

7.3 Maintenance of Dredging Fleet

There are several methods for maintaining the dredging fleet in a normal and economical condition to achieve the planned dredging schedule. Maintenance of dredging fleet would be remarkably improved by executing the following recommendations.

7.3.1 Regular Inspection

Judging from the trouble records which were explained by CDC II, the first step toward improvement is to establish a system of regular preventative inspection. Otherwise, it will take more time and money to rectify damage by acting after problems happen. Items of equipment to be inspected, inspection interval and the crew in charge, etc. should be decided for each dredger.

As inspection items and intervals are generally recommended by the manufacturer of engine or equipment, inspection works should follow these instructions.

General inspection items are shown below for reference.

- Quantity, pressure and temperature of lubricating oil
- Quantity, pressure and temperature of cooling water
- Quantity of fuel oil
- Exhaust gas temperature
- Leakage of oil or water
- Filter
- Abnormal vibration or noise

An example of a typical list of regular inspection items is shown in Table 7.3.1-1. This list may not coincide with the equipment and machinery of CDC II dredgers; however, the fundamental points of maintenance can be envisaged for such equipment. For doing the inspection at least once a year, the inspection items shown here can be utilized as a guideline. Other items not shown here will naturally be taken up, depending on the Center's workforce, their ability and facilities.

Table 7.3.1-1 Table of Typical Inspection Items

) Internal combustion engine			
Item	Content	Inspection method	Criteria
General	Starting	Operation	Normal starting
	Rpm, pressure, temperature	Measurement	Normal rpm & pressure, no abnormal high temperature
	Noise and vibration	Sound, touch, visual check	No abnormal noise and vibration
	Exhaust gas	Visual check	No dark smoke or no remarkable blue smoke
	Leakage	Visual check	No water leakage, no oil leakage No air leakage
	Oil supply	Visual check	Sufficient quantity of oil supply
	Indicator	Visual check	Normal indication and operation
Lubricating oil	Purity	Visual check	No mixture of foreign matters nor water
	Quantity	Visual check	To maintain the proper amount
	Viscosity	Measurement	Within the range of standard
) Cooling water and lubricating oil system			
Item	Content	Inspection method	Criteria
General	Movement	Operation	Normal movement
	Pressure, temperature	Measurement	Normal pressure, no abnormal high temperature
	Noise, vibration	Sound, touch, visual check	No abnormal noise and vibration
	Leakage	Visual check	No water leakage, no oil leakage
Piping	Damage, corrosion	Visual check, test hammer	No damage, no bad corrosion
	Leakage	Visual check	No water leakage
Filter	Clogging	Visual check	No clogging
Cooler	Temperature of cooling water	Visual check	Proper temperature
	Leakage	Visual check	No leakage

Table 7.3.1-1 Table of Typical Inspection Items(Cont'd)

) Oil hydraulic system			
Item	Content	Inspection method	Criteria
Hydraulic pump, motor, cylinder	Movement	Operation	Normal movement
	Pressure, temperature	Measurement, touch	Normal pressure, no abnormal high temperature
	Noise, vibration	Sound, touch, visual check	No abnormal noise and vibration
	Damage, leakage	Visual check	No damage, no oil leakage
Piping: pipe	Damage, corrosion, leakage	Visual check	No damage, no remarkable corrosion, no leakage
hoses	Damage, aging, deformation, leakage	Visual check	No damage, no aging, no deformation, no oil leakage
valve	Movement	Operation	Smooth movement, reliable open/shut
	Leakage	Visual check	No oil leakage
joint	Fitting, leakage	Visual check	No looseness, no oil leakage
Hydraulic oil	Cleanliness	Visual check	No foreign matters, no water mixture
	Quantity	Visual check	Normal oil level
	Viscosity	Measurement	Within the range of standard
Filter	Clogging	Visual check	No clogging
Cooler	Temperature of cooling water	Visual check	Proper temperature
	Leakage	Visual check	No leakage

Table 7.3.1-1 Table of Typical Inspection Items(Cont'd)

) Spud			
Item	Content	Inspection method	Criteria
Spud	Damage, deformation	Visual check, colour check	No damage, no crack, no remarkable deformation
Keeper	Damage, deformation, wear	Visual check	No damage, no remarkable deformation, no wear loss
Keeper pin	Damage, deformation, wear	Visual check	No damage, no remarkable deformation, no wear loss
Holder	Damage, deformation, wear	Visual check	No damage, no crack, no remarkable deformation, no wear loss
Lifting device	Movement	Visual check	Normal movement
	Noise, vibration	Sound, touch, visual vibration	No noise, no abnormal vibration
	Lubrication	Visual check	Good lubricating condition
) Gauge, indicator			
Item	Content	Inspection method	Criteria
General	Movement	Visual check	Normal movement, normal indication
Censer, indicator	Damage, corrosion, deformation	Visual check	No damage, no remarkable corrosion, no deformation
	Fitting	Visual check	No looseness, no loss of fitting bolt, etc
) Dredge pump			
Item	Content	Inspection method	Criteria
General	Noise, vibration	Sound, touch, visual check	No noise, no abnormal vibration
	Temperature	Touch	No abnormal high temperature
	Lubrication	Visual check	Good lubricating condition
	Fitting	Visual check, wrench	No looseness, no loss of fitting bolt
	Leakage	Visual check	No water leakage
Impeller	Damage, wear	Touch, visual check	No damage, no remarkable wear
Casing liner	Damage, wear	Touch, visual check	No damage, no remarkable wear
Mouth ring, suction mouth	Damage, wear	Touch, visual check	No damage, no remarkable wear
Shaft, shaft bearing	Wear, adjustment	Touch, visual check	No remarkable wear, good adjustment

Table 7.3.1-1 Table of Typical Inspection Items(Cont'd)

) Ladder			
Item	Content	Inspection method	Criteria
General	Noise, vibration	Sound, visual check	No noise, no abnormal vibration
	Lubrication	Visual check	Good lubricating condition
Trunion shaft	Wear	Visual check	No remarkable wear
Cap tightening bolt	Fitting	Visual check, wrench	No looseness, no loss of bolt
Suction head	Wear	Visual check	No remarkable wear
) Cutter			
Item	Content	Inspection method	Criteria
General	Noise, vibration	Sound, visual check	No noise, no abnormal vibration
	Lubrication	Visual check	Good lubricating condition
	Fitting	Visual check, wrench	No looseness, no loss of fitting bolt
Coupling	Damage, wear	Visual check	No damage, no remarkable wear
	Aging	Visual check	No remarkable aging at flexible coupling
	Non-alignment of shaft	Visual check	Proper alignment of shaft center
Cutter head, blade, tip	Damage, wear	Visual check	No damage, no crack, no remarkable wear

Source: “ Inspection Criteria of Work Vessel ” published by the Japan Work Vessel Association.

7.3.2 Training and Education of Crew

Many of the problems that often take place will be avoided by a careful initial inspection. As the inspection requires the sufficient knowledge of mechanical equipment and its function, training and education should be carried out in connection with the promotion of the crew.

For example, training items for repair work will be:

- Welding of steel plate or pipe
- Gas cutting
- Deck machinery and equipment
- Main engine, generator engine and dredge pump
- Electric equipment, etc

7.3.3 Machinery Indicators

Operation of machinery has to be carried out according to the conditions of equipment as precisely as possible. Particularly, careful attention must be paid to the indicator readings whether they show the machinery's physical level within the operating limit or not. Essential equipment should be periodically monitored with reliable indicators so that engines, pumps, generators, etc can be operated smoothly and safely.

Indicators to be monitored are listed below:

- Engine revolution
- Engine fuel notch
- Engine exhausted gas temperature
- Dredge pump revolution
- Dredge pump delivery pressure
- Dredge pump suction pressure
- Lubricating oil pressure and temperature
- Cooling water pressure and temperature

7.3.4 Adaptability to Site Conditions

Actual site conditions are very different from the design specifications of the dredgers as shown below:

Wide Variation Between Specifications and Site Conditions

	<u>C-25 Specifications</u>	<u>Site Conditions</u>
Dredge depth:	Max 16m	Approx. 2 ~ 5m
Discharge distance:	1,000m	Approx. 200 ~ 300m
Soil content:	15%	Approx. 5%

Therefore, in order to cope with this difference, the dredging equipment should be modified to meet the site conditions. Main items to be modified, for example, are the cutter angle, cutter blade, impellers of a pump, and engine output and revolution, etc.

7.3.5 New Dredger Purchase Option

As an alternative solution to meet the site conditions, purchase of a new dredger may be an option. A cutter suction dredger if deployed at CDC II must be operated at shallow water with a short discharge distance to dig soft material. In order to purchase a suitable dredger, HD should prepare the specifications to meet the particular requirements of the site.

When the dredging site condition of CDC , as mentioned in above section 7.3.4 Adaptability to Site Condition, is taken into consideration, the cutter suction dredger with following specifications would be feasible as an alternative.

Rough specifications of the proposed dredger is shown below for reference:

Length x Breadth x Depth	abt. 30m x abt. 10m x abt. 2m
Draft	abt. 1.5m
Dredging depth	max. abt. 6m, min. abt.2m
Dredge pump	Diesel driven, abt 1,000PS
Dredge pump capacity	abt.7,000m ³ /h
Discharge distance	abt. 300m
Terminal elevation	abt.5m
Ladder winch	Electric motor driven
Cutter motor	Electric motor driven
Swing winch	Electric motor driven