs. The manual was developed based on the maintenance schedule recommended by the equipment manufacturer and by the years of experience of this Department's engineers in the field of dredge maintenance. With the adoption of this manual, the Department expects to have a standardized preventive maintenance program thus avoiding confusion and any delays in achieving the goals of this Department for its dredging programs.

Prior to dry-docking and repair of dredges, which is done every two and a half years as indicated in D.O 160, Series of 2015 or the "Guidelines for the Dry-docking and Repair of DPWH Dredges and Other Floating Equipment", all MPAD are required to undergo preventive maintenance activities which are done regularly based on calendar time or service hours of the dredge. This order should apply to all *Watermaster Classic II, III, IV and Dredge King* Dredges. Maintenance activities only applicable to each dredge model given their different structures are noted in the manual. Funding will be charged to the Maintenance and Other Operating Expenses (MOOE) of the Bureau of Equipment (BOE).

Please be guided by the attached Preventive Maintenance Daily Checklist for Multi-Purpose Amphibious Dredge Form, Preventive Maintenance Materials Request Form, Preventive Maintenance Materials Delivery and Acceptance Report Form, and Preventive Maintenance History Form. Instructions on filling up and submission of these forms are listed in the manual.

This Department Order shall take effect immediately.

RØGELIO(L. SINGSON Secretary Department of Public Works and Highways Office of the Secretary

Encl: Annex "A": Multi-Purpose Amphibious Dredge Preventive Maintenance Manual Annex "B": Preventive Maintenance Daily Checklist for Multi-Purpose Amphibious Dredge Form Annex "C": Preventive Maintenance Materials Request Form Annex "D": Preventive Maintenance Materials Delivery and Acceptance Report Form Annex "E": Preventive Maintenance History Form



Republic of the Philippines DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS OFFICE OF THE SECRETARY

Manila

FOREWORD

This Department's dredges play a major role on the nation's flood control and mitigation program. Proper care and effective maintenance not only extend the serviceable life of the equipment but also ensure its reliability in order to meet the needs of the Department for its dredging programs in a cost effective manner.

In line with this, DPWH through the Bureau of Equipment developed the **Multi-Purpose Amphibious Dredge Preventive Maintenance Manual (MPADPMM)** based on various references.

This Manual intends to provide systematic upkeep, service and inspection of equipment to detect and correct failures in the earliest possible time. All dredge personnel are responsible for the proper operation and maintenance of the equipment that they are assigned with. The overall appearance and condition of the equipment reflects the operators' attitude and concern towards their equipment and ultimately to their jobs.

All concerned personnel are enjoined to use this Manual as a guide in the proper practice of preventive maintenance of all Multi-Purpose Amphibious Dredges deployed nationwide.

RØGELIO K/ SINGSON Secretary



Republic of the Philippines Department of Public Works and Highways Fikating Equipment Division BUREAU OF EQUIPMENT

PREVENTIVE MAINTENANCE DAILY CHECKLIST FOR MULTI-PURPOSE AMPHIBIOUS DREDGE

for the month of: _____

Annex "B"

DREDGE NAME : AREA OF OPERATION :

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REMINDER: Wear Personal Protective Equipment (PPE) before proceeding to any maintenance work.

DM	ACT.	ACTIVITY NAME																DAY	•															DEMARKE
	NO		1	2	3	4	5	6	67	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	101	Inspection of Hull		-																														
	102	Inspection of Front and Rear Stabilizers																																l
	103	Inspection of Side Pontoons																																
	104	Inspection of Propulsion Unit													:																			
	105	Testing the Hydraulic Oil Filter Service Indicator																																
	106	Checking of Existence of Water in the Engine Room																																
	107	Checking of Engine Oil Level																																
- F	108	Checking of Engine Coolant Level																																
I (DAI	109	Draining of Fuel Water Separator																																
FWd	110	Checking of Hydraulic Oil Reservoir Level																																/
	111	Inspection of Hydraulic Pipings																																
	112	Checking the Bucket condition																																
	113	Checking of Cutter Pump and Cutter Bearings																																
	114	Checking of Dredging Pump Seals																																
	115	Greasing of Pivots																																
	116	Inspection of CCV Filter Service Indicator																																
	117	Inspection and Cleaning of Discharge Pipes																																
KLYJ	201	Inspection of the Cutter Pump																																
(WEE	202	Testing the Oil Tank Breather																																
PM2	203	Checking and Replacing the Zinc Rods																																
	301	Cleaning of Coolers																																
	302	Changing of Engine Oil and Filter												1																				
-	303	Checking of Adjusting Engine Valve Lash																																
THLY	304	Replacing Engine Fuel Filters																																
MOM	305	Cleaning of Engine Crankcase Breather																					_											
) EMq	306	Checking and Adjusting the Belts																																
	307	Draining of Water from Hydraulic Oil Tank																																
	308	Checking and Replacing of Zinc Anodes																																
	309	Checking the Battery condition																																

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Annex "B"

REMINDER: Wear Personal Protective Equipment (PPE) before proceeding to any maintenance work.

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DM	ACT.	ACTIVITY																	DAY	1							-									REMARKS	
P.M.	NO.		1	2	3	4	. 5	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20) 2	1 23	2 2:	3 24	1 2!	5 2	5 27	2	8 2	9 3	10	31	REMARKS	
	401	Checking the Spud Lining																																			
LHS)	402	Checking the Propulsion Unit Shaft Condition																															_				
MON	403	Checking the Cutter Pump Sealing and Bearing																																			
RY 3	404	Inspection of Aftercooler Condensate Drain Valve																		•																	
I (EVE	405	Cleaning the Aftercooler																																			
PM4	406	Replacing the Battery																																			
	407	Replacing the Closed Crankcase Ventilation (CCV) Fumes Disposal Filter																																			
ERY HS)	501	Changing the Hydraulic Filters																																			
PMS (EVER 6 MONTHS	502	Changing the Dredging Pump Bearing Housing Oil																																			
	503	Cleaning the Engine Air Cleaner Element																																			
	601	Changing of Hydraulic Oil																																			
	602	Inspection and Greasing of Propeller Bearing Housing																																			
	603	Inspection and Repair of Cutter Hub Bearing																																			
۶	604	Inspection of Alternator																																			
NUAL	605	Inspection of Crankshaft Vibration Damper																																			
6 (AN	606	Checking the Engine Mounts																																			
Μd	607	Checking and Calibrating the Engine Speed/Timing Sensors																																			
	608	Inspection of Engine Valve Rotators																																			
1	609	Inspection of Starting Motor																																			
	610	Inspection of Water Pump																																			

Accomplished by:

Checked by:

Dredge Master

Chief, EMD

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Republic of the Philippines Department of Public Works and Highways Floating Equipment Division **BUREAU OF EQUIPMENT**

PREVENTIVE MAINTENANCE MATERIALS REQUEST FORM

Dredge Name: _____

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Area of Operation: ____

		PM Activi	ty				Materials	Requested
Activity	Activity Namo	Last re	placement	At the tin	ne of request	0	Unit of	
No.		Date	Service hours	Date	Service Hours	Quantity	Measure	Material Description
	· · · · · · · · · · · · · · · · · · ·							

Requested by:

-

Submitted by:

Recommending Approval:

Approved By:

Dredge Master

Chief, EMD

Ferdinand R. Fugaban Chief, FED-BOE

<u>Toribio Noel L. Ilao</u> Acting Director IV

Annex "C"



Republic of the Philippines Department of Public Works and Highways Floating Equipment Division BUREAU OF EQUIPMENT

Annex "D"

PREVENTIVE MAINTENANCE MATERIALS DELIVERY AND ACCEPTANCE REPORT

Dredge Name: _____

Area of Operation: _____

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ltem No.	Quantity	Unit	Material Description
	INSPECTI	ON	ACCEPTANCE
Date of Insp	ection:		Date Received:
	Inspected, verified quantity and specif	and found OK as to ications	Complete
	Inspected, verified quantity and specif	and found NOT OK as to ications	Partial
Other Rema	irks:		

Checked and verified by:

Submitted by:

Dredge Master

Chief, EMD



Republic of the Philippines Department of Public Works and Highways Floating Equipment Division **BUREAU OF EQUIPMENT**

PREVENTIVE MAINTENANCE HISTORY

DREDGE N	EDGE NAME:			Ŀ	AREA OF OPERATION:		REGION:		YEAR ACQUIRED:	DPWH NO.:		·····
DREDGEM	ASTER:	· · · · · · · · · · · · · · · · · · ·	SIZE AND CAF	ACITY:	ENGINE SERIAL N	0:	J			DATE OF A R	F.	
					MGE:	-	DPE:		AE:	DATE OF A.R.		
ACTIVITY	MAINTENANCE			NO. OF SEF	VICE HOURS				MATERIALS USED			
NO.	ТҮРЕ	ACTIVITY DESCRIPTION	DATE	previous replacement	on the date of replacement	QTY	UNIT	MAT	ERIAL DESCRIPTION	UNIT COST	TOTAL COST	REMARKS
							 					
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Accomplished by:

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Checked by:

Dredge Master

Chief, EMD

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MULTI-PURPOSE AMPHIBIOUS DREDGE PREVENTIVE MAINTENANCE MANUAL

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NOTE: Activity Codes with an asterisk (*) should follow the recommended										

service hours of materials before replacement to maximize their service lives.

	Pa	ge No.
PM1:1	DAILY	11-12
A101	Inspection of Hull	13
A102	Inspection of Front and Rear Stabilizers	14
A103	Inspection of Side Pontoons	15
A104	Inspection of Propulsion Unit	16
A105	Testing the Hydraulic Oil Filter Service Indicator	17
A106	Checking the Existence of Water in the Engine Room	18
A107	Checking of Engine Oil Level	19
A108	Checking of Engine Coolant Level	20
A109	Draining of Fuel Water Separator	21
A110	Checking of Hydraulic Oil Reservoir Level	22
A111	Inspection of Hydraulic Pipings	23
A112	Checking the Bucket Condition	24
A113	Checking of Cutter Pump and Cutter Bearings	25
A114	Checking of Dredging Pump Seals	26
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A202	Testing the Oil Tank Breather	32		Disposal Filter	
A203	Checking and Replacing the Zinc Rods	33	PM5 : E\	VERY 1000 SERVICE HOURS/ SEMI-ANNUALLY	57
PM3 : EV	ERY 200 SERVICE HOURS/MONTHLY	34	*A501	Changing the Hydraulic Filters	58
A301	Cleaning of Coolers	35	*A502	Changing the Dredging Pump Bearing Housing Oil	59-60
*A302	Changing of Engine Oil and Filter	36-37	A503	Cleaning the Engine Air Cleaner Element	61-62
A303	Checking and Adjusting Engine Valve Lash	38	*A504	Replacing the Batteries	63
*A304	Replacing Engine Fuel Filters	39	PM6 : EV	PRY 2000 SERVICE HOURS/ANNUALLY	64
A305	Cleaning of Engine Crankcase Breather	40	*A601	Changing of Hydraulic Oil	65-66
A306	Checking and Adjusting the Belts	41-42	A602	Inspection and Greasing of Propeller Bearing Housing	67-68
A307	Draining of Water from the Hydraulic Oil Tank	43	A603	Inspection and Repair of Cutter Hub Bearing	69-70
A308	Checking and Replacing of Zinc Anodes	44	A604	Inspection of Alternator	71
A309	Checking the Battery Condition	45	A605	Inspection of Crankshaft Vibration Damper	72
PM4 : EV	ERY 500 SERVICE HOURS/QUARTERLY	46	A606	Checking the Engine Mounts	73
A401	Checking the Spud Lining	47	A607	Checking and Calibrating the Engine Speed/Timing Sensors	74
A402	Checking the Propulsion Unit Shaft condition	48-49	A608	Inspection of Engine Valve Rotators	75
A403	Checking the Cutter Pump Sealing and Bearing	50-51	A609	Inspection of Starting Motor	76
A404	Inspection of Aftercooler Condensate Drain Valve	52	A610	Inspection of Water Pump	77
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Republic of the Philippines DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS OFFICE OF THE SECRETARY Manila

FOREWORD

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This Manual intends to provide systematic upkeep, service and inspection of equipment to detect and correct failures in the earliest possible time. All dredge personnel are responsible for the proper operation and maintenance of the equipment that they are assigned with. The overall appearance and condition of the equipment reflects the operators' attitude and concern towards their equipment and ultimately to their jobs.

I enjoin all concerned personnel to use this Manual as a guide in the proper practice of preventive maintenance of all Multi-Purpose Amphibious Dredges deployed nationwide.

ROGELIO L. SINGSON Secretary

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EXECUTIVE SUMMARY

Preventive maintenance (PM) is the predetermined work scheduled and performed with the goal of preventing the wear and tear or sudden breakdown of equipment parts and components. PM helps to protect assets and prolong the useful life of the equipment. It also improves the equipment's reliability, decreases costs of repair and parts replacements, minimizes system downtime, and also reduces personnel injury.

Thus, to ensure reliability of equipment, all deployed Multi-Purpose Amphibious Dredges are required to undergo PM. All Dredge Masters (DMs) are hereby ordered to perform the mandatory checking and possible repair of the equipment assigned to them. This order is strictly required and any end user who shall not comply will be met by sanctions.

PM activities listed in this manual comprised of inspection, cleaning, testing, oil top-ups, calibration, adjustment/ alignment, removal and replacement of some parts. List of tools and materials needed in performing the PM activities are stated in the manual. Safety hazards present on each activity and the required precautionary measures to be done were identified. Any irregularities/problems encountered during the PM servicing that require repairs or any maintenance activities not included in this manual should prompt the Dredge Master to prepare the detailed Maintenance Plan.

Safety on all maintenance activities should be governed by the guidelines under D.O. 74, Series of 2015. It is a requirement that each personnel should be familiar with this guidelines before proceeding to any maintenance activity.

This Manual only provides an overview of the basic procedures and requirements needed in the execution of the PM activities and is open to corrections or any modifications necessary.

ACKNOWLEDGEMENT

The Bureau of Equipment (BOE), thru the Office of the Bureau Director, wishes to extend thanks and appreciation to the construction and maintenance equipment distributors/suppliers that have supplied and made available the Operation and Maintenance Manuals and to the engineers and staff of FED-Maintenance and Dry-docking Services Section (MDSS) who rendered their time and expertise in the development of this manual:

TORIBIO NOEL L. ILAO

Director, Bureau of Equipment

FERDINAND R. FUGABAN

Chief, Floating Equipment Division (FED)

VICTOR J. JAVIER

Chief, Maintenance and Dry-docking Services Section (MDSS)

MAXIMO R. CABASISI Engineer III

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FRANCIS L. NUÑEZ Engineer II

KENNETH H. MAGPAYO Engineer II

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DEFINITION OF TERMS

Activity	Type of work performed with enough frequency to produce a significant impact on the resource requirements of a work program.
Corrective Maintenance (CM)	Type of maintenance done to take corrective action in the event of a breakdown of the equipment. The equipment is repaired, calibrated to its serviceable condition.
<u>Maintenance</u>	Ensuring that physical assets continue to do what their intended users want them to do. It is a function of keeping physical assets in or restoring them to serviceable condition.
Maintenance Personnel	People that will perform the maintenance activities that includes employees of this Department either Regular, Co-terminous with the Incumbent (CTI) and Job Order employees; mechanics, operators and laborers.
<u>Maintenance Plan</u>	A maintenance plan is developed for each activity and includes the following information: •maintenance activity name and number; •PM interval group; •work method and estimated duration; •crew composition •list of safety hazards and precautionary measures needed; •Personal Protective Equipment (PPE) needed; •list of tools and materials
<u>Multi-Purpose Amphibious</u> <u>Dredge</u>	Type of dredge that is self-propelled, can operate on both land and water and uses two principal modes of dredging namely suction and excavation by backhoe, bucket, clamshell or rake.
Preventive Maintenance (PM)	Proactive approach of maintaining equipment on a regular schedule based on elapsed time or meter readings. The purpose of PM is to prevent maintenance problems or fail- ures before they take place.

1. ORGANIZATION

DUTIES AND RESPONSIBILITIES

Maintenance personnel are assigned by activity according to the work to be performed. However, they are not permanently assigned to any activity but are utilized in the most efficient and effective combinations for the work scheduled.

In order to apply preventive maintenance management, the dredge maintenance personnel must be organized to perform the required services to the equipment. The assignment of maintenance personnel according to the activity to be performed is necessary to fulfill the preventive maintenance plan and schedule. It should be noted that any personnel can perform the duties of the absent personnel to avoid any delay in operations or shorten maintenance time provided that consent is given by the Dredge Master (DM).

Every MPAD should have the following personnel on board dredge that will be assigned to execute the activities included in this manual.

1.1 Dredgeman Foreman (DF)

- Checks the condition of dredge parts and components
- In-charge of the lubrication of parts and components;
- Report any observations from the daily inspections to the DM for his/her immediate action;
- Perform other duties assigned by the DM.

1.2 Marine Engineman (ME)

- Ensures the proper operation of engine by performing scheduled engine maintenance activities works like engine check-ups, oil top-ups, changing the filters, cleaning the engine room etc;
- Report any observations from the daily inspections to the DM for his/her immediate action;
- Perform other duties assigned by the DM.

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1. ORGANIZATION

DUTIES AND RESPONSIBILITIES

1.3 Dredge Master (DM)

- Supervises the execution of PM activities (PM1-PM7) and ensures they are within the plan and schedule;
- Conducts field inspections to identify and document maintenance needs;
- Conducts daily equipment check using the Dredge PM Daily Checklist.
- Assign work to foremen in an effective manner;
- Conducts field inspections of work-in-progress and completed work to ensure work is directed appropriately and effectively;
- Submits monthly preventive maintenance accomplishment reports;
- Prepares the PM Materials Request Form;
- Supervises the installation/replacement of PM materials
- Performs related work as assigned by EMD Chief.

1.4 Chief, Equipment Management Division (EMD)

- Directs the crew of each dredge assigned in his area of jurisdiction, to take in effect the program and schedule for checking, repair and monitoring of equipment and shall be standard practice and must be conducted on the schedule indicated;
- Reviews and submits project maintenance estimates;
- Reviews and submits monthly reports;
- Ensures resources are properly procured and assigned for maintenance work;
- Directs the Dredge Master;
- · Performs related work as directed by the FED Chief;

1. ORGANIZATION

DUTIES AND RESPONSIBILITIES

1.5 Chief, Floating Equipment Division

The Floating Equipment Division (FED) is headed by a Division Chief and is composed of two major sections: Dredging Operations and Support Services Section (DOSSS) and Maintenance and Dry-docking Services Section (MDSS).

- Ensures resources are used and money is spent to achieve Department objectives and priorities;
- Conducts field inspections and takes corrective measures to ensure reports are accurate and submitted on time;
- Reviews and analyzes monthly reports submitted by the DM and EMD Chief;
- Prepare 3 months before the quarter covered, the POW and the corresponding PPMP for approval of the BOE Director to adequately support the various PM activities and anticipated repairs.
- Undertake procurement of these PM parts in accordance with the Quarterly Program of Work (POW) and the Project Procurement Management Plan (PPMP) approved by the BOE Director at least 3 months before the beginning of the quarter covered. The FED and EMD shall be represented in the Prequalifications, Bidding, and Awards Committee (PBAC) and the supply delivery Inspection Team whenever the subject PM parts are under procurement.
- Prepare the Purchase Request (PR) as based on the approved POW and PPMP.

2. **REPORTING**

Reporting acts as the source of information and data upon where PM Plan depends. It tells the management what are the maintenance needs and concerns that need to be addressed. The objectives of the PM Plan cannot be attained without adequate and accurate reports.

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2.1 PM Daily Checklist

Recording what and when a PM activity has been done is beneficial. This will tell and remind the maintenance personnel on what maintenance activity has been and what should be carried out. It can also be helpful to show supervisors and inspectors that care is being taken of on the dredge.

Dredge Master should accomplish PM Daily Checklist that can be used to keep track of the PM Activities. The checklist will also be used to check compliance with the PM program. Findings and observations from inspections should be listed in the "Remarks" Section of the form. PM Checklist should be attached in the monthly accomplishment reports submitted to the EMD and FED. Surprise Inspection will be done by the EMD or FED to validate the reports submitted by the Dredge Master.

2.2 PM Materials Request Form

Dredge Master sends PM Materials Request Form two (2) weeks before scheduled PM to the EMD copy furnished FED. In case the DM overlooked or failed to send a request, FED should notify or remind the concerned EMD and DM about the upcoming scheduled PM activities.

2. **REPORTING**

2.3 **PM Materials Delivery and Acceptance Form**

After request assessment and approval, materials will be delivered on site. Upon receipt of materials, DM accomplishes a materials acceptance form and should be sent to the FED. Incoming PM materials should be carefully checked by the DM and any representative from the EMD for possible shipment damages and compliance with specifications in the request form.

2.4 Preventive Maintenance History

Comprehensive documentation is important to an effective maintenance program. Whether it is preventive, corrective (interim repair), express maintenance or capital project, keeping track of the equipment condition and maintenance performed or planned is critical.

Regional EMD, FED and all DMs are tasked to keep track of the maintenance of each dredge. A Preventive Maintenance History Form includes information about the dredge, maintenance activities details such as activity description, maintenance type, date of execution, number of service hours from the previous replacement, number of service hours on the date of replacement, materials used and total cost for each activity.

To simplify, only include activities that require repair, oil top-ups, calibration, adjustment/alignment, removal and replacement of parts. Activities such as inspection and cleaning are not included in this form.

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3. ACTIVITIES

The MPAD PM Manual prepared by the Floating Equipment Division is composed of set of activities. Each activity listing includes the labor, tool, material and safety requirements. Activities are numbered and named in groups indicating the maintenance interval schedule on when the activities should be performed. Maintenance intervals are determined either by the dredge's service hours or by calendar time.

As much as possible, activities that require replacement of parts/components should follow the recommended intervals determined by the service hours of the dredge while activities that require visual inspections, cleaning, functional tests, measurement of operating quantities, lubrication are done on a regular interval or based on the calendar time.

Code is assigned to each maintenance activity to provide quick and easy identification and reference to the interval group of maintenance activities. The code is composed of a letter followed by three numbers. The letter stands for the dredge class as shown in the table below. The first number indicates the interval group where the PM activity belongs and the following two numbers indicated the activity item number from its PM group.

<u>A 1 01</u> –	Inspection of Hull			PM Interval based on			
	Activity Item No.	Code	PM Group	Calendar Time	Service Hours		
· · · · · · · · · · · · · · · · · · ·	> Dredge Class	+100	PM1	Daily	na mana ana ang kanang kan Manang kanang		
Dredge Code	Dredge Class	+200	PM2	Weekly	50		
Α	Multi-Purpose Amphibious Dredge						
В	Amphibious Excavator	+300	PM3	Monthly	200		
С	PDDP Dredges	+400	PM4	Quarterly	500		
D	Pinatubo Dredges	+500	PM5	Semi-Annually	1000		
Е	Luzon, Visayas, Mindanao Dredges	+600	PM6	Annually	2000		
F	Other Cutter Suction Dredges	+700	PM7/DDR	Every 2.5 years	ина и политика и полити Г стал		

PM Group : PM1 Maintenance Interval : DAILY

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ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
A101	Inspection of Hull	4.00	DM	flashlight	-	hard hat, life vest, safety shoes, gloves
A102	Inspection of Front and Rear Stabilizers	6.00	DM, DF	-	-	hard hat, life vest, safety shoes, gloves
A103	Inspection of Side Pontoons	2.00	DM	-	-	hard hat, life vest, safety shoes, gloves
A104	Inspection of Propulsion Unit	3.00	DF	wrench	-	hard hat, life vest, safety shoes, gloves
A105	Testing the Hydraulic Oil Filter Service Indicator	1.00	DM	-	filter element*	hard hat, life vest, safety shoes, gloves
A106	Checking of Existence of Water in the Engine Room	3.50	DM	flashlight,, bilge pump*	-	hard hat, life vest, safety shoes, gloves
A107	Checking of Engine Oil Level	1.40	ME	-	clean cloth, engine oil*	hard hat, life vest, safety shoes, gloves
A108	Checking of Engine Coolant Level	7.20	ME	-	clean cloth, engine coolant*	hard hat, life vest, safety shoes, gloves
A109	Draining of Fuel Water Separator	1.50	ME	container	-	hard hat, life vest, safety shoes, gloves

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PM Group : PM1 Maintenance Interval : DAILY

PM Group	: PM1 Maintena	nce Interval	: DAILY			*If necessary
	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
A110	Checking of Hydraulic Oil Reservoir Level	6.40	DM	-	clean cloth, hydraulic oil*	hard hat, life vest, safety shoes, gloves
A111	Inspection of Hydraulic Pipings	5.00	DM	wrench, plier	-	hard hat, life vest, safety shoes, gloves
A112	Checking the Bucket Condition	6.00	DF	-	-	hard hat, life vest, safety shoes, gloves
A113	Checking of Cutter Pump and Cutter Bearings	1.00	DF	-	-	hard hat, life vest, safety shoes, gloves
A114	Checking of Dredging Pump Seals	2.20	DF	oil*	-	hard hat, life vest, safety shoes, gloves
A115	Greasing of Pivots	1.25	DF	grease, grease gun*	-	hard hat, life vest, safety shoes, gloves
A116	Inspection of Closed Crankcase Ventilation Filter Service Indicator	1.50	DM		Filter*	gloves
A117	Inspection and Cleaning of Discharge Pipes	5.50	DF			hard hat, life vest, safety shoes, gloves

Activity Code : A101 **Crew Composition** Dredge Master : Maintenance Activity : INSPECTION OF HULL Maintenance Interval : Daily Tools Materials Estimated Sequence Activity **Duration** in Quantity Quantity No. **Tool Class Material Description** Minutes & Unit & Unit 1 Open deck hatch. 1.0 2 Check if there is water inside and check for 1.0 1 pc. flashlight* signs of wear (leaks, dents, broken and missing parts, corrosion etc.) 2.0 3 Keep compartments watertight closed 4 Do minor repairs if necessary. TOTAL 4.0 *If necessary Safety Hazard Precaution **Required PPE** Slips, trips and falls Maintain good housekeeping. Clear the area of any hard hat, life vest, safety shoes, gloves

13

unnecessary materials that blocks the passageway.

Activity Code

-

Blows from moving components

: A102

Maintenance Activity : INSPECTION OF FRONT AND REAR STABILIZERS

Crew Composition : Dredge Master, Dredgeman Foreman Maintenance Interval : Daily

hard hat

6	Activity		Estimated	Tools		Materials	
No.			Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check for signs of wear and de dents, broken parts, missing p sion, etc.)	efects. (leaks, parts, corro-	3.00				
2	Check the functionality.		3.00				
3	3 Do minor repairs if necessary.						
TOTAL			6.00				
				Safety			
Hazard		Precaution			Required PPE		
Slips, trips and falls Maintain unnecess		good housekeeping. Clear the area of any sary materials that blocks the passageway.		a of any ha ngeway.	rd hat, life vest, sa	fety shoes, gloves	

Make sure there are no people in the working area.

: A103 **Activity Code** : Dredge Master **Crew Composition** Maintenance Activity : INSPECTION OF SIDE PONTOONS Maintenance Interval : Daily Tools Materials Estimated Sequence Activity **Duration in** Quantity Quantity No. **Tool Class** Material Description Minutes & Unit & Unit 1 Check for signs of wear and other defects. 2.00 (leaks, dents, broken parts, missing parts, corrosion, etc.) 2 Do minor repairs if necessary. TOTAL 2.00 Safety Hazard Precaution **Required PPE**

Maintain good housekeeping. Clear the area of any

unnecessary materials that blocks the passageway.

* '

15

Activity Code

Slips, trips and falls

: A104

Maintenance Activity : INSPECTION OF PROPULSION UNIT

Crew Composition : Dredgeman Foreman

Maintenance Interval : Daily

hard hat, life vest, safety shoes, gloves

Sequence No.		Estimated Duration in Minutes	Tools		Materials	
	Activity		Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check pivots.	1.00		· · · · · · · · · · · · · · · · · · ·		
2	Check and tighten all fixing bolts.	1.00	1 pc.	wrench		
3	Check the functionality.	1.00				
4	Do minor repairs if necessary.					
	TOTAL	3.00		**************************************		bi, ,,,, it d i i i a di si i i di d

Safety

Hazard	Precaution	Required PPE						
Slips, trips and falls	Maintain good housekeeping. Clear the area of any unnecessary materials that blocks the passageway.	hard hat, life vest, safety shoes, gloves						
Hand injuries caused by sharp tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves						

: A105

Maintenance Activity : TESTING THE HYDRAULIC OIL FILTER SERVICE INDICATOR Crew Composition : Dredge Master

Maintenance Interval : Daily

6		Estimated	Tools		Materials	
No.	Activity	Duration in Minutes	Quantity	Tool Class	Quantity	Material Description
1	Run the engine at 1900 rpm	0.20				
2	Keep left flow control lever in neutral	0.20				
3	Retract digging arm and bucket cylinders simultaneously on full speed	0.50				
4	Check the filter service indicator. If the indicator turns red, install new filter element	0.10			1 pc.	filter element *
TOTAL 1.00		1.00				*If necessary
Safety						

Hazard	Precaution	Required PPE		
Blows from moving components	Make sure there are no people in the working area.	hard hat, life vest, safety shoes, gloves		

17

Activity Code

: A106

Crew Composition : Dredge Master

Maintenance Activity : CHECKING THE EXISTENCE OF WATER IN Maintenance Interval : Daily THE ENGINE ROOM

			Estimated		Tools			Materials	
No.	Activity		Duration in Minutes	Quantity & Unit	Tool Cl	ass	Quantity & Unit	Material Description	
1	Check if the bilge alert system alarm.	n gives an	0.10						
2	Open the engine room.		0.10						
3	Check if there is water inside water, proceed to the next s	. If there is tep.	0.10	1 pc.	flashli	ght			
4	4 Remove water by opening the plug at the rear of the engine room or using the bilge pump		3.00	1 pc.	bilge pu	mp*			
5	Close the plug.		0.10						
6	Close the engine room.		0.10						
	TOTAL		3.50	*If necessary				*If necessary	
			Safety						
Hazard			Precau	ution		Required PPE			
Slips, trips and falls Maintai unnece		in good housekeeping. Clear the area of any essary materials that blocks the passageway.		ha	ard hat, life vest, s	afety shoes, gloves			
Head blows		Watch you	r head from low be	ams. Wear hea	d protection.	hard hat			

: A107

Maintenance Activity : CHECKING OF ENGINE OIL LEVEL/ TOP-UP

-	-		
Crow	Com	nacitian	•
CIEW	COIII	posicion	

Maintenance Interval : Daily

Marine Engineman

Tools Materials Estimated Sequence Activity Duration in Quantity Quantity No. **Tool Class Material Description** Minutes & Unit & Unit 1 Open engine room. 0.10 2 Pull out dipstick and wipe with clean cloth 0.20 1 pc. clean cloth 3 Insert and pull out again. Check if the oil level 0.20 is between the ADD and FULL marks. 4 If top-up is needed, remove oil filler cap. 0.10 5 Add oil until the oil level is between the ADD and FULL marks on the dipstick thru the fill 0.50 engine oil* liter tube. Clean and reinstall the oil filler cap. 6 0.20 clean cloth 1 pc. 7 Close the engine room 0.10 TOTAL *If necessary 1.40 Safety **Required PPE** Hazard Precaution gloves, long sleeved shirt Burns caused by flames, by contact with Do not allow hot oil and equipment components to contact hot parts of equipment and fluids skin. Wear prescribed PPE.

19

Wear prescribed hand protection and maintain all hand and

power tools in a safe condition.

Activity Code

Hand injuries caused by sharp tools,

slipping of tools, etc.

: A108

Crew Composition : Marine Engineman

gloves

Former		Estimated	Tools		Materials	
No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check engine coolant sensor.	0.10				
2	Check engine coolant tank.	0.50			· · · · · · · · · · · · · · · · · · ·	
3	Stop the engine.	0.10				
4	Wait until the cooling system components are cool.	5.00				
5	Loosen the cooling system filler cap slowly in order to relieve pressure.	0.10				
6	If the engine is equipped with a sight glass, maintain the coolant level to the proper level in the sight glass.	1.00			liter	engine coolant*
7	Clean the cooling system filler cap or re- place if damaged	0.10			1 pc.	clean cloth
8	Reinstall the cooling system filler cap.	0.10				
9	Inspect the cooling system for leaks	0.20				
	TOTAL	7.20				*If necessary

Hazard	Precaution	Required PPE		
Slips, trips and falls	Maintain good housekeeping. Clear the area of any Unnecessary materials that blocks the passageway.	hard hat, life vest, safety shoes, gloves		

: A109

Crew Composition

: Marine Engineman

Maintenance Activity : DRAINING OF FUEL WATER SEPARATOR Maintenance Interval : Daily

Sequence No.	Activity	Estimated Duration in Minutes	Tools		Materials	
			Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Open drain.	0.25				
2	Collect the draining water	0.50	1 pc.	container		
3	Dispose the water properly	0.50				
4	Close drain.	0.25				
TOTAL		1.50				1999 1999 1999 1999 1999 1999 1999 199
Safaty						

Jarely								
Hazard	Precaution	Required PPE						
Fire and slips	Wipe up spills. Store oily rags or other flammable material in a protective container stored safely. Do not leave rags in the engine.	hard hat, life vest, safety shoes, gloves						

21

Activity Code

: A110

Maintenance Activity : CHECKING THE HYDRAULIC OIL

Crew Composition

: Dredge Master Maintenance Interval : Daily

hard hat, life vest, safety shoes, gloves

Blows from moving components

RESERVOIR LEVEL

Tools Materials Estimated Sequence Activity **Duration** in Quantity Quantity No. **Tool Class Material Description** Minutes & Unit & Unit 1 Put as many cylinders as possible in retract-5.00 ed position. Check oil level if it is at maximum through 2 0.20 oil level glass. 3 Add oil if necessary. 1.00 liter hydraulic oil* 4 Wipe up spills. clean cloth 0.20 1 pc. TOTAL 6.40 *If necessary Safety Hazard Precaution **Required PPE** Fire and slips Wipe up spills. Store oily rags or other flammable material in a hard hat, life vest, safety shoes, gloves protective container stored safely. Do not leave rags in the engine.

Make sure there are no people in the working area.

Activity Code : A111

: Dredge Master **Crew Composition**

* *

Maintenance Activity : INSPECTION OF HYDRAULIC PIPES/LINES Maintenance Interval : Daily

Sequence No.		Estimated	Tools		Materials	
	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check for leaks.	1.00				
2	Tighten fittings.	2.00	pcs	wrench, plier		
3	Tighten connections.	2.00	pcs.	wrench, plier		
4	Do minor repairs if needed. Repair leaks or replace hydraulic pipes and lines.					
	TOTAL	5.00				

Safety								
Hazard	Precaution	Required PPE						
Escaping fluid under pressure, even a pin-hole sized leak can penetrate body tissue causing serious injury and possi- ble death	Never check for leaks in a hydraulic system with your bare hands. Always use a board or cardboard when checking for a leak.	hard hat, life vest, safety shoes, gloves, goggles						

23

Activity Code

: A112

Crew Composition

Maintenance Interval : Daily

: Dredgeman Foreman

Maintenance Activity : CHECKING THE BUCKET LINKAGE PIVOTS

			Estimated	Tools			Materials	
Sequence Activity No.		Duration in Minutes	Quantity & Unit	Tool (Class	Quantity & Unit	Material Description	
1 Check for signs of wear and other defects. (leaks, dents, broken parts, missing parts, corrosion, etc.)		3.00						
2	2 Check the functionality.		3.00					
3	3 Do minor repairs if necessary.							
	TOTAL		6.00					
		<u>, , , , , , , , , , , , , , , , , , , </u>		Safety				
	Hazard		Precaut	tion		Required PPE		
Slips, trips and falls Maintair unneces		good housekeeping. Clear the area of any sary materials that blocks the passageway.			hard hat, life vest, safety shoes, gloves			
Blows from moving components Make sure the		e there are no people in the working area.			hard hat, life vest, safety shoes, gloves			

: A113

Crew Composition : Dredgeman Foreman

Maintenance Interval : Daily

* *

Maintenance Activity : CHECKING OF CUTTER PUMP AND **CUTTER BEARINGS**

Sequence			Estimated	Tools			Materials	
No.	Activity	Activity		Quantity & Unit	Tool (Class	Quantity & Unit	Material Description
1	1 Check axial and radial play.		1.00					
2	2 Do adjustments and minor repairs if necessary.							
ΤΟΤΑΙ			1.00					
	· · · · · · · · · · · · · · · · · · ·		, · , , , , , , , , , , , , , , , , , ,	Safety				
	Hazard Precaution				Required PPE			
Slips, trips and falls Maintain g unnecessa		good housekeeping. Clear the area of any ary materials that blocks the passageway.			hard hat, life vest, safety shoes, gloves			

25

Activity Code

: A114

Crew Composition

: Dredgeman Foreman

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Maintenance Activity : CHECKING OF DREDGING PUMP SEALS Maintenance Interval : Daily

		Estimated		Tools	Materials		
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
1	Check the oil sight glass.	0.20					
2	If there is any change, check for leakages.	1.00					
3	Add oil if necessary.	1.00			liter	oil*	
TOTAL 2		2.20				*If necessary	

Safety

Safety							
Hazard	Required PPE						
Head blows	Watch your head from low beams. Wear head protection.	hard hat					
Fire and slips	Wipe up spills. Store oily rags or other flammable material in a protective container stored safely. Do not leave rags in the engine.	hard hat, safety shoes, gloves					

: A115

Crew Composition

: Dredgeman Foreman

Maintenance Activity : GREASING OF PIVOTS

Maintenance Interval : Daily

* *

			Estimated		Tools			Materials
Sequence No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
	Grease the following until excess shows:			1 pc.	grease	gun*		
1	Boom cylinder pivots		0.25					grease
2	Arm cylinder pivots		0.25					grease
3	3 Pivots on central frame of excavator		0.25					grease
4	Front stabilizer pivots		0.25					grease
5	Spud tilt cylinder pivots		0.25					grease
	TOTAL		1.25	*If necessary				
				Safety				
	Hazard Precaution				Required PPE			
Slips, trips and falls Maintain good housekeeping. Clear the are unnecessary materials that blocks the pass			ı of any geway.	hard hat, life	vest, safety shoes	s, gloves		

27

Activity Code

: A116

Crew Composition : Dredge Master

Maintenance Activity : INSPECTION OF CLOSED CRANKCASE VENTILATION FILTER SERVICE

Maintenance Interval : Daily

	INDICA	ATOR							
			Estimated Duration in Minutes	Tools			Materials		
Sequence No.	Activity			Quantity & Unit	Тоо	l Class	Quantity & Unit	Material Description	
1	1 Inspect closed crankcase ventilation filter service indicator		0.50						
2	2 Check the pressure in the crankcase.		1.00						
3*	If pressure continues to rise replace the filter.						1 pc.	Filter*	
TOTAL			1.50	*If necessary					
	Safety								
	Hazard	Precaution					Required	PPE	

Hand injuries caused by sharp parts and Wear prescribed hand protection and maintain all hand and gloves tools, slipping of tools, etc. power tools in a safe condition.

: A117

Maintenance Activity : INSPECTION AND CLEANING OF DISCHARGE PIPES Crew Composition : Dredge Master

* *

Maintenance Interval : Daily

			Estimated	Tools		Materials		
Sequence No.	Activity		Duration in Minutes		Tool	Class	Quantity & Unit	Material Description
1	Run and lower the cutter. Make sure that it pumps water only.		0.50					
2 Pump until water comes out at the end of the discharge pipelines. Do this for 5 minutes.		5.00						
3	Inspect for leaking pipes.							
4	Do adjustments and repairs i	if necessary.						
	TOTAL		5.50	*If necessary				*If necessary
		,, <u>,</u> ,		Safety				
	Hazard		Precauti	on			Required PPE	
Hand injuries caused by sharp parts and Wear prescribed tools, slipping of tools, etc. power tools in a s		hand protection a safe condition.	tion and maintain all hand and n.			gloves		

29

PM Group

: PM2

Maintenance Interval : Every 50 hours of operation or weekly

NOTE: All PM1 activities are included in the PM2 Group

*If necessary							
ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN	LABOR	TOOLS	MATERIALS	PPE	
A201	Inspection of the Cutter Pump	4.00	DF		seals*	hard hat, life vest, safety shoes, gloves	
A202	Testing the Oil Tank Breather	1.00	DM	wrench*, pliers*, screw driver*	filter cartridge*	hard hat, gloves	
A203	Checking and Replacing the Zinc Rods	18.00	DM, ME	hammer, hand drill*	sandpaper*, clean cloth, thread lock compound*, pipe sealant*, zinc rods*	gloves, goggles	

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2

: A201

Maintenance Activity : INSPECTION OF THE CUTTER PUMP

Crew Composition : Dredgeman Foreman

Maintenance Interval : Every 50 hours of operation/ weekly

			Estimated	Tools			Materials	
ltem	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1 Check the cutter bearings lubrication oil level.		2.00						
2 Check condition of the impeller and suction ring.		2.00						
3	3 Repair or replace leaking seals.						pcs.	seals*
	TOTAL		4.00	*If necessary				
				Safety				
Hazard		Precaut	ion		Required PPE			
Slips, trips and falls Maintain unneces		good housekeeping. Clear the area of any ary materials that blocks the passageway.			hard hat, life vest, safety shoes, gloves			

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Activity Code

: A202

Crew Composition

: Dredge Master

Maintenance Activity : TESTING THE OIL TANK BREATHER

Maintenance Interval:

Every 50 hours of operation/ weekly

		F-through d		Tools	Materials		
Sequence No.	Activity	Estimated Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
1	Check the free air flow through the filter.	0.50					
2	Check the pressure. If the pressure is over/ under pressure than the normal operating pressure, proceed to next step. NOTE: If breather filter gets clogged, the varying oil level makes over/under pressure in tank. Under pressure may lead to oil aeration and foaming.	0.50					
3	Replace the filter cartridge.		pcs.	wrench, pliers, screw driver	1 pc.	filter cartridge*	
TOTAL		1.00	*If necessary				
			Safety				

Hazard	Precaution	Required PPE					
Head blows	Watch your head from low beams. Wear head protection.	hard hat					
Hand injuries caused by sharp tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves					

Hand and eye injuries caused by sharp

tools and parts, slipping of tools, etc.

: A203

Crew Composition : Dredge Master, Marine Engineman

gloves, goggles

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Maintenance Activity : CHECKING AND REPLACING THE ZINC RODS Maintenance Interval: Every 50 hours of operation/ weekly

			Estimated		Tools	Materials		Materials
No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1	Remove all the zinc rods.		3.00					
2	Tap the zinc rods lightly with they flake, install new rods.	a hammer. If	2.00	1 pc.	ham	mer		
3	<i>If to be reused</i> , scrape the lay oxidation from the zinc rods.	ver of	2.00	1 pc.	sand p	aper*		
4	If to be replaced, unscrew or zinc rod from the plug. and pl next steps.	drill the old roceed to the	2.00	1 pc.	hand	drill*		
5	Clean the plug.		2.00				1 pc.	clean cloth
6	Apply Thread Lock Compound shoulder of the new zinc rods	d only to the	2.00					thread lock compound*
7	Coat external threads of the p Sealant.	plug with Pipe	2.00					pipe sealant*
8	8 Install the zinc rods onto the plug.		3.00				pcs.	zinc rods*
TOTAL		18.00					*If necessary	
				Safety				
Hazard			Precau	tion			Require	d PPE

33

PM Group : PM3 Maintenance Interval : Every 200 hours of operation or monthly

Wear prescribed hand and eye protection and maintain all

hand and power tools in a safe condition.

NOTE: All PM1 and PM2 activities are included and should also be performed together with the PM3 activities. Activity Codes with an asterisk (*) should follow the recommended service hours of materials before replacement to maximize their service lives.

ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
A301	Cleaning the Coolers	5.10	ME	air compressor		hard hat, safety shoes, gloves, face shield, long sleeved shirt
*A302	Changing the Engine Oil and Filter	16.70	ME	container, wrench, filter cutter	clean cloth, engine oil, engine filter	Hard hat, life vest, safety shoes, gloves
A303	Checking and Adjusting Engine Valve Lash					Hard hat, gloves
*A304	Replacing the Engine Fuel Filters	8.60	ME	wrench	fuel filter, engine oil	Hard hat, life
A305	Cleaning the Engine Crankcase Breather	10.50	ME	wrench	nonflammable solvent	Gloves
*A306	Checking, Replacing and Adjusting the Belts	25.75	ME	wrench, ruler,	belts	Hard hat, gloves
A307	Draining of Water from the Hydraulic Oil Tank	1.75	DM	container,	clean cloth	Hard hat, life vest, safety shoes, gloves
*A308	Checking and Replacing the Zinc Anodes	3	DF	zinc anodes		Gloves
A309	Checking the Battery Condition	11.5	ME		Sandpaper, distilled water, mixture of baking soda and clean water, clean water	safety shoes, gloves, long sleeve shirt

: A301

Crew Composition

: Marine Engineman

Maintenance Interval : Every 200 hours of operation/monthly

Maintenance Activity : CLEANING THE COOLERS

	Item Activity Duration in Activity Minutes & Unit Tools				Materials			
ltem			Duration in Minutes	Quantity & Unit	ΤοοΙ	Ciass	Quantity & Unit	Material Description
1	Stop the engine.		0.10					
2	Blow out the cooler with co NOTE: If badly clogged, use detergent.	ompressed air. e some	5.00	1 pc.	air com	pressor		
TOTAL		5.10						
				Safety				
	Hazard		Precauti	on			Required	I PPE
Slips, trips and falls Maintain good housekeep unnecessary materials that		good housekeeping ary materials that t	od housekeeping. Clear the area of any materials that blocks the passageway.		hard hat, life vest, safety shoes, gloves			
Pressure air can cause personal injury (30 psi) when used for cleanin		nust be below 2 ng purposes.	05 kPa	face sh	ield, protective cl	othing, safety shoes		

35

Activity Code

: *A302

Crew Composition

: Marine Engineman

Maintenance Activity : CHANGING OF ENGINE OIL AND FILTER Maintenance Interval : Every 200 hours of operation

		Estimated		Tools		Materials
Item	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	DRAIN THE ENGINE OIL					
1.1	Run the engine at the normal operating temperature.	1.00				
1.2	Stop the engine.	0.10				
1.3	Turn the drain valve knob counterclock- wise or remove the oil drain plugs to drain the oil.	0.50	1 pc.	container		
1.4	Clean and reinstall the oil drain plugs.	0.25				
2	REPLACE THE OIL FILTER					
2.1	Remove the oil filter.	0.25	1 pc.	wrench		
2.2	Cut the oil filter open and inspect for metal debris.	0.25	1pc.	filter cutter		
2.3	Clean the sealing surface of the filter mounting base. Ensure that all of the old oil filter gasket is removed.	0.25	1 pc.	clean cloth		
2.4	Apply clean engine oil to the new oil filter gasket.	0.25			liter	engine oil
2.5	Install the oil filter. Tighten until the oil filter gasket contacts the base.	0.25			1 pc .	oil filter
CON	TINUATION ON THE NEXT PAGE.					

: *A302

Crew Composition

: Marine Engineman

		Estimated		Tools	Materials	
No.	No. Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
3	FILL THE ENGINE CRANKCASE WITH OIL					
3.1	Remove the oil filler cap.	0.10				
3.2	Add oil. Wipe up spills.	0.50			liter	engine oil
3.3	Crank the engine with the fuel OFF for not more than 30 seconds.	0.50				-
3.4	Start the engine and run the engine at "LOW IDLE' for two minutes.	2.00				
3.5	Inspect the oil filter for oil leaks.	0.20				
3.6	Stop the engine and allow the oil drain back to the sump for a minimum of ten minutes.	10.00				
3.7	Check oil level.	0.10				
3.8	Maintain oil level between the ADD and FULL marks on the oil level gauge.	0.10			liter	engine oil
3.9	Clean and reinstall the oil filler cap.	0.10			1 pc.	clean cloth
	TOTAL	16.70		99 - 19 - 19 - 19 - 19 - 19 - 19 - 19 -	******	

Hazard	Precaution	Required PPE
Fire/Explosion	Wipe up spills. Store oily rags or other flammable material in a	hard hat, life vest, safety shoes, gloves
	protective container stored safely. Do not leave rags in the engine.	

37

Activity Code

: A303

Crew Composition

: Marine Engineman

monthly

Maintenance Activity : CHECKING AND ADJUSTING ENGINE

VALVE LASH

Maintenance Interval : Every 200 hours of operation or

Sequence No.	Activity	Estimated Duration in Minutes		Tools	Materials		
			Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
1	Only qualified service personnel should perform this maintenance.						
2	Refer to the Service Manual of the engine for the complete valve lash adjustment procedure.						
	TOTAL	1		Ann	k ay and a set of a		

Safety

Hazard	Precaution	Required PPE						
Head blows	Watch your head from low beams. Wear head protection.	hard hat						
Hand injuries caused by sharp tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves						

: *A304

Maintenance Activity : REPLACING ENGINE FUEL FILTERS

Crew Composition

*

: Marine Engineman

Maintenance Interval : Every 200 hours of operation

Sequence		E	Estimated	Tools		Materials		
No.	Activity	D	Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1	Remove old fuel filter.		2.00	1 pc.	wre	nch		
2	Install the new filter and lubric gasket.	cate the	3.00				1 pc.	fuel filter
3	Tighten the gasket.		1.00					
4	Top up with oil.		1.00				liter	engine oil
5	Start the engine.		0.10					
6	Check if there oil leakage .		1.00					
7	Check the oil level.		0.50					
TOTAL			8.60					999 - Barra Baran Manana - California - Arrando Andre Schalter - Arrando Andre Schalter - Andre Schalter - Andr
				Safety		· · · · · · · · · · · · · · · · · · ·		
	Hazard Precaution				Required PPE			

Hand injuries caused by sharp parts and Wear prescribed hand protection and maintain all hand and gloves tools, slipping of tools, etc. power tools in a safe condition. Fire/Explosion Wipe up spills. Store oily rags or other flammable material in a hard hat, life vest, safety shoes, gloves protective container stored safely. Do not leave rags in the engine.

39

Activity Code

: A305

Crew Composition

: Marine Engineman

Maintenance Activity

: CLEANING OF ENGINE CRANKCASE BREATHER

Maintenance Interval :

Every 200 hours of operation or monthly

Formerer				Tools	Materials	
No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Loosen the hose clamp.	0.25				
2	Remove hose from the breather assembly.	0.25				
3	Loosen the bolt.	0.25	1 pc.	wrench	· · · · · · · · · · · · · · · · · · ·	
4	Remove breather assembly and the seal.	1.00				
5	Wash the breather element in solvent that is clean and nonflammable.	1.00			1 liter	nonflammable solvent
6	Dry the breather before installation.	5.00				
7	Install the breather assembly and the seal.	1.00				
8	Tighten bolt.	0.25	1 pc.	wrench		
9	Install the hose.	0.25				
10	Install and tighten the hose clamp.	0.25				
TOTAL		10.50				

,							
Hazard	Precaution	Required PPE					
Hand injuries caused by sharp tools,	Wear prescribed hand protection and maintain all hand and	gloves					
slipping of tools, etc.	power tools in a safe condition.	с. С. м.					
	I Contraction of the second seco	1					

: *A306

Crew Composition

: Marine Engineman

Maintenance Activity : CHECKING, REPLACING AND ADJUSTING Maintenance Interval : Done monthly while replacement should THE BELTS

be done every 200 hours of operation

Sequence		Estimated		Tools	Materials	
No.	Activity	Duration in Minutes	Quantity	Tool Class	Quantity	Material Description
1	INSPECT BELTS					
1.1	Remove belt guard.	0.25				
1.2	Inspect the belts for wear and cracking.	0.50				
2	REPLACE BELTS*					
2.1	Loosen the mounting bolts and adjusting nut.	1.00	1 pc.	wrench*		
2.2	Remove the old belt.	0.25				
2.3	Install the new belt.	0.25			pcs.	belts
3	ADJUST BELTS*					
3.1	Measure the belt tension by applying force midway between the pulleys. The recom- mended belt deflection is stated in the engine manual. If the deflection is not as recommended, proceed to next steps.	1.00	1 pc.	ruler		
3.2	Slightly loosen the two mounting bolts.	0.50	1 pc.	wrench*		
3.3	Slightly loosen adjusting nut.	0.50	1 pc.	wrench*		
-						

CONTINUATION ON THE NEXT PAGE.

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Activity Code

: A306

Crew Composition : Marine Engineman

Maintenance Activity : *CHECKING, REPLACING AND ADJUSTING Maintenance Interval : Done monthly while replacement should THE BELTS

be done every 200 hours of operation

_	Activity		Estimated	Tools		Materials		
Sequence No.			Duration in Minutes	Quantity & Unit Tool C		Class	Quantity & Unit	Material Description
3.4	Move the pulley in order to tension.	ə adjust belt	0.25					
3.5	Tighten the two mounting	bolts.	0.50	1 pc.	wre	ench		
3.6	Tighten the adjusting nut.		0.50	1pc.	wre	ench		
3.7	Install the belt guard.	M. K. 2440	0.25					
3.8	Run the engine for 20 minutes.		20.00					
3.9	Remove the belt guard and Sequence nos. 3.1– 3.8 unt recommended deflection is	repeat il the s obtained.						
	TOTAL		25.75				* <u> </u>	<u> </u>
			L	Safety				
Hazard			Precaution			Required PPE		
Head blows Watch your hear		d from low beams.	Wear head pro	tection.		hard ha	it	
Hand injuries caused by sharp tools, slipping of tools, etc. Wear prescribed hand protection and maintain			nd maintain all	hand and		gloves		

: A307

OIL TANK

Maintenance Activity : DRAINING OF WATER IN THE HYDRAULIC

Crew Composition

Maintenance Interval :

* *

: Dredge Master

Every 200 hours of operation or monthly

Sequence No.	Activity	Estimated Duration in Minutes		Tools	Materials	
			Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Remove the plug.	0.25				
2	Open the tap of the water cup.	0.25				
3	Drain and collect the fluid.	1.00	1 pc.	container		
4	Clean and reinstall the plug.	0.25			1 pc.	clean cloth
TOTAL		1.75	· · · · · · · · · · · · · · · · · · ·			<u></u>
1		• • • • • • • • •	Safety			

,									
Hazard	Precaution	Required PPE							
Fire/Explosion	Wipe up spills. Store oily rags or other flammable material in a protective container stored safely. Do not leave rags in the engine.	hard hat, life vest, safety shoes, gloves							
Hand injuries caused by sharp tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves							

43

Activity Code

: A308

Crew Composition

: Dredgeman Foreman

Maintenance Activity : CHECKING AND REPLACING THE ZINC

Maintenance Interval :

Replacement done every 200 hours of operation

,	Sequence Activity No.		Estimated		Tools		Materials
Seguence No.			Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	1 Check if the Zinc Anodes needs replacement		3.0		ан бараан тараан тар		
2*	Replace the Zinc Anode or unit	the propulsion				1 pc.	Zinc anode*
3*	3* Replace the Zinc Anodes on the hull at the front stabilizers					1 pc.	Zinc anode*
	TOTAL		3.0				*If necessary
				Safety		****	
Hazard			Precautio	on		Required PPE	
Hand injurie slipping of t	es caused by sharp tools, cools, etc.	Wear prescribed power tools in a	hand protection a safe condition.	and maintain all l	id maintain all hand and gloves		

: A309

Crew Composition : Marine Engineman

Maintenance Activity : CHECKING AND CLEANING THE BATTERIES Maintenance Interval : Every 200 hours of operation/monthly

		Estimated		Tools		Materials
No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Remove the filler caps	0.25				
2	Maintain the electrolyte level at FULL mark on the battery (use distilled water)	0.50			liter	distilled water
3	Check the condition of the electrolyte.	0.25				
4	CLEANING THE BATTERIES	· · · · · · · · · · · · · · · · · · ·				
4.1	Loosen and remove cable clamps from all battery terminals.	1.00				
4.2	Clean the terminals and the cable clamps .	1.00	1 pc.	sandpaper		
4.3	Clean the battery case with cleaning solution	2.00			liter	mixture of baking soda and clean water
4.4	Rinse the battery case with clean water	0.50			liter	clean water
4.5	Dry the battery case.	5.00				
4.6	4.6 Install and tighten cable clamps to battery terminals.					
	TOTAL	11.50				
			Safety			

Safety

Hazard	Precaution	Required PPE
Fire/Explosions: Batteries give off	Wear prescribed PPE and do not smoke when observing	gloves, goggles, long sleeved shirt
flammable fumes that can explode.	battery electrolyte level. Remove any source of ignition.	

45

PM Group

: PM4

Maintenance Interval : Every 500 hours of operation or quarterly

NOTE: All PM1, PM2 and PM3 activities are included and should also be performed together with the PM4 activities. Activity Codes with an asterisk (*) should follow the recommended service hours of materials before replacement to maximize their service lives. *If necessary

ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
A401	Checking the Spud Lining	28.50	DM, DF, ME	Crane*		hard hat, life vest, safety shoes, gloves
A402	Checking the Propulsion Unit Shaft condition	4.50	DM, DF, ME	Grease nipple	Water resistant grease*, clean cloth	hard hat, life vest, safety shoes, gloves
A403	Checking the Cutter Pump Sealing and Bearing	24.00	DM, DF,	container	Oil, glide ring sealing	hard hat, life vest, safety shoes, gloves
A404	Inspection of Aftercooler condensate drain valve	1.50	ME		Cleaning solvent*	gloves
A405	Cleaning the Aftercooler	25.50	DF	Air compressor	Cleaning solution, hot and soapy water	hard hat, long sleeved shirt, face
A406	Replacing the Closed Crankcase Ventilation (CCV) Fumes Disposal Filter	4.00	ME		Filter element	gloves

: A401

Maintenance Activity : CHECKING THE SPUD LINING

Crew Composition

* *

: All dredge personnel

Maintenance Interval : Every 500 hours of operation or

.

				quarterly					
Sequence		1	Estimated	Tools			Materials		
No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description	
1	Check the plastic lining betwo and the sleeve*	een the spud	0.50						
2	Put the spud in the horizonta	l position.	1.00						
3	3 Remove the plate on the upper end of the spud.		2.00						
4*	4* Draw the spud out of the sleeve using a crane.		10.00	1 pc.	Cra	ine*			
5	Check for water inside the sp	ud	5.00						
6	With the end plate removed, let water out.	tilt the spud to	5.00						
7	If there is water in the spud , possible leaks .	find the	5.00						
8*	Do the necessary repair.								
TOTAL		28.50	*If necessary						
	· · · · · · · · · · · · · · · · · · ·	4		Safety					
	Hazard		Precauti	on		Required PPE			
Blows from	n moving components	Make sure there	are no people in t	the working area.		hard hat, life vest, safety shoes, gloves			
Hand injuries caused by sharp tools, Wear prescribed		d hand protection and maintain all hand and			gloves				

47

Activity Code

slipping of tools, etc.

: A402

SHAFT CONDITION

Maintenance Activity : CHECKING THE PROPULSION UNIT

power tools in a safe condition.

: All dredge personnel

Maintenance Interval :

Crew Composition

Every 500 hours of operation or quarterly

_	Activity	Estimated		Tools	Materials	
Sequence No.		Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check the shaft seal.	1.00				
	CHANGE THE GREASE IN THE BARREL					
2	Remove both plugs in both plugged threads in the barrel.	1.00				
3	Mount a grease nipple to one of the threads	0.50	1 pc.	grease nipple		
4	Pump water resistant grease with grease gun into the barrel until grease come out of the other thread.	0.50			lb	water resistant grease
5	If no water or dirt comes out of the other thread continue pumping grease until clean grease comes out of the thread.	0.50				
6	Remove grease nipple.	0.50				
7	Plug both threads again.	0.50				
8*	If the grease that comes out is contaminated with water and dirt, open the bearing assembly.					
9*	Remove the propeller.					 • •
C	ONTINUATION ON THE NEXT PAGE.		4			*If necessary

: A402

Maintenance Activity : CHECKING THE PROPULSION UNIT SHAFT CONDITION

Crew Composition

Maintenance Interval :

* *

: All dredge personnel

Every 500 hours of operation or quarterly

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			Estimated		Tools		Materials		
No.	Activity		Duration in Minutes	Quantity & Unit	Tool Clas	s Quantity & Unit	Material Description		
10*	Remove the propeller tur	nnel.							
11*	11* Remove the propeller bearing assembly from the bearing housing								
12*	12* Open the assembly								
13*	13* Clean the inside of the housing					1 pc.	clean cloth*		
14*	4* Replace worn out/ damaged parts								
15*	Reassemble the bearing a	assembly							
16*	Fill the housing with wate	er resistant grease				lb	water resistant grease*		
	TOTAL		4.50		*If necessary				
Safety									
	Hazard		Precaution			Required PPE			
Hand injuries caused by sharp tools/ Wear prescribed hand protection			nd protection and	maintain all hand and power gloves			loves		

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Hand injuries caused by sharp tools/	Wear prescribed hand protection and maintain all hand and power	gloves
parts, slipping of tools, etc.	tools in a safe condition.	
Fire/Explosion, Slips	Wipe up spills. Store oily rags or other flammable material in a protec-	hard hat, life vest, safety shoes, gloves
	tive container stored safely. Do not leave rags in the engine.	

49

Activity Code

: A403

Crew Composition : Dredge Master, Dredgeman Foreman

Maintenance Activity : CHECKING OF CUTTER PUMP SEALING Maintenance Interval : Every 500 hours of operation or

quarterly

AND BE	ARING
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		Estimated Tools		Materials		
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Dismount pump suction pipe from the pump and frame.	2.00				
2	Remove the suction ring .	3.00				
3	Dismount pump bearing housing together with the hydraulic motor from the casing.	5.00				
4	Remove the impeller fastening bolt and impeller.	3.00				
5	Disconnect the pressurized sealing plug.	1.00				
6	Let oil bleed out.	5.00	1 pc.	container		
7	IF THE OIL COMING OUT OF THE PLUG IS CLEAN, continue draining the oil and fill with new clean oil.	5.00			liter	oil
8*	IF OIL COMING OUT OF THE PLUG IS CON- TAMINATED, the bearing assembly needs to be cleaned. Proceed to next steps.					
8.1*	Remove outer sealing housing.			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
8.2*	Remove the outer glide ring.					
C	CONTINUATION ON THE NEXT PAGE.		A A			*If necessary
			50			

: A403

Maintenance Activity : CHECKING OF CUTTER PUMP SEALING

Crew Composition : Dredge Master, Dredgeman Foreman

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Maintenance Interval : Every 500 hours of operation or auarterly

AND BEARING						quarterly			
_			Estimated	Estimated Tools		Materials			
Sequence No.	Activity	,	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description		
8.3*	Remove inner sealing hou	sing.							
8.4*	Check the bearing house and replace if damaged.								
8.5*	Replace the glide ring seal	ing.				1 pc.	glide ring sealing*		
8.6*	8.6* Connect the pressurized sealing plug.								
8.7*	8.7* Fill the housing with clean new oil.					liter	oil*		
8.8*	8.8* Reassemble the impeller.								
8.9*	Mount the pump bearing housing together with the hydraulic motor to the casing.								
8.10*	Reinstall the suction ring.								
8.11*	Connect the pump suction	n pipe.							
	TOTAL		24.00	*If necessary					
	Safety								
	Hazard		Precaution			Required PPE			
Fire/Explosion Wipe up spills. State tective container		re oily rags or other flammable material in a pro- tored safely. Do not leave rags in the engine.			hard hat, life vest,	safety shoes, gloves			

E	1
3	Τ.

Wear prescribed hand protection and maintain all hand and power

Activity Code

Hand injuries caused by sharp parts

and tools, slipping of tools, etc.

: A404

Crew Composition

: Marine Engineman

gloves

Maintenance Interval :

Every 500 hours of operation or quarterly

Maintenance Activity		INSPECTION OF AFTERCOOLER			
		CONDENSATE DRAIN VALVE			

tools in a safe condition.

	Activity		Estimated	imated Tools		Materia		Materials
Sequence No.			Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1	Remove valve from the hous	ing	1.00					
2	Check if the plunger moves freely		0.50					
	IF THE PLUNGER IS STUCK, p steps.	roceed to next						
3*	Clean the valve with solvent						liter	cleaning solvent*
4*	Reassemble the drain valve					*****		
	TOTAL		1.50					*If necessary
	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		L	Safety				
Hazard		Precaution		Required PPE				
Hand injuries caused by sharp parts and Wear prescriber tools, slipping of tools, etc. power tools in a		d hand protection a safe condition.	and maintain all hand and gloves			S		

: A405

Crew Composition : Dredgeman Foreman

Maintenance Activity : CLEANING OF AFTERCOOLER CORE

Maintenance Interval : Every 500 hours of operation/quarterly

Sequence		Estimated		Tools	Materials	
No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Remove the core from the assembly.	5.00				
2	Turn the aftercooler to one side to remove debris.	0.50				
3	Back flush the core with cleaner.	2.00			liter	Cleaning solution
4	Steam clean the core to remove any residue.	2.00			liter	hot and soapy water
5	Wash the core with hot, soapy water.	2.00				
6	Flush the core thoroughly with fresh water to remove residue and remaining debris.	2.00				
7	Dry the core with compressed air.	2.00				
8	Inspect the core for trapped debris and cleanliness.	1.00				
9*	If necessary repeat the cleaning procedure.					
10	Inspect the core for damage and leaks.	1.00				
11	Plug both ends of the core and pressurize up to 205 kPa.	1.00	1 pc.	air compressor		
(CONTINUATION ON THE NEXT PAGE.					

53

Activity Code

: A405

Crew Composition Maintenance Interval : Every 500 hours of operation/quarterly

: Dredgeman Foreman

Maintenance Activity : CLEANING OF AFTERCOOLER CORE

Sequence No.		Estimated Duration in Minutes		Tools		Materials
	Activity		Quantity & Unit	Tool Class	Quantity & Unit	Material Description
12	Submerge the core in water and check for bubbles.	2.00		w		
13	If no leaks are found reassemble the aftercooler.	5.00				
14	If leaks are found install a new core that is clean and without leaks.				······································	
	TOTAL	25.50				
		<u>kon nem al sen de ser i des 2 con a difició a de actorita</u>	Safety			

Safety

Hazard	Precaution	Required PPE		
Hand injuries caused by sharp parts and tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gioves		
Injuries from high pressure/compressed air	The maximum air pressure must be below 205 kPa (30 psi) when used for cleaning purposes.	hard hat, long sleeved shirt, face shield, gloves		

: A406

Maintenance Activity : REPLACING THE CLOSED CRANKCASE VENTILATION FUMES DISPOSAL FILTER **Crew Composition**

Maintenance Interval :

* *

: Marine Engineman

Every 500 hours of operation or quarterly

		Estimated		Tools		Materials
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check the pressure. If the pressure continues to rise, replace the fume disposal filter and proceed to next steps.	1.00				
	RESETTING THE SERVICE INDICATOR					
2	Remove the cover of service indicator.	0.25				
3	Reset the service indicator by pushing down on it.	0.25				
4	Replace plastic cover.	0.25				
	REPLACING THE FUMES DISPOSAL FILTER					
5	Release latches that hold the canister to filter base assembly.	0.25				
6	Lower canister to expose the element. There may be oil in the bottom of the canis- ter. Avoid spilling the oil.	0.25				
7	Remove the filter element by pulling down.	0.50				
8	Ensure that the O-ring is installed on the top of the new element. Place the new element.	0.50			1 pc.	filter element
C	DNTINUATION ON THE NEET PAGE.					

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Activity Code

: A406

Crew Composition

: Marine Engineman

Maintenance Activity : REPLACING THE CLOSED CRANKCASE

VENTILATION FUMES DISPOSAL FILTER

Maintenance Interval :

Every 500 hours of operation or quarterly

Sequence No.		Estimated Duration in Minutes	Tools			Materials	
	Activity		Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
9	9 Ensure that the O-ring is installed on the lip which is located at the top of the canister. Install canister and align with the boss on filter base assembly.		0.50				
10	10 Clamp latches in the closed position.		0.25				
TOTAL		4.00					
Safety							
Hazard Pre			Precau	ntion Required PPE			ed PPE

	•	
Hazard	Precaution	Required PPE
Hand injuries caused by sharp parts	Wear prescribed hand protection and maintain all hand and power	gloves
and tools, slipping of tools, etc.	tools in a safe condition.	

NOTE: All PM1, PM2, PM3 and PM4 activities are included and should also be performed together with the PM5 activities. Activity Codes with an asterisk (*) should follow the recommended service hours of materials before replacement to maximize their service lives. *If necessary

ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
*A501	Changing the Hydraulic Filters	4.5	ME		clean cloth, filter element	gloves
*A502	Changing the Dredging Pump Bearing Housing Oil	25.5	DM, DF	wrench, pliers, screw drivers	oil	hard hat, life vest, safety shoes, gloves
A503	Cleaning the Engine Air Cleaner Element	56	DM	soft bristle brush, compressor	oil, water	gloves
*A406	Replacing the Battery	4.75	ME		12V batteries	hard hat, long sleeved shirt, face

57

Activity Code

: *A501

Crew Composition

: Marine Engineman

Maintenance	Activity
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: CHANGING THE HYDRAULIC FILTERS

Maintenance Interval : Every 1000 hours of operation

6			Estimated	Estimated Tools	Tools	Materials	
No.	Activity		Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Open the cover above the	filter.	0.50				
2	Remove the filter support	5.	0.50				
3	Clean the filter support.	π _{φα} τ _π ι Η _τ , _η ι _φ τ _η τ − Η τ π του	0.50			1 pc.	clean cloth
4	Check the bypass valve.	an a	0.50				
5	Install new filter element.		1.00			1 pc.	filter element
6	Check sealing.		0.50				
7	Reassemble the spring and	the cover.	1.00				
	TOTAL		4.50				
				Safety			
	Hazard Precaution			Required PPE			

	-	
Hazard	Precaution	Required PPE
Hand injuries caused by sharp parts	Wear prescribed hand protection and maintain all hand and power	gloves
and tools, slipping of tools, etc.	tools in a safe condition.	

: *A502

Maintenance Activity : CHANGING THE DREDGING PUMP **BEARING HOUSING OIL**

Crew	Comp	osition
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: Dredge Master, Dredgeman Foreman

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Maintenance Interval : Every 1000 hours of operation

		Estimated		Tools	Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Dismount pump suction pipe from the pump and frame.	3.00	pcs	wrench, pliers, screwdrivers		
2	Remove the suction ring .	2.00				
3	Dismount pump bearing housing together with the hydraulic motor from the casing.	5.00				
4	Remove the impeller fastening bolt and impeller.	2.00				
5	Disconnect the pressurized sealing plug.	0.25				
6	Let oil bleed out. If the oil coming out of the plug is clean, continue draining the oil.	1.00				
7	Connect the pressurized sealing plug .	0.25			liters	oil
8	Fill the housing with clean new oil.	1.00				
	If oil coming out of the plug is contaminated, the bearing assembly needs to be cleaned and proceed to the next steps.					
9*	Remove outer sealing housing.					
10*	Remove the outer glide ring.					
11*	Remove the inner glide ring.	999 an ann an Mar Ann Ann an Ann ann ann ann ann ann ann				
C	CONTINUATION ON THE NEXT PAGE.		59			

59

Activity Code

: *A502

Crew Composition

: Dredge Master

Maintenance Activity : CHANGING OF DREDGING PUMP

BEARING HOUSING OIL

Maintenance Interval : Every 1000 hours of operation

Saguanca		Estimated	Tools		Materials	
No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
12*	Remove inner sealing housing.					
13*	Check the bearing house and replace if damaged.					
14*	Replace the glide ring sealing.					
15*	Connect the pressurized sealing plug.					
16*	Fill the housing with clean new oil.				liters	oil
17	Reassemble the impeller.	1.00	pcs.	wrench, pliers, screwdrivers		
18	Mount the pump bearing housing together with the hydraulic motor to the casing.	5.00	pcs	wrench, pliers, screwdrivers		
19	Reinstall the suction ring.	2.00				
20	Connect the pump suction pipe.	3.00		ANNA ANA BARA KARAMANA ANA ANA ANA ANA ANA ANA ANA ANA AN		
	TOTAL	25.50				
			Safety			

: A503

Maintenance Activity : CLEANING THE ENGINE AIR CLEANER ELEMENT Crew Composition

: Marine Engineman

Maintenance Interval :

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Every 1000 hours of operation or semi-annually

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Converse		Estimated		Tools		Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
1	Open the engine room.	0.25					
2	Remove the cover plate.	0.25					
3	Remove air cleaner element.	0.25					
4	Tap the air cleaner element to dislodge dirt particles.	0.50					
5	Gently brush the filter with a soft bristle brush.	1.00	1 pc.	soft bristle brush			
6	Spray air cleaner with cleaning solution. Do not use gasoline, steam, unapproved detergents, or parts cleaning solvents.	1.00					
7	Allow air cleaner to stand for 20 minutes.	20.00					
8	Rinse the cleaner element with low pressure water. Maximum pressure is 275 kPa (40 psi). Start to rinse from the inside then the outside.	5.00	1 pc.	compressor	liters	water	
9	Inspect air cleaner for tears and/or holes.	1.00					
10	Shake excess water off air cleaner element.	0.50					
C	ONTINUATION ON THE NEXT PAGE.						

61

Activity Code

tools, slipping of tools, etc.

: A503

Maintenance Activity : CLEANING THE ENGINE AIR CLEANER

ELEMENT

Crew Composition

: Dredge Master

Maintenance Interval :

semi-annually

Every 1000 hours of operation or

Sequence No.	Activity		Estimated	Tools			Materials
			Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
11	Allow the air cleaner to dry		5.00				
12	Apply small amounts of oil or pleat.	n top of each	1.00			liters	oil
13	Allow the oil wick into the air minutes. Oil any remaining "	r cleaner for 20 white" spots.	20.00				
14 Inspect and replace if necessary the housing and the clamp for air cleaner element.		1.00					
15	Install the air cleaner elemer	ıt.	1.00				}
TOTAL		56.00		,,,,,_,_,_,_,_,,,,,,,,,,		•	
				Safety			
	Hazard		Precauti	on		Required PPE	
Hand injuries caused by sharp parts and Wear prescribed		hand protection a	and maintain all I	ntain all hand and gloves			

power tools in a safe condition.

: *A504

Maintenance Activity : REPLACING THE BATTERIES

: Marine Engineman

* *

Crew Composition

Maintenance Interval : Every 1000 hours of operation

_		Estimated	Tools		Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Turn the key start switch to the OFF position.	0.25				
2	Turn OFF and disconnect the battery charger.	1.00				
3	Disconnect the cables from the battery terminals.	0.50				
4	Remove the used battery/batteries.	1.00				
5	Install the new battery/batteries.	1.00			2 pcs.	12 V Battery
6	Connect the cables from the starting motor to the POSITIVE "+" battery terminal.	0.50				
7	Connect the cables from the ground plane to the NEGATIVE "-" battery terminal.	0.50				
N	TOTAL	4.75				

Safety

	•	
Hazard	Precaution	Required PPE
Batteries give off combustible gases which	Ensure proper ventilation for batteries that are in an enclosure. Follow	hard hat, long sleeved shirt, face shield,
can explode. A spark can cause the combus-	the proper procedures in order to help prevent electrical arcs and/or	gloves,
tible gases to ignite. This can result in severe	sparks near batteries. Do not smoke when the batteries are serviced.	
personal injury or death.		

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PM Group

: PM6

Maintenance Interval

: Every 2000 hours of operation or annually

NOTE: All PM1, PM2, PM3, PM4 and PM5 activities are included and should also be performed together with the PM6 activities. Activity Codes with an asterisk (*) should follow the recommended service hours of materials before replacement to maximize their service lives.

ACTIVITY CODE	MAINTENANCE ACTIVITY	ESTIMATED DURATION IN MINUTES	LABOR	TOOLS	MATERIALS	PPE
*A601	Changing of Hydraulic Oil	67.00	DM, DF	drain pump, container	oil filter element	hard hat, life vest, safety shoes, gloves
A602	Inspection and Greasing of Propeller Bearing Housing	3.50	DM, DF		water resistant grease	hard hat, life vest, safety shoes, gloves
A603	Inspection and Repair of Cutter Hub Bearing.	16.50	DM, DF	container	oil	hard hat, life vest, safety shoes, gloves
A604	Inspection of Alternator	5.00	ME			long sleeved shirt, safety shoes, gloves,
A605	Inspection the Crankshaft Vibration Damper	2.50	ME		crankshaft vibration damper	gloves
A606	Checking the Engine Mounts	7.00	ME	wrench, pliers	clean cloth	gloves
A607	Checking and Calibrating the Engine Speed/Timing Sensors	15.00	DM, ME		clean cloth isolators	gloves
A608	Inspection of Engine Valve Rotators	2.50	DM, ME			long sleeved shirt, safety shoes, gloves,
A609	Inspection of Starting Motor	7.00	ME		clean cloth	gloves
A610	Inspection of Water Pump	7.00	DM		pump seals	gloves

: A601

CHANGING OF HYDRALILIC OIL

* *

Crew Composition : Dredge Master, Dredgeman Foreman

Maintenance Activity	CHANGING OF HYDRAULIC OIL

Maintenance Interval : Every 2000 hours of operation

		Estimated	Tools		Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Run the engine until the oil is warm.	10.0				
2	Drive all the piston rods of the hydraulic cylinders in.	5.00				
3	Stop the engine.	0.25				
4	Connect the drain pump to the oil tank drain coupling.	0.25	1 pc.	drain pump		
5	Pump oil out of both compartments.	5.00	1 pc.	container	1 pc.	oil filter element
6	Clean the reservoir with clean lint-free cloth.	1.00				
7	Drain water cap.	1.00				
8	Change 2 of the 4 return filters, drain filter and pilot pressure filter.	20.0				
9	Fill the reservoir with new oil through the return filters.	3.00				
10	Disconnect the pumps.	0.50				
C	ONTINUATION ON THE NEXT PAGE.			en an		

65

Activity Code

: *A601

Crew Composition : Dredge Master

Maintenance Activity	:	CHANGING OF HYDRAULIC OIL
		· · · · · · · · · · · · · · · · · · ·

Maintenance Activity : CHANGING OF HYDRAULIC		RAULIC OIL	IC OIL Maintenance Interval : Every 2000 hours				
Sequence No.	Activity	Estimated Duration in Minutes	Tools			Materials	
			Quantity & Unit	Tool Class	Quantity & Unit	Material Description	
	PERFORMANCE TESTING						
11	Start the engine and let it operate at idle.	1.00					
12	Increase engine speed	10.00					
13	Drive all the cylinders back and forth one at a time. Observe the response of the equip- ment. Note any observations.	10.00					
	TOTAL	67.00					
			Safety		1997		

Hazard Precaution		Required PPE
Hand injuries caused by sharp parts and tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves
Blows from moving components	Make sure there are no people in the working area.	hard hat, life vest, safety shoes, gloves
Fire/Explosion, Slips	Wipe up spills. Store oily rags or other flammable material in a protective container stored safely. Do not leave rags in the engine.	hard hat, life vest, safety shoes, gloves

: A602

Maintenance Activity : INSPECTION AND GREASING OF PROPELLER BEARING HOUSING

Crew Composition

* *

: Dredge Master, Dredgeman Foreman

annually

		Estimated	Tools		Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Check the shaft seal.	0.50				
,	CHANGE THE GREASE IN THE BARREL	· · · · · · · · · · · · · · · · · · ·				
2	Remove both plugs in both plugged threads in the barrel.	0.50				
3	Mount a grease nipple to one of the threads.	0.50				
4	Pump water resistant grease with grease gun into the barrel. If no water or dirt comes out of the other thread, continue pumping grease until clean grease comes out of the thread.	1.00	1 pc.	grease gun		water resistant grease
5	Remove grease nipple.	0.50				
6	Plug both threads again.	0.50				
	If the grease that comes out is contaminated with water and dirt, open the bearing as- sembly by proceeding to the next steps.					
7*	Remove the propeller	0.50				
8*	Remove the propeller tunnel.	0.50		••••••••••••••••••••••••••••••••••••••		
C	CONTINUATION ON THE NEXT PAGE.		*******			*If necessary

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Activity Code

: A602

Crew Composition

: Dredge Master, Dredgeman Foreman

Maintenance Activity : INSPECTION AND GREASING OF **PROPELLER BEARING HOUSING**

Т

Maintenance Interval : Every 2000 hours of operation or

annually

-			Estimated	Tools			Materials	
Sequence No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
9*	Remove the propeller bearir from the bearing housing.	ng assembly						
10*	Open the assembly.							
11*	Clean the inside of the housi	ng.						
12*	Replace worn out/ damaged	parts.						
13*	Reassemble the bearing assembly.							
14*	Fill the housing with water resistant grease.						lb.	water resistant grease*
TOTAL 3.50					-	*If necessary		
Safety								
	Hazard	Precaution				Required PPE		
Hand injuries caused by sharp parts and tools, slipping of tools, etc.Wear prescribed hand protection and maintain all hand and power tools in a safe condition.			hand and		glove	5		
Fire/Explosion, Slips Wipe up spills. Store oily rags or other flammable material in protective container stored safely. Do not leave rags in the engine.			material in a gs in the	hard	l hat, life vest, saf	ety shoes, gloves		

Maintenance Interval : Every 2000 hours of operation or

: A603

Maintenance Activity : INSPECTION AND REPAIR OF CUTTER HUB BEARING

Crew Composition : Dredge Master, Dredgeman Foreman

Maintenance Interval : Every 2000 hours of operation or annually

		Estimated		Tools		Materials
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Put the cutter pump in vertical position.	1.00				
2	Slightly open the plug to let oil come out. NOTE: If the oil is contaminated or no oil is coming out, the seal may be leaking or damaged. To check, proceed to the next steps.	0.50				
3	Dismount the cutter crown.	5.00				
4	Drain oil from the plug.	1.00	1 pc.	container		
5	Remove coupling flange to expose sealing	1.00				
6	Check the condition of the metal face seal	1.00				
7	Clean the inside of the housing	2.00				
8	Replace the worn out parts	5.00				
9*	If the oil from step 2 is not contaminated continue draining the oil through the drain plug.					
C						

69

Activity Code

: A603

Maintenance Activity : INSPECTION AND REPAIR OF CUTTER HUB BEARING

Crew Composition Maintenance Interval : Every 2000 hours of operation or

: Dredge Master, Dredgeman Foreman

annually

		Estimated	Tools		Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
10*	Fill the housing with new oil through the plug.				liters	oil*
11*	Rotate the shaft to get the oil all the way down.					
12*	Close the plug.					
	TOTAL	16.50				

Suicty							
Hazard	Precaution	Required PPE					
Hand injuries caused by sharp parts and tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves					
Fire/Explosion, Slips	Wipe up spills. Store oily rags or other flammable material in a protective container stored safely. Do not leave rags in the engine.	hard hat, life vest, safety shoes, gloves					

No.

1

2

3

: A604

Crew Composition

: Marine Engineman

Maintenance Activity : INSPECTION OF ALTERNATOR

ammeter reading should be very near zero. All batteries should be kept charged.

TOTAL

Maintenance Interval : Every 2000 hours of operation/annually Tools Materials Estimated Sequence Duration in Activity Quantity Quantity **Tool Class Material Description** Minutes & Unit & Unit Inspect for loose connections and proper 1.00 battery charging. Inspect the ammeter (if equipped) during 2.00 engine operation in order to ensure proper battery performance and/or proper performance of the electrical system. Check the alternator and the battery 2.00 charger for proper operation. If the batteries are properly charged, the

Cafatu

5.00

		Salety		
Hazard Hand injuries caused by sharp parts and tools, slipping of tools, etc. Fire/Explosion, Slips	Precaution	Required PPE		
	Hand injuries caused by sharp parts and tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves	
	Fire/Explosion, Slips	Batteries give off combustible gases which can explode. Do not smoke when batteries are serviced. Remove any source that can be provide spark.	long sleeved shirt,, safety shoes, gloves, goggles	

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Activity Code

: A605

Crew Composition

: Marine Engineman

Maintenance Activity : INSPECTION OF CRANKSHAFT

VIBRATION DAMPER

Maintenance Interval :

Every 2000 hours of operation or annually

			Estimated	Tools			Materials	
Sequence No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1	Inspect the damper for the for conditions:	ollowing						
	The damper is dented, cracked, or fluid is leaking from the damper.		0.50					
	The paint on the damper is discolored from excessive heat.		0.50					
	The damper is bent.		0.50					
	The bolt holes are worn or there is a loose fit for the bolts.		0.50					
	The engine has had a cranksl to torsional forces.	naft failure due	0.50					
2*	Replace the damper if any of conditions exist.	these						Crankshaft vibration damper*
	TOTAL		2.50					*If necessary
				Safety				
	Hazard		Precaution			Required PPE		
Hand injuries caused by sharp parts and Wear prescribed tools, slipping of tools, etc. power tools in a			hand protection a safe condition.	and maintain all hand and gloves			1 m	

: A606

Maintenance Activity : CHECKING THE ENGINE MOUNTS

Crew Composition : Marine Engineman

Maintenance Interval : Every 2000 hours of operation/annually

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		Estimated		Tools	Materials	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Ensure that the mounting bolts are tightened to the proper torque.	2.00	pcs	wrench, pliers		
2 Ensure that the isolators are free of oil contamination.		2.00			рс	clean cloth
3	Inspect the isolators for deterioration. Replace if needed.	1.00				Isolators*
4	Ensure that the bolts for the isolators are tightened to the proper torque.	2.00	pcs	wrench, pliers		
	TOTAL	7.00		, <u>, , , , , , , , , , , , , , , , , , </u>		*If necessary
	· · · · · · · · · · · · · · · · · · ·	Safety				

	•	
Hazard	Precaution	Required PPE
Hand injuries caused by sharp parts and	Wear prescribed hand protection and maintain all hand and	gloves
tools, slipping of tools, etc.	power tools in a safe condition.	



Activity Code

: A607

Crew Composition

: Dredge Master, Marine Engineman

Maintenance Interval :

Every 2000 hours of operation/ annually

Maintenance	Activity	:

: CHECKING AND CALIBRATING THE ENGINE SPEED/TIMING SENSORS

		Estimated		Tools	Materiais	
Sequence No.	Activity	Duration in Minutes	Quantity & Unit	Tool Class	Quantity & Unit	Material Description
1	Remove the speed/timing sensors from the front housing.	3.00				
2	Check the condition of the plastic end of the speed/timing sensors for wear and/or contaminants.	1.00				
3	Clean the metal shavings and other debris from the face of the speed/timing sensors.	1.00		,	рс	clean cloth
4	Calibrate the speed/timing sensors.	10.00				
	TOTAL	15.00		anna - an		

Survey								
Hazard	Precaution	Required PPE						
Hand injuries caused by sharp parts and tools, slipping of tools, etc.	Wear prescribed hand protection and maintain all hand and power tools in a safe condition.	gloves						

Maintenance Activity

: A608

: INSPECTION OF ENGINE VALVE ROTATORS

power tools in a safe condition.

power tools in a safe condition.

uniform.

Crew Composition

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Maintenance Interval :

: Dredge Master, Marine Engineman

Every 2000 hours of operation/ annually

			Estimated	Tools			Materials	
Sequence No.	No. Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
	NOTE: Perform the following steps after the engine valve lash is set, but before the valve covers are installed.							
1 Start the engine.		0.50						
2	2 Operate the engine at low idle.		1.00		·····			
3	3 Observe the top surface of each valve rotator. The valve rotators should turn slightly when the valves close.		1.00					
4	4 If a valve fails to rotate, consult your engine manufacturer.							
TOTAL		2.25						
	Safety							
Hazard			Precaution			Required PPE		
Hand injuries caused by sharp parts and Wear prescribed			hand protection and maintain all hand and			gloves		

75

Stay away from hot components/parts. Wear the prescribed

Activity Code

tools, slipping of tools, etc.

tools, slipping of tools, etc.

Burns

: A609

Maintenance Activity : INSPECTION OF STARTING MOTOR

Crew Composition

: Marine Engineman

Every 2000 hours of operation/

goggles/face shield, long sleeved shirt, safety shoes

Maintenance Interval :

annually

			Estimated	Tools			Materials		
Sequence No.	Activity		Duration in Minutes	Quantity & Unit	Tool	Class	Quantity & Unit	Material Description	
1 Check the starting motor for proper operation.		2.00							
2	Check and clean the electrical connections.		5.00				рс	clean cloth	
3	3 Do necessary repairs if needed.					<u>1</u> . Manaka an Madana an Indonesia da an Andriana Andriana di			
	TOTAL		7.00						
	Safety								
Hazard			Precaution			Required PPE			
Hand injurie	es caused by sharp parts and	d hand protection and maintain all hand and			gloves				

: A610

Maintenance Activity : INSPECTION OF WATER PUMP

Crew Composition

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Maintenance Interval :

: Dredge Master

Every 2000 hours of operation/ annually

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<u>.</u>...

	1		Estimated		Tools		Materials	
Sequence No.	Activity	Activity		Quantity & Unit	Tool	Class	Quantity & Unit	Material Description
1	Visually inspect the water pu	imp for leaks.	1.00					
2 If leaking of the water pump seals is observed, replace all of the water pump seals.		5.00				pcs	pump seals*	
3	3 Inspect the water pump for wear, cracks, pin holes and proper operation.		1.00					
4	4 Do repair or replacement if needed.							
TOTAL			7.00		*If necessary			
·····	Safety							
Hazard			Precaution			Required PPE		
Hand injuries caused by sharp parts and Wear prescribed tools, slipping of tools, etc. power tools in a			d hand protection a safe condition.	and maintain all hand and gloves				

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BIBLIOGRAPHY

- Caterpillar C7 Marine Engine Maintenance Interval
- Watermaster Operation and Maintenance Manuals