



Australian Government

Comcare

Report of Investigation

Department of Transport and Regional Services

**Flying Fish Cove
Christmas Island**

Failure of Favelle Favco Tower Crane

8 April 2005

Investigation Number: 2957

Investigator: David House

To assess compliance with the
Occupational Health and Safety (Commonwealth Employment) Act 1991

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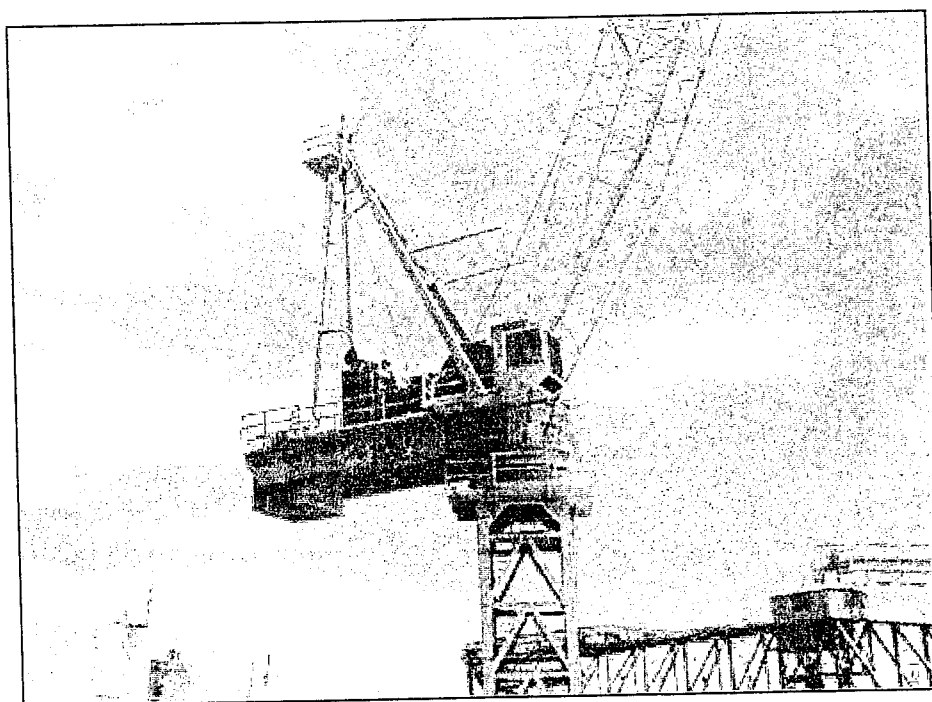
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Investigation Report

Introduction

1. On 8 April 2005 a Favelle Favco Tower Crane Model No 760DW failed whilst in operation allowing two empty sea containers to drop onto the deck of the supply ship MV Finex Trader. The ships deck and the container sustained damage when the containers landed heavily.
2. The tower crane tank operates under Comcare Licence number 946 and was being operated by Mr Mohd Hasinudin Hassin who is the holder of NOHSC Certificate No W0299496. This certificate includes endorsement CT which is appropriate for this class of crane. The containers had been raised off the deck and the boom was being luffed up when one of the two luffing motors failed allowing the boom to lower.



Photograph 1: Favelle Favco Tower Crane.

3. Comcare was notified of the incident on 11 April 2005 by Christmas Island Ports (CI Ports) Harbourmaster Mr Andrew Butterworth.
4. I am David House, an Investigator appointed under subsection 40(2) of the *Occupational Health and Safety (Commonwealth Employment) Act 1991* (the Act). I was directed to conduct the investigation by R. J. Gherardin, Team Leader SA/NT/WA Team, Workplace Safety Group, on 11 April 2005, Attachment A.
5. The parties relevant to the investigation were employees of the Department of Transport and Regional Services (DOTARS), Toll Ports Pty Ltd – trading as CI Ports, Indian Ocean Stevedores (IOS), N & R Marine Surveying, Lift & Loader Servicing, and Favelle Favco Cranes (FFC).

- Rebecca Hogben – Executive Officer, DOTARS.
 - Andrew Butterworth – Harbourmaster, CI Ports.
 - Neil Mc Neil – Wharf Manager, CI Ports.
 - Mohd Hassin – Crane Driver, IOS.
 - Neil Mc Govern – Port Loadmaster, N & R Marine Surveying.
 - Doug Todd – Maintenance Fitter, Lift & Loader Services.
 - David Calcott – Service Technician, FFC.
6. DOTARS is the asset owner and is the employing authority as defined by section 5 of the Act for contractors who operate and maintain the crane.
7. I conducted the investigation between 14 April 2005 and 18 April 2005. The steps I took are shown in a timeline for the investigation at Attachment B. This report is based on information obtained from interviews, discussion, documents and observations as follows:
- Discussions with Rebecca Hogben, Andrew Butterworth, Neil Mc Neil, Doug Todd.
 - Statement – Mohd Hasinudin Hassin.
 - Statement – Neil Mc Govern.
 - Statement – David Calcott.
 - Document – Favelle Favco Maintenance procedures and drawings.
 - Document – Favelle Favco Test and commissioning procedures.
 - Document – CI Ports Maintenance History Reports.

Analysis of Evidence

8. The sequence of events prior to, during and immediately after the incident are shown in a timeline at Attachment C.
9. The Favelle Favco Tower Crane Model M760DW was commissioned on the wharf at Flying Fish Cove on 5 December 2003. The purpose of the crane is the loading and unloading of supplies and cargo for the Island. The tower crane is essentially a construction site crane adapted for this mode of operation. The crane design for the crane at this location was registered by WorkSafe WA under WAC19270.
10. On the day of the incident the crane was being used to unload cargo from MV Finex Trader. Crane driver Mohd Hasinudin Hassin, an employee of IOS, commenced work at 0630hrs. Two crane operators are rostered and work on a two hour turn around roster, two hours in the crane cab and two hours on general stevedoring duties. Hassin commenced his last crane driving roster for the day at approximately 1515hrs he was driving when the incident occurred at 1737hrs.

11. Just prior to the incident Hassin had picked up two empty shipping containers (one on top of the other) from location B5 at the right end of the ship's Port side. He raised the load on the hoist winch and then operated the luffing winch lever to raise the boom, at the same time he ceased raising the load on the winch and commenced lowering the load so as to have more control of the load.
12. Before Hassin commenced to slew the load he noticed that the boom was lowering of its own accord, he still held the luffing control in the raise position; he heard a noise that sounded as though the winch was increasing in speed. He kept the luffing control in the raise position but the boom kept lowering. His concern was for a trainee who was on the deck of the ship. He tried to keep the load under some control by lowering it to the deck on the hoist winch.
13. The speed of the boom lowering was reported to be similar to that of being under power, not a "free fall speed". The load hit the deck with considerable force, however this was probably accentuated by the fact that the ship was rolling and pitching. See photograph 2. in Attachment D.
14. When the load was on the deck, the boom stopped lowering, this was because Hassin had released the luffing lever and the brakes to the winch automatically applied. This uncontrolled "deadman" operation of the brakes brought the luffing winch to a sudden stop causing the whole of the crane structure to shake.
15. When Hassin left the crane cabin to survey the machinery deck he found that one of the luffing motor assemblies had broken into two pieces see photograph 3 in Attachment D. Hassin ascertained that the crane hoist and slewing motions were still operable and proceeded to stow the crane in a safe manner.
16. Western Stevedores made a preliminary assessment, took photographs and contacted FFC advising them of the failure. A service technician and two new luffing motor assemblies were despatched to Christmas Island. A Do not Disturb Notice 2957DND1 Attachment E, was placed on the crane to be effective from 4:00 pm 11 April 2005 to 5:00 pm 15 April 2005. I discussed the proposed repair procedure with the Technician David Calcott by telephone and permitted him to remove the damaged components, with the provision that they were not to be dismantled prior to my arrival at Christmas Island on 14 April 2005.
17. Both luffing motors were replaced with all new components on 14 April 2005 see FFV Service Docket No 11802 Attachment F. On 15 April 2005 the crane was inspected and tested by the FFC Technician (Competent Person) and witnessed by CI Ports, Port Manager see Test Procedure report Attachment N. I also witnessed the testing. The crane was returned to service on completion of testing.
18. A general arrangement of the winch assembly is shown in FFC drawing A2-2300276 (Attachment G). I requested that the luff drum drive assembly be dismantled and stripped in my presence, the assembly consists the following components shown in FFC drawing 760-515-32-12 Attachment H:
 - Brevini reduction gearbox – item 2.
 - Brevini brake – item 3.
 - Brevini motor adaptor – item 4.
 - Rexroth hydraulic motor. – item 6.

19. The motor is secured to the adaptor unit by four M12 hex bolts, removal of these bolts gave access to the connection of the motor adaptor to the brake unit. This is where the failure had occurred. The adaptor is secured to the brake unit by six M12 cap bolts. These bolts are not visible unless the adaptor is unbolted from the drive motor. Of these six, four were found to be loose inside the adaptor. Two had stripped threads on the threaded section and two were clean. The casing surrounding the brake unit had two sections broken away, with the cap bolts still attached to the threaded sections. See photographs 4 to 9 Attachment D
20. It appears that during operation of the crane two of the cap bolts had worked loose from the casing, leaving four bolts to secure the assembly. Continued operation of the crane had put stress on the four remaining cap bolts causing two to strip the threads from the casing. This then left only two bolts securing the assembly. The added stress caused two sections of the brake unit casing to break away allowing the hydraulic drive motor with the adaptor to detach.
21. This failure resulted in only one luffing motor to power the luff winch. There was no hydraulic failure so the anti cavitation device did not automatically apply the brake. If the operating lever had been returned to neutral, (providing no drive) the brakes would have applied thus stopping the boom from dropping.
22. It was noted during the disassembly of the units that some the M19 nuts and bolts shown as item 8 & 9 Attachment I, which secure the whole drive assembly to the luffing winch frame were loose. One of the nuts had actually disengaged from the bolt (see photograph 10 Attachment D). The new drive assembly attached to the luffing winch frame is shown in photograph 11 Attachment D.
23. The second drive assembly was also dismantled for inspection at my request. It was found that a circlip, which retains the drive spline, had failed, see photograph 12 Attachment D. The failure of this circlip could lead to incorrect positioning of the spline drive causing additional stresses on the drive. This also could cause vibration in the drive assembly.
24. This crane is a construction site tower crane with a load chart that has been modified to include conditions when operating with a significant wave height suitable for 0.5 metre swell and 1.5 metre swell. Flying Fish Cove is not a sheltered harbour as found in normal ship unloading harbours. The crane is therefore subjected to some added stresses as shock loading will occur due to swell. Vibration due to shock loading may have been a factor in allowing bolts to come loose. I have been unable to determine if the bolts were tightened correctly during initial assembly.
25. Maintenance has been carried out three monthly by FFC and monthly by Lift and Loader Servicing as shown in CI Ports Maintenance History at Attachment I. A daily maintenance check is carried out by the crane drivers at the start of their shift, this includes a general inspection of the crane. There are no maintenance procedures or check lists written that include checking the tightness of bolting, other than checking the powerpack holding down bolts/ pins, this is included in FFC daily maintenance checks Appendix J. I was unable to find reference to a maintenance procedure that refers to dismantling and inspection of the components within the drive assembly.
26. When the drive assembly failed the crane driver acted instinctively by pulling back on the luffing motion lever with the expectation that the boom would raise. He could not see what had happened on the machinery deck. If he had returned the lever to neutral

or let go of the lever, the brakes would have applied and the downward boom motion stopped. The crane driver is considered to be an experienced driver having held a Certificate of Competency for more than ten years. All crane drivers were given induction training by FFC on this crane when it was commissioned in 2003, however there is no documentation to support this.

Conclusions

27. The ultimate cause of the incident was the failure of the cap bolts securing the motor adaptor to the brake assembly.
28. There are no positive means provided to ensure that the cap bolts cannot come loose.
29. There are no maintenance procedures that include checking the tightness of the six cap bolts.
30. If the crane driver had returned the luffing motion lever to neutral or let go of the lever the brakes would have been applied and the downward motion of the boom would have stopped.
31. Servicing and maintenance of the crane had been carried out as required by the manufacturer. Operators had completed the required daily checks. There was no evidence that the Department of Transport and Regional Services had breached the Act.

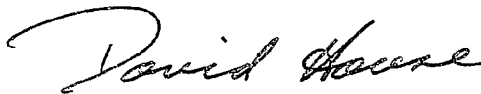
Statutory Notices

32. Do Not Disturb Notice 2957DND1 was issued on 11 April 2005 by Robert James (Gerry) Gherardin Attachment F.

Recommendations

33. I recommend that:

- 33.1. FFC maintenance procedures for this and all cranes incorporating similar drive assemblies are amended to include dismantling of the motor adaptor to check tightness of bolting and integrity of the drives.
- 33.2. FFC implements a system to reduce the possibility of the cap bolts working loose.
- 33.3. DOTARS amends maintenance procedures for the Favelle Favco Tower Crane Model M760DW at Flying Fish Cove to include checking on a regular basis tightness of bolting for all major components such as drive assemblies to the luffing winch and hoisting winch frames.
- 33.4. Indian Ocean Stevedores provides additional refresher training to crane drivers to ensure that all are aware of steps to take in the event of an emergency such as has occurred in this instance.
- 33.5. Comcare refers this report to the WA OHS authority, the WorkSafe Division of the Department of Consumer and Employment Protection, for their information and any appropriate action.



David House
Investigator

6 May 2005



Australian Government

Comcare

In Reply Quote: 2005/620
Facsimile: (08) 8124 0413
Telephone: (08) 8124 0502

Investigation No. 2957

Direction to Conduct an Investigation

(Occupational Health & Safety [Commonwealth Employment] Act, 1991(the Act))

Mr. David House
 David House & Associates Pty Ltd
 29 Sholl Ave
 North Beach WA 6020

You are directed to conduct an investigation at the Department of Transport and Regional Services (DOTARS) – Christmas Island.

On 8 April 2005 a Savelle Favco tower crane owned and maintained by DOTARS failed whilst in operation and dropped two sea containers onto a ships deck. No injuries occurred. I have attached the registration and other relevant details of the plant

The initial contact person in the Mr Andrew Butterworth 0439 215 225 -- an employee of Toll Ltd.

Please investigate the matter under the Act and ascertain:

- Whether the requirements of the Act are being complied with,
- Whether there have been any breaches of the Act or Regulations, and
- The circumstances that led to the incident/s.

The above includes compliance of manufacturers, suppliers, and persons erecting or installing plant, with Sections 18 to 20 of the Act.

I request a report of your investigation by 30 May 2005. Your Comcare contact is Andrew Scheer on (08) 8124 0504.

RJ (Gerry) Gherardin
Team Leader SA/NT/WA Team
Workplace Safety Group
Sub Delegate of the
Safety, Rehabilitation and Compensation Commission

11 April 2005

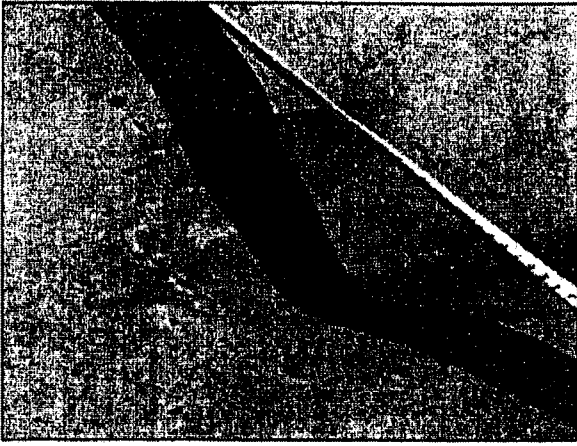
Attachment B

Timeline for the Investigation

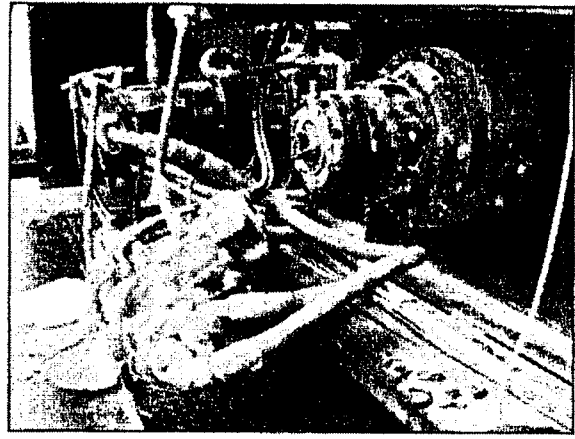
Date / Time	Details
11 April 2005 PM	Direction to investigate the incident and briefing with Comcare by telephone.
12 April 2005 AM	Telephone discussion with Rebecca Hogben and Andrew Butterworth in relation to the Do Not Disturb Notice issued to DOTARS on the crane.
13 April 2005 AM	Telephone discussion with David Calcott FFC regarding the lifting of the Do Not Disturb notice.
14 April 2005 1700hrs	Travelled to Christmas Island, met with Rebecca Hogben, Andrew Butterworth & Neil Mc Neil.
15 April 2005 0800hrs 1000hrs 1300hrs-1700hrs	Inspected damaged components, met with David Calcott, Neil Mc Neil, Doug Todd Attended load testing of crane following installation of replacement motors and parts. Continued assessing damaged components and taking photographs. Took statements.
16 April 2005 0900hrs-1600hrs	Perused operation and maintenance manuals, collated evidence, reviewed statements.
18 April 2005 0800-1000hrs 1415-2145hrs	Inspected and photographed second motor after it was dismantled. Verbal feedback to Comcare re visit Travel to Perth

Timeline for the Incident

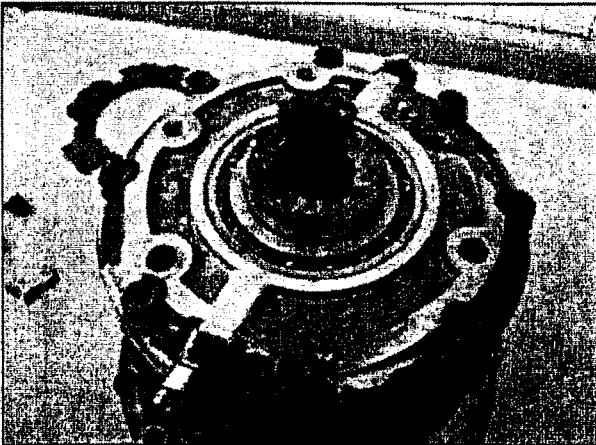
Date / Time	Details
08 April 2005	
1515hrs	Mohd Hassin commenced final 2 hour shift for the day, driving the Tower Crane, working cargo on MV Finex Trader.
1737 hrs	<p>Two containers being lifted began to fall back to the ships deck due to the boom lowering in an uncontrolled manner. The crane driver attempted to keep control of the load by luffing up and lowering the hoist.</p> <p>Load landed onto the deck heavily and the Tower Crane shook on its mountings. Inspection by driver found that one of the two luffing winch drive motors had broken away from the gearbox.</p> <p>Driver determined that the hoist and slewing mechanisms of the crane were fully functional. He slewed the crane, lowered the hoisting attachments then locked all motions to render the crane safe.</p>
11 April 2005	The incident was reported to Comcare.



Photograph 2 Showing Indentation on ships deck.



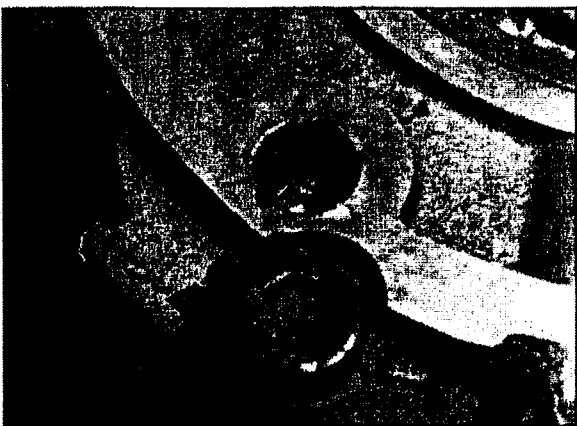
Photograph 3 Showing Failed luffing motor assembly.



Photograph 4 Showing damaged brake unit casing.



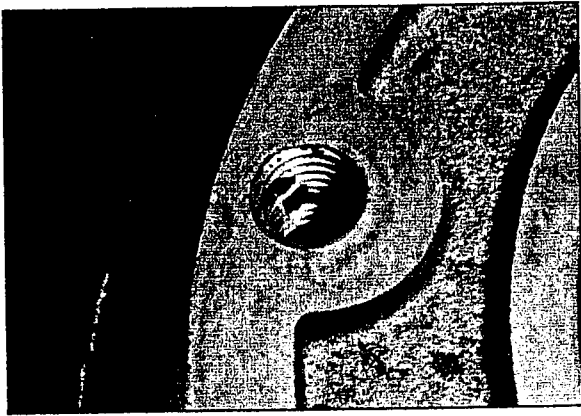
Photograph 5 Showing motor adaptor with sections of brake unit casing.



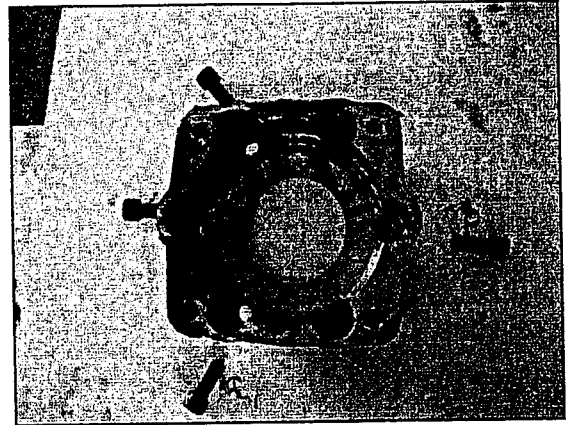
Photograph 6 Showing stripped bolt hole in brake unit casing.



Photograph 7 Showing cap bolt with threads stripped from casing.



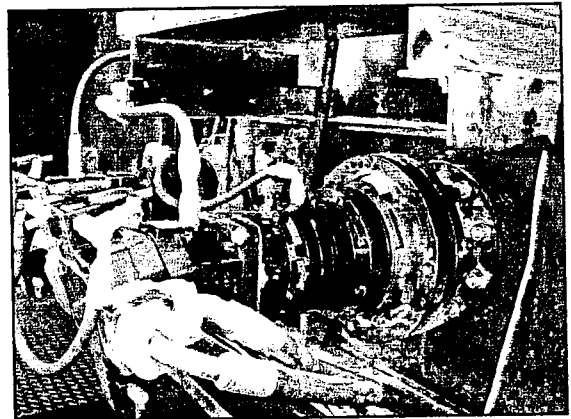
Photograph 8 Showing intact threaded bolt hole in brake unit casing.



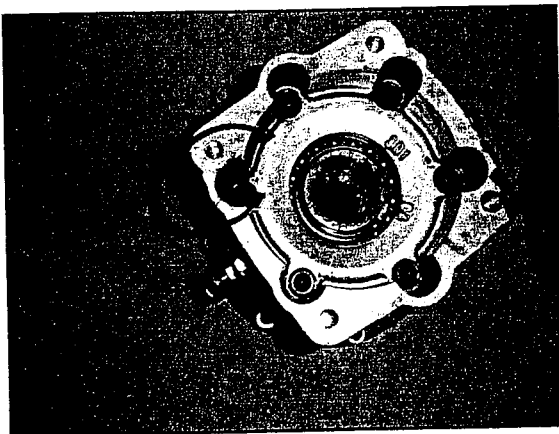
Photograph 9 Showing motor adaptor after removal from motor.



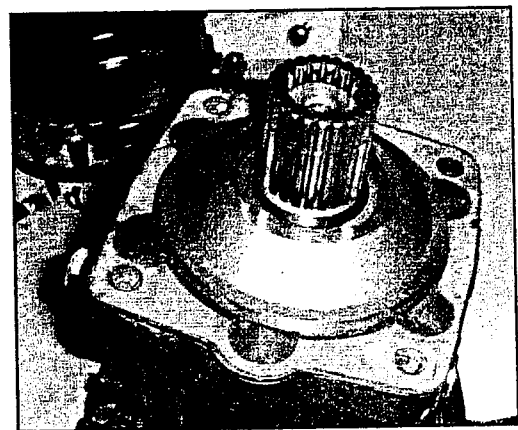
Photograph 10 Showing loose bolt on drive assembly to luffing winch frame.



Photograph 11 Showing new drive assembly attached to luffing winch frame.



Photograph 12 Showing damaged circlip in motor adaptor on winch assembly 2.



Photograph 13 Showing circlip locating groove on drive spline winch assembly 2.



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SRC113
Form 3

Do Not Disturb Notice

Occupational Health and Safety (Commonwealth Employment)
Regulations 1991 Paragraph 34(b)

2957DND1

To Grant Barons, Director, Transport and Regional Services (DOTARS), WA

I, Robert James (Gerry) Gherardin an investigator appointed under section 40 of the *Occupational Health and Safety (Commonwealth Employment) Act 1991*, direct that:

the Savelle Favco Tower Crane, Comcare Licence No. 946, Design Registration Worksafe WAC19270, Model M760DW, Serial Number 1145 involved in the incident on Friday 8 April 2005 at Christmas Island when the luffing motor sheared off and the load was dropped.

is not disturbed during the period from: 4:00 pm on 11 April 2005
to: 5:00 pm on 15 April 2005

The reasons for issuing this notice are:

An investigation into this incident is being conducted by Investigator David House under the *Occupational Health and Safety (Commonwealth Employment) Act 1991*. This notice is to ensure that the investigator can examine the plant and equipment in the condition that it was immediately after the incident. The crane is not to be used until it has been inspected and considered safe by a competent person.

Note: The crane technician that has been arranged by DOTARS is to contact the investigator (Davis House) once he has assessed the problem.

Signed: _____

(Investigator)

Dated: 11 4 105

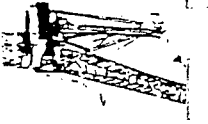
(See Notes over)

Page 1 of 2

Copy 1: Responsible Person
Copy 2: Comcare
Copy 3: Investigator

NOTES

1. Under subsection 45 (3) of the Act, this direction must be displayed in a prominent place at the workplace:
 - (a) that is, or the specified part of which is, under this direction, to be left undisturbed; or
 - (b) at which the plant, substance or thing that is, under this direction, to be left undisturbed, is located.
 2. Under subsection 45 (5) of the Act, an employer who has control over the workplace, plant, substance or thing to which this direction relates, and whose employees use the workplace, plant, substance or thing in the performance of work for the employer, must ensure that this direction is complied with. The penalty for non-compliance with this requirement by a Government business enterprise is \$25 000.
 3. Under subsection 48 (1) of the Act, any of the following persons may, in writing, ask the Australian Industrial Relations Commission to review the investigator's decision, under section 45 of the Act, to give this direction:
 - an employer affected by the investigator's decision;
 - a person to whom a notice has been issued under subsection 29 (2) or 47 (1) of the Act;
 - the health and safety representative or an involved union for a designated work group in which is included an employee affected by the decision;
 - if there is no such designated work group — an involved union in relation to the employee;
 - the owner of any plant, substance or thing to which the investigator's decision relates.
 4. Under subsection 48 (3) of the Act and subject to section 48, the making of an appeal against a decision by an investigator, under section 45 of the Act, to give this direction does not affect the operation of the decision or prevent the taking of action to implement the decision, except to the extent that the reviewing authority makes an order to the contrary.
 5. Under section 50 of the Act, this direction must not be tampered with or removed before the notice has ceased to have effect. The penalty for tampering with or removing this direction is \$3 000 or imprisonment for 6 months, or both.
-



**FAVELLE
FAVCO**
the cranimakers



Favelle Favco Cranes Pty. Ltd.
A.B.N. 29 067 562 449
A subsidiary of Mubibah Engineering (M) BHD
28 Yarrunga Street, Preston
P.O. Box 456, Liverpool
N.S.W. 2170 Australia
Tel: (02) 9607 0055, 9608 2000
Fax: (02) 9607 0022
Telex: AA121559

Service Docket No. 11802

JOB No. 5700091

CLIENTS ORDER No.

CLIENT
SITE ADDRESS
CHRISTMAS ISLAND
CRANE TYPE 760 BX SERIAL No. 1145

DATE	HOURS WORKED		ORD. TIME	PENAL TIME	TRAVEL TIME	kms	No. Men
	FROM	TO					
11.4.05	6:30am	6:30pm					
15.4.05	6:30am	6:30pm					

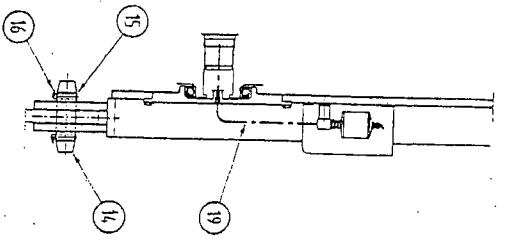
CLIENTS Representative Nick M. Nisbett
Signature [Signature]

JOB COMPLETE? YES / NO

SERVICE MECHANIC (S) N. Callaghan

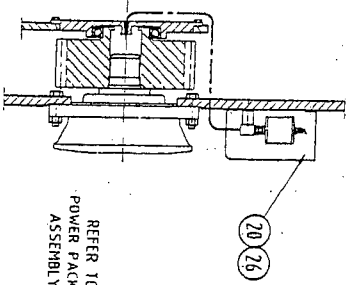
Description of Work

Description of Work	Materials		Office Use Only
	Qty	Part No.	
DISUAL ASSESSMENT OF CRANE. REPAIR REMOVE ONE BEARING MOTORS & BEARING HOLES. REPAIR NEED MOTOR & BEARING HOLES. REPAIR GEAR BOX WITH OIL & BRAKE TIGHTENING WHEELS. REPAIR HOLES HOSES TO SYSTEM. CHECK ALL PARTS & FINE UP ENGINE. TEST FUNCTIONS ALL OPERABLE. SET HUB MOUNTS FOR UP, DOWN & SWAY & STABILISERS. REMOVE LOGS AND BEARING MOTORS & BEARING HOLES. REPAIR 8 OUT OF 10 GEARBOX TO CORRECT BEARING MOTORS. TIGHTEN UP BOLTS TO 204 MM & LOCKING WASHERS. REPAIR 2 OFF DRIVE MOTORS & BEARING HOLES. REPAIR UP 14.5 TOR & CHECK FUNCTIONS BY CHECK ALL PARTS & DETAILS TO TEST PROPERLY. DO OVERHAUL WAYS TO TEST PROPERLY OK.			
Recommended Repairs			
Parts Required			



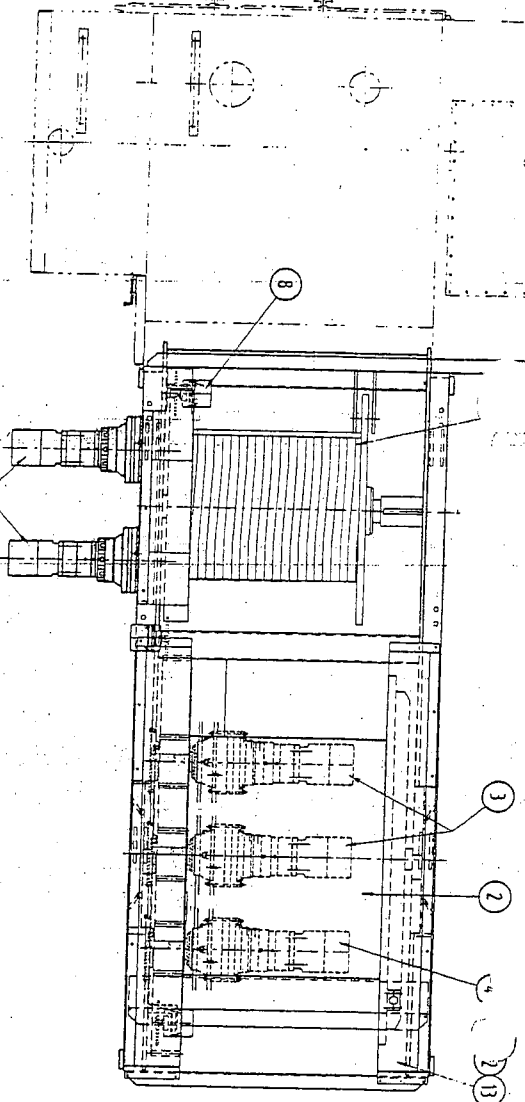
SECTION A-A
TYP. FOR ALL 6 LUGS

DRILL $\phi 10$ & $\phi 12$
HOLES AT ASSEMBLY
TO SUIT OILERS & COVERS.

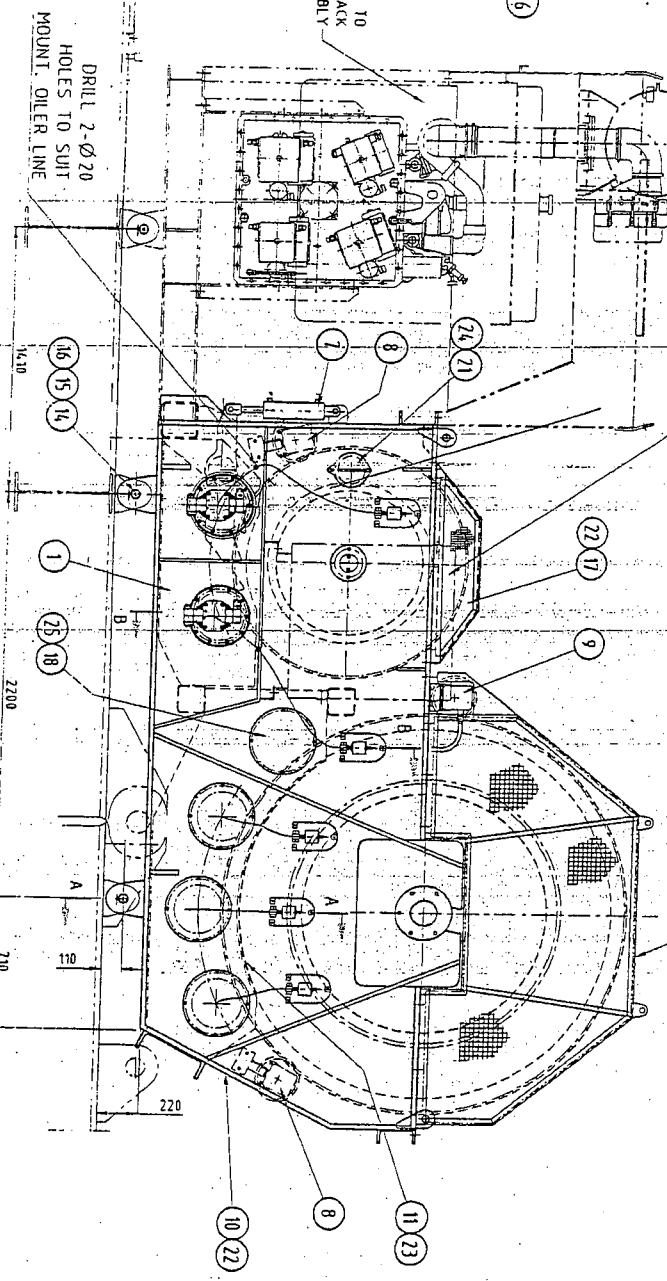


SECTION B-B

REFER TO
POWER PACK
ASSEMBLY



OIL COOLER
REFER TO
HYDRAULIC CIRCUIT



DRILL 2- $\phi 20$
HOLES TO SUIT
MOUNT. OILER LINE

WEIGHT ASSY	WINCH ASSY (Empty drums) - 11.8 T
	WINCH ASSY (with ropes) - 14.6 T
	HOIST DRUM ASSY (double tail rope) - 6.85 T
	LUFF DRUM ASSY (with rope) - 3.1 T

DO NOT SCALE FROM DRAWING. IN THE DRAWING ASK THE CIVIL ENGRG. DEPT.

THIS DRAWING BEING THE PROPERTY
OF FAVELLE FAVCO IS NOT TO BE REPRODUCED
OR USED FOR ANY OTHER PURPOSE
WITHOUT WRITTEN PERMISSION.

Material List

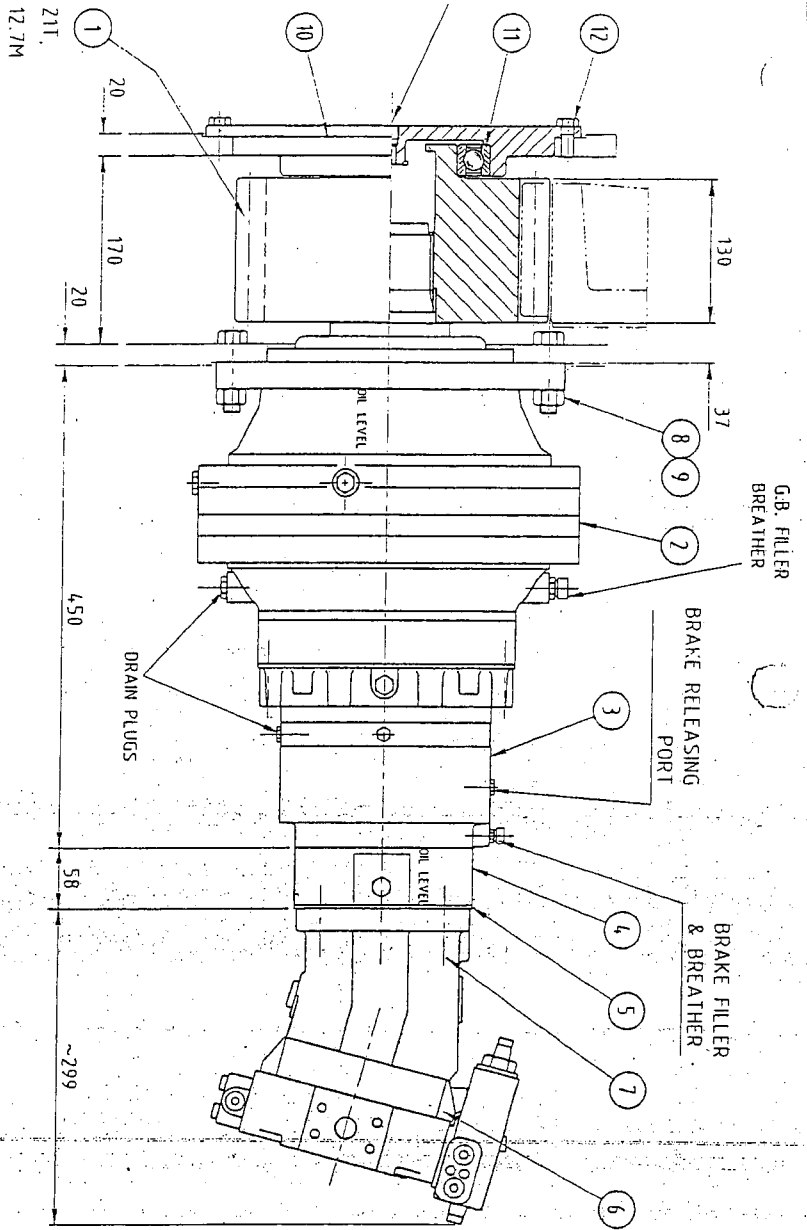
Col Item	code	Qty	Description	reference	kg
1	REF	1	WINCH FRAME DETAIL'S	A3-2310.214	3160
2	REF	1	HOIST DRUM ASSEMBLY	A3-2320.256	5220
3	REF	2	DRUM DRIVE ASSY - Hoist	A3-2390.237	590
4	REF	1	DRUM DRIVE ASSY - Hoist	A3-2390.293	281
5	REF	1	LUFF DRIVE ASSEMBLY	A3-2330.257	1860
6	REF	2	DRUM DRIVE ASSY - Luff	A3-2350.025	75
7	REF	1	LUFF RATCHET ASSY	A3-2370.002.003	10
8	REF	2	L. SWITCH ASSY - Hoist & Hoist	A3-2310.104.003	5
9	REF	1	L. SWITCH ASSY - Hoist	A3-2315.167	20
10	REF	1	HOIST DRIVE COVER	A3-2315.210	45
11	REF	1	HOIST GEAR GUARD	A3-2315.187	42
12	REF	1	HOIST FLANGE GUARD	A4-2311.018	18
13	REF	1	HOIST FLANGE GUARD	A4-2315.186	15
14	REF	6	HOLD DOWN PIN	A4-2315.185	8
15	CP	12	CLEVIS PIN - "Spares"	P/No. 5.14.45	-
16	GC	12	GRIP CLIP - "Spares"	P/No. 5.10	-
17	REF	1	LUFF GEAR GUARD	A4-2315.186	15
18	REF	1	LUFF GEAR GUARD	A4-2315.185	8
19	REF	5	SPLINE MAINTENANCE	A4-2394.010	5
20	REF	5	OILER COVER	SK-3336	10
21	REF	1	$\phi 180$ ACCESS HOLE COVER	A4-2315.189	4
22	HEX	26	BOLT M10 x 40 C/W NUT	ST. STEEL	-
23	HEX	4	BOLT M10 x 50 C/W NUT	ST. STEEL	-
24	HSS	2	SCREW M10 x 25	ST. STEEL	-
25	HSS	4	SCREW M12 x 25	ST. STEEL	-
26	HEX	15	BOLT M8 x 40 C/W NUT	ST. STEEL	-

NOTE:

1. U.O.N. ALL BOLTS TIGHTENED TO DWG. A3-9900.214

Checked	9.05.03	ORIGINAL ISSUE	Revision	ECH	Name	Issue	
Date	9.05.03	Scale	1:20	Drawn	L.ZUBIC	Approved	
<p>FAVELLE FAVCO Fovelle Fovco Cranes Pty. Ltd. A subsidiary of Moulton Engineering (A) BHD First floor 5th Fl., 115 M7600D - CHRISTMAS ISLAND Activity No. 238</p>							
The WINCH ASSEMBLY		Sheet	1 of 1	Weight	18000 kg	Volume	A
Drawing No. L.ZUBIC		Scale	1:20	Drawing number			A2-2300276

FOR SPLINE MAINTENANCE
REFER A4-2394.010
SEE WINCH ASS.Y



ATTENTION: MAINTENANCE PERSONNEL

USE ONLY OIL AS NOMINATED IN
CRANE MANUAL, SECTION 4 TO FILL
GEARBOX, BRAKE AND MOTOR.
DO NOT OVERFILL GEARBOX OR BRAKE.

DO NOT SCALE FROM DRAWING
IF IN DOUBT ASK FIC PTY LTD ENGINEERING DEPT.

Item Code	Qty	Description	Reference	kg
1	1	DRIVE PINION	A4-2394.005	53
2	1	GEARBOX	24.5	115
3	1	BRAKE		29
4	1	MOTOR ADAPTOR		2
5	1	MOTOR GASKET	A3-2394.003	-
6	1	MOTOR HYDRAULIC MOTOR		34
7	4	HEX M12 x 40	GR 8.8	-
8	10	HEX M16 x 60	GR 8.8	-
9	10	NUT M16	GR 8	-
10	1	BEARING HOUSING	A3-2391.023.005	17
11	1	BR BEARING (120/180/28)	6024-2RS1	2
12	4	HEX M12 x 30	GRADE 8.8	-

NOTES

1. MATERIAL LIST IS FOR ONE (1) DRIVE ONLY. REFER TO WINCH ASSEMBLY FOR NUMBER OFF REQUIRED.
 2. FULLY CLEAN MATING SURFACE OF GEARBOX AND WINCH AND THEN APPLY "LOTTITE 277" TO PROVIDE FRICTION JOINT.
 3. U.O.N. ALL BOLTS TIGHTENED TO DWG. A3-9900.214. *Note: (1) M400*
- ** TO BE ORDERED WITH SHAFT SEAL REMOVED AND A LEVEL PLUG ON THE SHAFT CENTERLINE

THIS DRAWING REMAINS THE PROPERTY OF FAVELE FAVCO CRANES PTY LTD AND MUST NOT BE USED OR COPIED WITHOUT WRITTEN PERMISSION.

Project	760-515-32-12		Title		LUFF DRUM DRIVE ASSEMBLY	
Project	760-515-32-12		Title		LUFF DRUM DRIVE ASSEMBLY	
Checked	22.02.01	DATE CHANGED TO USE OUTRIGGER BEARING WITH SHAFT ADJUST SHAFT	Checked	2.02.01	DATE ORIGINAL ISSUE	Revision
Checked	2.02.01	DATE ORIGINAL ISSUE	Checked	2.02.01	DATE ORIGINAL ISSUE	Revision
Drawn	L.Zubir	Scale	1 of 1	Weight	1235 kg	W/Firm
Approved	B.M.	Scale	1:5	Drawing Number	A3-2390.238	Issue
FAVELLE FAVCO Fovelle Favco Cranes Pty. Ltd. A subsidiary of Mulhens Engineering (Pty) BHD ACN. 087 582 419 First Used On S/No. 106.3			Activity No. 230 Project: 760-515-32-12 Title: LUFF DRUM DRIVE ASSEMBLY			

PC07 Favelle Favco 770

Index #:	PC07	Object Name:	Favelle Favco 760DW	Current Units:	1046
Year:	2003	Make:	Favelle Favco	Model:	760DW
Date Purchased:	06-12-2003	Purchase Cost:		Purchase Units:	0
Dotars No.:	n/a	SAP Number:	n/a	Asset No.:	n/a
SWL:	51 Tonnes	Test Cert:	???????	Manufacturer:	Favelle Favco
Reg No.:	WAC19270				

- History Report -
Printed: 13/04/2005

Date	Hours	Maintenance Performed	Service Provider	Cost
<u>12 Month Service</u>				
22/12/2004	720	12 Month Service	Favelle Favco	\$0.00
Comments: Service carried out by Stuart Bateman. Failed to leave service report				
Subtotal:				\$0.00
<u>3 Month Service</u>				
6/12/2003	22	3 Month Service	C.I. Ports	\$0.00
Comments: Crane commenced operations 6/12/03 & first 3 month service scheduled for 6/3/04				
22/03/2004	301	3 Month Service	Favelle Favco	\$0.00
Comments: All open gears need greasing				
25/06/2004	400	3 Month Service	Favelle Favco	\$0.00
Comments: Completed with 6 month service				
27/09/2004	615	3 Month Service	Favelle Favco	\$0.00
Comments: Stuart carried out service Job No. 1-1145-060				
22/03/2005	1,046	3 Month Service	Lift & Loader Servicing	\$0.00
Comments: Fit up 2 only Racor Fuel Filters & Hoses				
Subtotal:				\$0.00
<u>Month Service</u>				
25/05/2004	381	6 Month Service	Favelle Favco	\$0.00
Comments: minor oil leaks, slewing ring floor check plates cracked, horn not working - All Items repaired at service				
Subtotal:				\$0.00
<u>Comcare Licence 946</u>				
14/01/2004	22	Comcare Licence 946	Comcare Australia	\$90.00
Comments: 4 year Licence issued on 14/1/04 & expires 13/1/08 (PH 1300 366 979)				
Subtotal:				\$90.00
<u>General</u>				
11/03/2005	720	General	Lift & Loader Servicing	\$487.50

History Report - PC07 Favelle Favco 770

Printed: 13/04/2005

Date	Hours	Maintenance Performed	Service Provider	Cost
		Comments: Retorque tower bolts		
7/11/2004	655	General	C.I. Hydraulic Hoses	\$405.00
		Comments: Remove faulty batteries, fit battery isolater, adjust & test alternator		
30/09/2004	615	General	C.I. Hydraulic Hoses	\$357.50
		Comments: Replace hydraulic hose - warranty claim		
13/03/2005	720	General	Lift & Loader Servicing	\$325.00
		Comments: Assist Favco Technician to replace tower bolts		
15/10/2004	615	General	C.I. Hydraulic Hoses	\$292.50
		Comments: Diagnos & rectify start fault - re battery flat		
8/03/2005	720	General	Lift & Loader Servicing	\$292.50
		Comments: Attend to fuel problem		
1/03/2005	720	General	Lift & Loader Servicing	\$292.50
		Comments: Replace o rings on luffing motor hoses, diagnose slew fault and repair door locks		
13/08/2004	540	General	C.I. Hydraulic Hoses	\$0.00
		Comments: Diagnose hydraulic fault in hoist (emergency lowering valve opened?)		
10/11/2004	720	General	C.I. Hydraulic Hoses	\$240.41
		Comments: Fitted 2 new batteries (N70Z) as suspected damaged by charging each @ 24 volts (key had been left on to cause battery drain)		
9/03/2005	720	General	Lift & Loader Servicing	\$235.50
		Comments: Modify fuel line & fit Racor filter		
9/02/2005	720	General	C.I. Hydraulic Hoses	\$97.50
		Comments: Repair slew shudder fault		
17/02/2005	720	General	C.I. Hydraulic Hoses	\$65.00
		Comments: Repair luffing limit fault		
13/03/2005	900	General	Favelle Favco	\$0.00
		Comments: Retensioned tower bolts & ordered s/s shims to replace corrode m/s shims in crane legs		

Subtotal: \$3,350.91

Wire Rope Grease

27/10/2004	655	Wire Rope Grease	Christmas Island Enterprises	\$3,840.00
		Comments: greased ropes using mobile crane & used in excess 40 litres grease		

Subtotal: \$3,840.00

Total Maintenance Cost: \$7,280.91

Cost Per Hours: \$0.000

4.6.4 Maintenance Log

(This is a general maintenance sheet and items not applicable are to be deleted).

Refer also to sections

- 3.4 : Check lists
- 4.2 : Maintenance - detailed
Lubrication Diagram

DAILY MAINTENANCE/CHECKS

ITEM	(WHERE APPLICABLE) MARK S OR MARK U S CRITERIA SATISFACTORY/UNSATISFACTORY							OPERATORS NAME & CERT NO & SIGNATURE
	Mon	Tue	Wed	Thur	Fri	Sat	Sun	
TIME								
OVERALL INSPECTION								
CHECK ENGINE OIL LEVEL								
CHECK RADIATOR WATER LEVEL								
CHECK DIESEL FUEL LEVEL								
CHECK PUMP DRIVE OIL LEVEL								
CHECK HYDRAULIC OIL LEVEL								
CHECK ENGINE AIR CLEANER								
CHECK HOIST ROPE LAY								
CHECK THE ANNUNCIATOR TO ENSURE THE VISUAL AND AUDIBLE ALARMS ARE WORKING								
CHECK THE HOIST UP LIMIT								

CHECK THE HOIST DOWN LIMIT								
CHECK THE LUFF IN LIMIT								
CHECK THE LUFF OUT LIMIT								
CHECK THE ENGINE/ CRANE BATTERY (IF APPLICABLE)								
CHECK POWERPACK HOLDING DOWN BOLTS/PINS								
CHECK THE EMERGENCY STOP FUNCTION								
CHECK THE SLEW LIMITS								
Remarks								

MAINTENANCE LOG	WEEKLY OR EVERY 40 WORKING HOURS						
DATE							
TIME							
OVERALL INSPECTION INCLUDING VISUALLY CHECKING FOR OIL LEAKAGE AROUND THE POWERPACK AND THE WINCH.							
CHECK OPERATION OF LUFF RATCHET							
CHECK THE HOIST ROPE FOR DEFECTS AND/OR FAILURE							
CHECK THE LUFF ROPE FOR DEFECTS AND /OR FAILURE							
INSPECT & GREASE SLEW RING BEARINGS							
INSPECT & GREASE THE HOIST DRUM GEAR							
INSPECT & GREASE THE LUFF DRUM GEAR							
INSPECT & GREASE THE SLEW RING GEAR							
GREASE THE BOOM HEEL BUSHES							
Remarks							

MAINTENANCE LOG	MONTHLY OR EVERY 100 WORKING HOURS							
DATE								
TIME								
CHECK THE ENGINE OIL LEVEL								
CHECK THE RADIATOR WATER LEVEL								
CHECK THE PUMP DRIVE OIL LEVEL								
CHECK THE HOIST BRAKE								
INSPECT & GREASE THE SHEAVE BEARINGS OF MAST, BRIDLE, BOOM AND HOOK SHEAVES ASSEMBLIES								
INSPECT & GREASE HOIST DRUM BEARINGS								
INSPECT & GREASE LUFF DRUM BEARINGS								
INSPECT & GREASE HOIST DRUM DRIVE BEARINGS								
INSPECT & GREASE LUFF DRUM DRIVE BEARINGS								
INSPECT & GREASE SLEW DRIVE BEARINGS								
INSPECT THE HYDRAULIC OIL TANK								
Remarks								

MAINTENANCE LOG	EVERY THREE MONTHS OR 250 WORKING HOURS							
DATE								
TIME								
INSPECT & GREASE HOIST DRUM BEARINGS								
INSPECT & GREASE LUFF DRUM BEARINGS								
INSPECT & GREASE HOIST DRUM DRIVE BEARINGS								
INSPECT & GREASE LUFF DRUM DRIVE BEARINGS								
INSPECT & GREASE SLEW DRIVE BEARINGS								
LUBRICATION OF LIMIT SWITCH DRIVES								
INSPECT THE HYDRAULIC OIL TANK								
Remarks								

MAINTENANCE LOG	EVERY 10000 WORKING HOURS							
DATE								
INSPECT THE SLEW DRIVE SPLINED PINIONS								
INSPECT THE LUFF DRIVE SPLINED PINIONS								
INSPECT THE HOIST DRIVE SPLINED PINIONS								
Remarks								

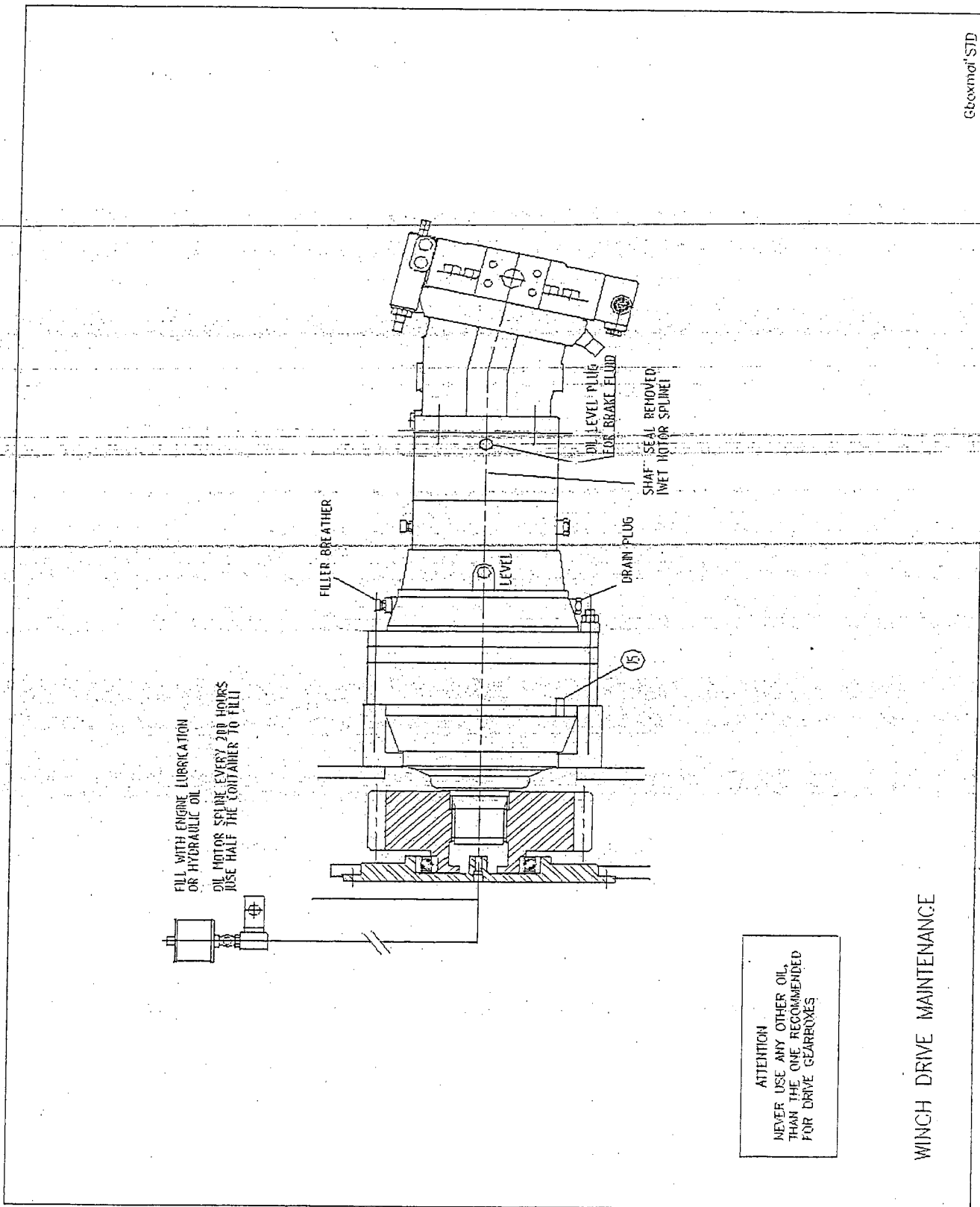


Figure 4-2 Hoist, Luff and Slew Drive Maintenance

STATEMENT OF WITNESS

Statement of: Mohd Hasinudin Hassin
Occupation: Plant Operator
Employer: Indian Ocean Stevedores
Contact Address: PO Box 125
Christmas Island 6798
Contact Telephone No: 08 91648454

This statement, consisting of one page, signed by me, is true to be best of my knowledge and belief.

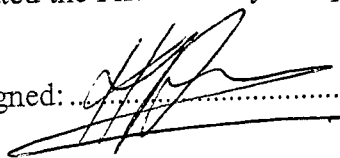
Included in my operator duties is operating the Favelle Favco Wharf Crane. I have a Certificate of Competency class CT number W0299496 dated 30 May 1996. On Friday 8th April 2005 I started at 0630 hrs, there were two operators rostered. We are on a two-hour turn around roster. Two hours in the crane cab and two hours on general stevedoring duties. I commenced my last crane-driving roster at around 1515 hrs, the incident occurred at around 1745 hrs.

Just before the incident I had picked up two containers, stacked two high from location B5 at the right end on the Port side of the ship. My boom was at an angle of between 30 and 20 degrees elevation close to the maximum radius. I lifted the load on the hoist rope, as soon as the load was off the deck I boomed up and at the same time I hoisted down to control the load. The load was in a stable condition and when the boom reached an angle of 40 to 45 degrees before slewing the boom just dropped by itself. I heard a noise that sounded like the winch speeding up. I tried to boom up and lowered the load by the hoist, trying to gain full control of the load. The boom kept lowering very fast, similar to a free fall of the boom. I was worried for one of the trainees, who in my view was walking towards where the load was going to drop. I kept watching the load until the load was on the deck, I was very concerned for the trainee.

When the load was on the deck the boom stopped. After a couple of seconds the whole of the crane structure was shaking, probably due to the brakes applying quickly. I was in a shocked state and sat in the cabin wondering what had happened. One of the workers came up to the cab and asked if I was OK, he told me that the boom motor had broken in two pieces. I left the cab to have a look and found that the hoist could be used. I told the ships crew to unhook the lifting gear, I hoisted up and then slewed the crane away from the vessel. The crew unhooked the spreader; I parked the crane in safe location, locked the slewing mechanism and shut the crane down.

Dated the Fifteenth day of April 2005.

Signed:



Signature witnessed by:



STATEMENT OF WITNESS

Statement of: Neil Mc Govern
 Occupation: Ship Owners Agent & Port Loadmaster
 Employer: N & R Marine Surveying
 Contact Address: PO Box 103
 Christmas Island 6798
 Contact Telephone No: 0439215210

This statement, consisting of one page, signed by me, is true to be best of my knowledge and belief.

On Friday 8th April 2005 at 1737 hrs local time I was positioned to the north side of the Favelle Favco Crane adjacent to the Quarantine wash down bay. I heard a scream from the crane driver over channel 69 on the VHF radio in my car. I could see all that was happening on the main deck of the Finex Trader from this location. I saw the two empty that were being lifted, fall back onto the main deck as the boom lowered. I could see the hook block, hoist rope and boom head from this position. The speed of the lowering appeared to be similar to that of being lowered under power.

The ship was rolling and pitching and the inshore side of the bottom container hit the deck with force, leaving an indentation into the steel deck. When the container had fully landed it slid a few metres across the deck away from the crane. The boom was still lowering, it caused the lifting arrangement to go slack, the spreader bar with slings landed on the seaward side of the container. At that point the crane boom stopped lowering and the whole structure shook, my assumption was that this occurred due to the brakes being applied.

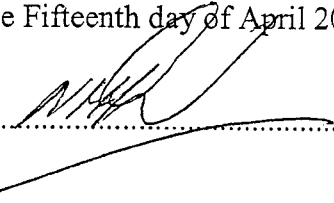

The whole event would have taken no more than ten to fifteen seconds.

My view is that the container was lowered to the deck by the main hoist rope as a reaction by the crane Driver.

Weather conditions were that there had been rain during the day, a light easterly wind of less than ten knots 0.5 metre. The ship was in a light condition and there was a backwash off the cliff, which amplified the swell. The ship was reacting badly to what was a seemingly reasonable weather conditions, it was dusky due to the overhead cloud.

Please note that the crane operates far more than a similar crane would on a normal construction site. We ship out 7000 metric tonnes of bagged phosphate per month in sixteen and twenty tonne lifts. In addition the crane has picked up 12000 tonnes of aggregate by grab over the past eight weeks as well as the normal operations of 100 full and 100 empty containers per month. The crane will be under considerable duress during the construction of the IRPC facility which is due to commence in the near future.

Dated the Fifteenth day of April 2005.

Signed:  Signature witnessed by: 

STATEMENT OF WITNESS

Statement of (full name): David Calcott
Occupation: Service Technician - Shop Floor Supervisor
Employer: Favelle Favco Cranes
Contact Address: Favelle Favco Cranes
28 Yarrunga St
Prestons NSW 2170
Contact Telephone No: 02 96082000

This statement, consisting of one page, signed by me, is true to be best of my knowledge and belief.

I arrived at the crane site and carried out a visual inspection of the crane tower whilst climbing to the crane upper. On arrival at the crane machinery deck I saw the Rexroth hydraulic drive motor detached from the brake unit and realised that there was an adaptor failure between the Rexroth motor and Brevini brake unit.

On further inspection I came to the conclusion that through constant vibration of the system, two of the bolts had unscrewed from the adaptor, leaving four bolts to hold it. Further vibration to the system allowed two more bolts to fail by stripping the threads from the brake unit. This left only two bolts to hold the units together. These two bolts were insufficient to retain the motor, leading to failure of the casing. We removed both Brevini brake units from the gearbox on both drives and replaced them with brand new units.

On further inspection I found the main retaining bolts from the gearbox to the main winch frame were loose. I removed the drive pinions, replaced eight out of the ten bolts, applied Loctite to the nuts and then re torqued them.

On completion of the work I carried out load testing to Christmas Island Ports requirements and Favelle Favco Commissioning procedures. I also carried out a visual inspection of the crane boom, pendent rope pins and all other components that may have been affected by shock loading, all appeared to be satisfactory.

Dated the Fifteenth day of April 2005.

Signed: Signature witnessed by:

Christmas Island Ports Procedure Document

C.I. Ports

Favelle Favco

M760DW

Registration Number WAC 19270

Comcare License number 946

Test Procedure

Purpose

To provide a format for testing the crane which will ensure its integrity following the repair of the crane after failure of a luff motor on 8th April 2005

Scope

The procedure covers functional requirements of the cranes operation, as well as incorporating safety and overload

Responsibilities

- *Favelle Favco* – Provide technical personnel to carry out Tests
- *Port* – Provide personnel to witness tests, assist with rigging and test loads.

Procedure

1. No Load Function tests.

1.1 Limits

1.1.1 Hoist Limits

- Up –stops hoist up motion
- Down – stops hoist down motion
- Up Ultimate - Stops engine
- Hoist up Deceleratio – slows hoist up motion



1.1.2 Luff Limits

- In Ultimate – stops engine
- Out – Stops luff out motion
- Luff In Deceleration and stop



1.2 Anti-cavitation switch

1.2.1 Hoist

1.2.2 Luff



- 1.3 Slew Brake – operation
- 1.4 Luff Pawl – engagement and release
- 1.5 Emergency Stop switch – operation
- 1.6 Safe Load Indicator – check calibration



2. Overload Tests.

2.1 Overload at maximum radius

(lift - hold suspended for five minutes with controls in neutral)

	Design	Actual	
Static Load (13.0 + 25%)	16.25T	16.6T	(PT)
Test radius	53.0	52.9	(PT)
Luff Load	101.0T	N/A.	
Luff Pressure	357 Bar	320 BAR	DL
Hoist Pressure	223 Bar	210 BAR.	DL
Hoist Drum Rope layer	2nd	2nd.	(PT)
Luff Drum Rope layer	1st	1st	(PT)

2.2 Luff - line pull test and Dynamic structural test.

(Lift load at maximum radius- luff up to 40m radius –luff out to maximum radius)

	Design	Actual	
Load (13.0 + 10%)	14.3T	14.3.	(PT)
Test radius	53.0	52.9.	(PT)
Luff In radius	40.0	30.0	DL
Luff Out radius	53.0	52.9.	(PT)

2.3 Dynamic structural test.

(Lift load - slew 360°)

	Design	Actual	
Load (19.2 + 10%)	21.12	21.4 TON.	DL
Test radius	45.0	45.0	(PT)
Slew 360°	40.0	360°	(PT)

Christmas Island Ports Procedure Document

Date Test conducted... 15:4:05

CI Ports Representative

Third Party Representative

Name... NEIL M NEILL

Name.....

Position... WHARF MANAGER

Position.....

Signature... 

Signature.....

Statement By Competent Person

This plant Item has been repaired and inspected to manufacturers specification and is safe to operate.

Date of Inspection... 15:4:05 Details of competent persons employer

Name... DAVID CALCOTT

Name... FAUELLE FAUCCO... CRANES

Position... SERVICE TECHNICIAN

Address... 28 YARRUNGA ST PRESTONS

Signature... 

State... NSW Postcode... 2170

- 1.3 Slew Brake – operation
- 1.4 Luff Pawl – engagement and release
- 1.5 Emergency Stop switch – operation
- 1.6 Safe Load Indicator – check calibration



2. Overload Tests.

2.1 Overload at maximum radius

(lift - hold suspended for five minutes with controls in neutral)

	Design	Actual	
Static Load (13.0 + 25%)	16.25T	16.6T	(16.6)
Test radius	53.0	52.9	(52.9)
Luff Load	101.0T	N/A.	
Luff Pressure	357 Bar	320 BAR	(320)
Hoist Pressure	223 Bar	210 BAR.	(210)
Hoist Drum Rope layer	2nd	2nd.	(2nd)
Luff Drum Rope layer	1st	1st	(1st)

2.2 Luff - line pull test and Dynamic structural test.

(Lift load at maximum radius- luff up to 40m radius –luff out to maximum radius)

	Design	Actual	
Load (13.0 + 10%)	14.3T	14.3.	(14.3)
Test radius	53.0	52.9.	(52.9)
Luff In radius	40.0	30.0	(30.0)
Luff Out radius	53.0	52.9.	(52.9)

2.3 Dynamic structural test.

(Lift load - slew 360°)

	Design	Actual	
Load (19.2 + 10%)	21.12	21.4 Ton.	(21.4)
Test radius	45.0	45.0	(45.0)
Slew 360°	40.0	360°	(360°)

Christmas Island Ports Procedure Document

Date Test conducted..... 15:4:05

CI Ports Representative

Third Party Representative

Name..... NEIL M NEILL

Name.....

Position..... WHARF MANAGER

Position.....

Signature..... 

Signature.....

Statement By Competent Person

This plant Item has been repaired and inspected to manufacturers specification and is safe to operate.

Date of Inspection..... 15:4:05

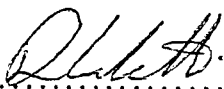
Details of competent persons employer

Name..... DAVID CALCOTT

Name..... FAUELLE FAUCO..... CRANES.....

Position..... SERVICE TECHNICIAN

Address..... 28 YARRUNGA ST PRESTONS.....

Signature..... 

State..... NSW..... Postcode..... 2170.....