

## ARVA CRANE PRE-INSPECTION – 5 YEAR

MANUFACTURER: ARVA INDUSTRIES  
MODEL: PE-48M  
CRANE SERIAL NUMBER: 1831-A171660  
SHIP: CCGS LIMNOS  
IMO: 6804903  
CUSTOMER: CANADIAN COAST GUARD



PRELIMINARY INSPECTION: NOVEMBER 15, 2019

FINAL INSPECTION: --

REPORT REVISION: 00

AUTHOR: SCOTT KNIERIEM, P.ENG.

CHECKED: SHAWN SMITH



## Revision History:

Revision	Notes	Date	Author
P0	PRE-INSPECTION REPORT DRAFT	November 19, 2019	Scott Knieriem
00	RELEASE FOR PUBLICATION	November 22, 2019	Scott Knieriem



## Table of Contents

Overview: .....	1
Crane Functionality: .....	1
Crane Operation Limits: .....	1
Limit Switches: .....	1
Anti-Two Block (ATB): .....	1
Load Moment Indicator (LMI): .....	2
Winch: .....	2
Ropes: .....	3
Sheaves: .....	3
Slew Drives: .....	3
Hydraulics: .....	3
Slew Bearing: .....	4
Boom Lift Cylinders: .....	5
Boom Telescope Cylinders: .....	5
Weld Inspection: .....	5
Electrical: .....	5
Recommendations: .....	6

## Overview:

CCGS Limnos crane PE-48M crane is due for a 5 year overhaul and recertification. The recertification is being performed by the American Bureau of Shipping (ABS) which is issuing the Transport Canada T2 operating certificate. The overhaul work is being contracted to "others".

The nature of the pre-inspection is intended to establish the operational condition of the crane to aid in the generation of overhaul quotes and scheduling.

It is recommended that all outlined, applicable inspections and overhauls outlined in the Arva manual be performed as part crane overhaul. Additional recommendations are contained within the pre-inspection report.

## Crane Functionality:

The crane appeared to be in good condition. The crane operated in a smooth, consistent manner in both loaded and unloaded conditions. At the time of the inspection the crane was observed to load a small pleasure craft sized boat onto the CCGS Limnos. Deficiencies within the crane system were observed and outlined within the body of this report.

## Crane Operation Limits:

### Limit Switches:

Slew limit switches were tested and found to be functional and acceptable.

### Anti-Two Block (ATB):

Anti-two blocks were tested and observed to be functional.

The anti-two block ball was observed as being installed the live line section of the crane rope. It is recommended the anti-two block ball be installed on the tag end of the crane line.

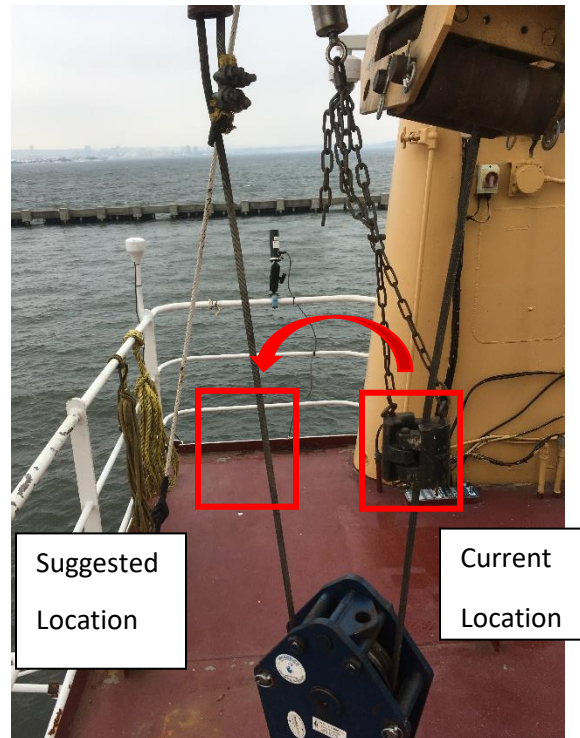


Figure 1: Suggested location of anti-two block ball.

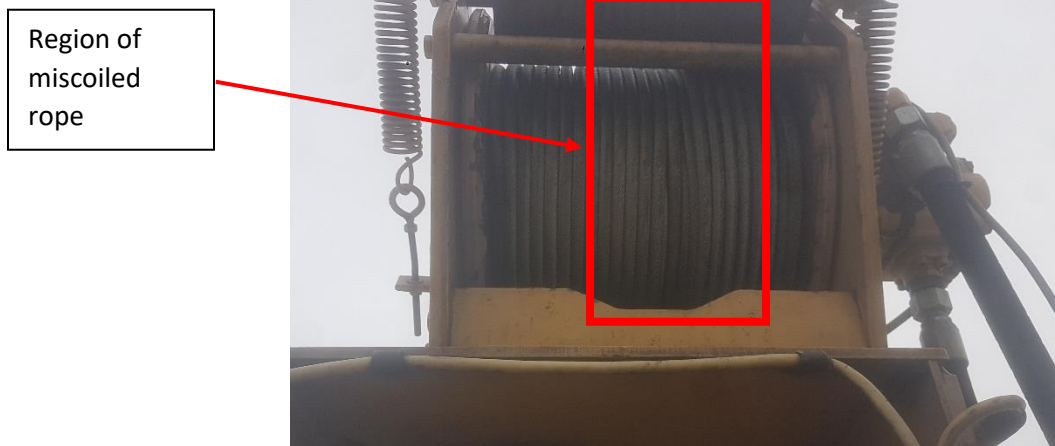
### Load Moment Indicator (LMI):

The load moment indicator system limits were tested and observed to be functional and acceptable. No overload testing was performed during the pre-inspection. During functional testing the LMI locked out the boom in the fully luffed condition due to a cylinder over pressure. It was initially believed the fault was LMI based, however it was determined the fault was caused by a sticking pilot cut out valve, A115241 in hydraulic schematic A115183. It is recommended all pilot cut-out valves (A115241) valves be replaced and an additional valve be purchased as a spare.

### Winch:

The winch was observed to operate normally without any unusual noises or vibration. The rope follower was observed to roll and apply tension to the rope spooling onto the drum. The rope was observed as not spooling onto the drum in uniform and even fashion. Miscoiling of rope was observed in previous layers of rope. Clearing the miscoiled rope is highly recommended. The rope needs to be paid out to the extend to clear the miscoil. The rope is to be hauled in, under tension to insure correct spooling of the rope. Continued operation of the winch with a miscoiled rope can cause unsafe operating conditions and accelerated rope wear.

The winch is to be rebuilt during the crane overhaul.



*Figure 2: Miscoiled rope observed on the winch drum.*

### Ropes:

Rope inspection was not conducted during the pre-inspection. It is recommended the ropes be inspected during the crane 5 year overhaul.

It was observed the hoist ropes appear dry and require additional lubrication.

### Sheaves:

The boom tip sheaves were observed to rotate freely when rotated by hand. No grinding or resistance was observed in the boom tip sheave bearings. No excessive rope wear was observed on the sheaves. It is recommended the sheaves be removed during crane overhaul and checked for cracking and wear.

The hook block sheave was observed to rotate during crane operation. It was not possible to inspect the block at the time of pre-inspection as it was fully reeved. It is recommended the sheave block be disassembled during crane overhaul for inspection.

The fairlead rollers on the boom tip were inspected and observed to be in good condition. The rollers moved freely without any undue resistance.

### Slew Drives:

The slew (swing) drives were observed during operational testing. The slew drives were observed to operate smoothly during operation without any undue noise or vibration. It is recommended the slew drive, gearbox and brake be rebuilt during the crane overhaul.

### Hydraulics:

Comprehensive testing of the hydraulic components was not carried out as part of the pre-inspection. The hydraulic system was observed to be in well maintained operational state with minor deficiencies which are as follows:

- As indicated in Load Moment Indicator (LMI) section, the pilot cut out valves were observed to be sticking. Conversation with the Chief Engineer (Limnos) previous crane problems have been

attributed to sticking pilot valves. It is recommended all pilot cut-out valves (A115241) valves be replaced and an additional valve be purchased as a spare.

- Leak observed between return filter and hydraulic tank. The original gasket supplied with the filter has either failed or been removed. The Coast Guard (CG) has indicated that there is not a gasket between the filter and the tank. It is recommended a gasket be procured for the filter A115267 or fabricated from nitrile rubber and installed rather than attempting to seal the unit with RTV sealant.
- Many of the hoses entering and exiting the base section of the boom were observed as having worn outer sheaths from rubbing against one another. It is recommended these hoses be regularly inspected and monitored for continued use. The hoses are being replaced as apart of the crane overhaul.
- The sight glass/temperature gauge on the hydraulic tank was observed to be heavily worn making it very difficult to read temperature and oil levels. It is recommended that they sight glass be replaced at the next oil change interval.

At the pre-inspection, there was a discussion with Leslie Veldman (Coast Guard) regarding the use of the existing spare hoses for the crane (from storage) as the replacement hoses for use in the overhaul of the crane. A second set of new hoses would be made to replace the original spare hoses and kept in storage. The Coast Guard has asked for Arva to comment to the viability of this option. Arva does not recommend this option due to the age (five years old) of the current spare hoses. Arva recommends the replacement of existing hoses on the crane with hoses of new manufacture.

During testing, the crane was observed to shudder and generate a harsh mechanical noise when attempting to fully retract the boom. Conversations with the Coast Guard revealed that the boom has not been fully retracted in approximately two years. The crane operators have noted they retract the boom as much as possible without the system shuddering and generating noise and stopping to protect the system. It was noted the hoses from the flow divider were shuddering with the crane. Arva required the boom to be fully retracted for testing and fully extended/retracted the boom several times. Over several cycles the shuddering and noise stopped being generated by the system. It was originally thought the source of the shuddering and noise was from ungreased wear pads in the boom. After consultation, the symptoms match that of the flow divider “finding” its zero position. The flow divider is a mechanical device and requires movement throughout its range. The shuddering and noise was a result of the flow divider not being pushed back into its zero position as the crane has not been fully retracted in two years. It is recommended that they Coast Guard regularly operate the crane through its full extended/retracted state. It is recommended the flow divider be removed and inspected as part of the crane overhaul.

The main control valve, A115184 was observed to be leak free and in good condition. As the Coast Guard has indicated there has been sticking solenoid valves elsewhere in the hydraulic circuit, and Arva witnessed a sticking valve. It is recommended the main control valve be removed for service during the crane overhaul.

## Slew Bearing:

A sample of 10% slew ring bolts are required to be removed from the slew bearing for non-destructive testing (NDT). For the installed slew ring A172055, this would equate to 6.5 bolts. For thoroughness,



Arva recommends testing four (4) bolts from each of the inner and outer ring of the bearing. New bolts to replace those removed for testing were delivered to the Coast Guard on November 15, 2019. The new bolts to installed to a dry torque of 820 lb-ft, or a lubricated torque of 574 lb-ft. Lubrication is defined by applying anti-seize compound to the threads of the bolt.

The internal clearance of the slew ring was checked as part of the pre-inspection of the crane. The internal clearance of the bearing was checked by inducing a negative moment on the slew bearing. The geometry of the PE-48M allows for the negative moment when the boom is in a the fully retracted state and at 75°. The test consisted of measuring the difference in deflection of the slew ring when a fully retracted boom is in the 0° and 75° boom angle states. The measure results are summarized in table 2 and are the first deflection measurements for this crane. The deflection observed is considered acceptable.

*Table 1: Slew Ring Clearance.*

Measurement Location	Clearance (in.)
Fore End of Crane	0.011
Aft End of Crane	0.013

## Boom Lift Cylinders:

During operational testing of the crane the cylinders were observed to be leak free and move in smooth and consistent manner. Despite being observed as leak free, it is recommended the cylinders be removed from the crane, inspected and resealed as part of the crane overhaul.

## Boom Telescope Cylinders:

The boom telescope cylinders were observed to operate in a smooth and consistent manner. It was not possible to inspect the boom telescope cylinder without removing the boom from the crane. It is recommended the boom be removed from the crane as part of the crane overhaul.

## Weld Inspection:

Weld NDT is required as part of the 5 year ABS recertification requirements of the crane. Arva recommends the entire crane (pedestal, turret and boom) be encompassed in weld NDT survey rather than just the kingpost and turret as outlined by ABS.

## Electrical:

A complete inspection of the electrical system was not carried out as part of the pre-inspection of the crane.

The electrical control panel for the crane was opened and observed to have corrosion in the lower starboard side of the box. The door seal was inspected and found to be in good condition.

It is recommended that corrosion within the control be monitored to insure it is not increasing. It is recommended that a electrician inspect the electrical panel as part of the crane overhaul.



## Recommendations:

1. All pilot cut-out valves (A115241) valves be replaced and an additional valve be purchased and kept as a spare.
2. Correct miscoiled rope observed on the winch drum.
3. All sheaves be removed during crane overhaul and checked for cracking and wear.
4. Sheave block be disassembled during crane overhaul for inspection.
5. Slew drive, gearbox and brake units be removed and rebuilt.
6. It is recommended a gasket be procured for the filter A115267 or fabricated from nitrile rubber and installed rather than attempting to seal the unit with RTV sealant
7. Hoses entering the base section of the boom be regularly inspected and monitored for wear as they are observed to rub against one another.
8. Sight glass on HPU be replaced at the next oil change interval.
9. Replacement of existing hoses on the crane with hoses of new manufacture, as opposed to using the existing hoses currently being stored as spares.
10. Main hydraulic control A115184 valve be removed for service.
11. Hydraulic flow divider A112386 be removed for service.
12. All cylinders be removed from the crane, inspected and resealed as part of the crane overhaul.
13. Boom to be removed from the crane as part of the crane overhaul. Allows for easy inspection, cylinder removal and re-hosing of equipment.
14. Arva recommends the entire crane (pedestal, turret and boom) be encompassed in weld NDT survey rather than just the kingpost and turret as outlined by ABS.
15. Corrosion within the electrical enclosure be monitored to insure it is not increasing.
16. Electrician inspect the electrical panel as part of the crane overhaul.