

Working Historic Machinery: Policy and Procedures

1. Introduction

This document sets out in general terms how Amgueddfa Cymru – National Museum Wales (AC-NMW) manages working historic machinery on its premises in order to comply with the requirements of the following regulations:

The Health and Safety at Work Act 1974 (HSW Act 1974)

The Management of Health and Safety at Work Regulations 1999 (MHSWR)

The Provision and Use of Work Equipment Regulations 1998 (PUWER)

The Provision and Use of Work Equipment Regulations 1998 Approved Codes of Practice (PUWER98 ACOP)

2. Philosophy

AC-NMW operates historic machinery from its collections to give greater understanding of their purpose and significance to the general public.

Operation may also contribute to the preservation of the machine through the distribution of lubricants, preventing the seizure of moving parts and retain operation and maintenance skills.

Although many of the machines we operate are not run at their original speeds or under the same stresses and strains, AC-NMW has an obligation under law to prevent any potential risk to members of staff and the public, as well as ensuring the preservation of items within its collections.

The primary objective of the PUWER 98 regulations are to ensure that work equipment should not result in any health and safety risks. Therefore historic machinery, regardless of their age, condition or origin must be maintained in accordance with this legislation.

3. Responsibilities

All site managers where historic or workshop machinery are used have duties under PUWER 98.

Employees DO NOT have duties under PUWER 98 but do have general duties under the HSW Act 1974 and the Management of Health and Safety at Work Regulations 1999 (MHSWR) to take reasonable care of themselves and others who may be affected by their actions, and to co-operate with others.

All work on historic working machinery must be carried out by a competent person with relevant training or experience.

4. Use of historic machinery

Prior to the operation of any historic machinery, AC-NMW need to ensure that they are:

- Suitable for use.
- Safe for use, maintained in a safe condition and inspected to ensure this remains the case.
- Used only by people who have received adequate information, instruction and training; and
- Accompanied by suitable safety measures e.g. protective devices, markings, warning signs.

On sites where working historic machinery are operated, the following procedures should be implemented to ensure the safety of staff, public and the object itself.

4.1 Condition survey

Thought should be given prior to the running of any historic machine with regard to its uniqueness, conservation ethics as well as safety. As there are components of a historic machine that are designed to wear and deteriorate, it has to be acknowledged that for the machines continued use, parts **must be** replaced and therefore the object will not be entirely original.

Where replacement of such components is deemed unacceptable it will be necessary to set limits of wear, beyond which, use will not be allowed and the operation of the machine stopped.

A detailed survey of the machine which accurately records the component parts and their condition must be carried out to determine whether the object is in a condition which will allow safe operation. Parts which are designed to wear e.g. bearings should be checked to ensure they have not worn beyond a safe working limit for the tolerances placed on that individual machine.

If the condition survey has found no cause to prevent operation, a full risk assessment should be undertaken to assess any hazards to the operator, staff and public.

An example of a condition survey can be found in Appendix A.

4.2 Risk Assessment

Risk assessments should identify any specific risks and consider the hazards presented during the normal operation by the machine. The assessment should also look at the guarding of dangerous parts, control of the machine, whether regular maintenance and inspections are carried out and the provision of information, training and instruction to operators and staff.

A helpful risk assessment guide for working machines can be found in the HSE publication "Health and Safety in Engineering Workshops."

The condition survey and risk assessment should also include the identification of other hazards not related to the mechanical integrity of the machine. These can include:

- Asbestos e.g. gaskets and lagging in steam boilers and pipework.
- Radiation e.g. radium paint on dials and gauges.
- Chemicals e.g. fuel, oil and coolant from vehicle engines.
- Noise e.g. excessive levels of noise in an enclosed area/gallery when a machine is operated.

Under regulation 12 of the PUWER 1998 approved codes of practice, "every employer shall take measures to ensure that the exposure of a person using work equipment to any risk to his/her health or safety from any hazard specified ...is either prevented, or, where that is not reasonably practicable, adequately controlled."

AC-NMW operates a number of policies to control the hazards mentioned above, and should be referred to in any risk assessment. They can be found on the museum intranet under Health and Safety:

AC-NMW Asbestos Management Plan - Collections
AC-NMW Health and Safety Management Control System
AC-NMW Health and Safety Continuous Monitoring Review

If the condition survey and risk assessment uncover any issues which could potentially compromise the safety of the operator, staff, public and the machine, it is **not** to be operated. The machine should if possible be locked out and the site manager and staff notified.

An example of a risk assessment can be found in Appendix B.

4.3 Guarding Historic Machines

Historic machines rarely have guarding fitted and thus present a conflict between conservation/museum ethics and modern health and safety.

PUWER 98 ACOP regulation 11(1) requires employers to take effective measures to prevent access to dangerous parts of machinery or stop their movement before any part of a person enters a danger zone.

Therefore fixed guards should be provided to enclose every dangerous part where practicable (Regulation 11 (2) a PUWER98 ACOP). Where guarding is not practicable other protection devices must be considered i.e. if the machine can be enclosed behind a viewing screen away from the danger zone and started remotely by the operator this may negate the need for guards being fitted to the machine.

If dangerous parts of the machine cannot be guarded or alternative methods cannot be employed to ensure its safe use, then the machine must not be operated.

4.4 Installation and Commissioning

Any historic machinery should be installed and commissioned by a competent person and signed off accordingly to verify that installation and commissioning has been carried out correctly and safely.

4.5 Inspection

Regulation 6(2) of PUWER98 ACOP states “Where work equipment is of a type where the safe operation is critically dependent on its condition in use and deterioration would lead to a significant risk to the operator or other worker, you should arrange for suitable inspections to be carried out.”

The need for inspection of working historic machines is imperative to the safety of operators, the public and the object itself. Inspections should be carried out by a competent person when any historic machine undergoes:

- Major modifications, refurbishment or major repair work.
- Substantial change in the nature of use e.g. extended periods of inactivity.
- Has known or suspected serious damage.

Inspection frequency may be dictated by the location of the object, the operational speed and the maintenance history.

Objects kept and run in a harsh external environment will need a higher frequency of inspection. Machines run at low operational speeds will have less wear and deterioration. Regular maintenance inspections of the machine will reveal what parts are vulnerable to wear and how fast or slow deterioration occurs.

Therefore inspection intervals should be reviewed in light of experience i.e. intervals can be extended if the inspection history shows negligible deterioration to moving parts or shortened if considerable wear is seen.

Records must be kept of each inspection for each working historic machine. These can be handwritten or stored electronically and should normally contain:

- Information on the type and model of equipment;
- Any identification mark or number that it has;
- Its normal location;
- The date that the inspection was carried out;
- Who carried out the inspection.
- Any faults; and/or

- Any action taken;
- To whom the faults have been reported;
- The date when repairs or other necessary actions were carried out.

When a historic working machine has been restored or dismantled and re-installed at a new location a suitable inspection must be carried out to prevent significant risk to the operator, public and machine (Regulation 6(1) of PUWER98 ACOP).

4.6 Controls and Control Systems

Under regulations 14 to 18 of PUWER98 ACOP, working historic machinery need to have suitable controls and control systems to ensure the safe starting, running and stopping of the machine.

Where practicable controls should be fitted to machines to prevent accidental activation and be placed away from danger zones i.e. at a distance from the machine.

Machinery that have control systems to regulate the speed of operation e.g. throttles and brakes, must be inspected and maintained to prevent failure.

Emergency stops should be fitted where practicable to machines, in locations easily reached by the operator and by other members of staff in an emergency situation.

Machinery operated by steam or water e.g. steam locomotives and water wheels, where starting and stopping are not as easily controlled, procedures must be put in place for their safe operation and deactivation in the event of an emergency. This can be undertaken in the form of training, warning signage, risk assessments, and operational controls and procedures.

Though sometimes not original, steam engines should be fitted with a means of releasing pressure from the boiler in an emergency situation e.g. fusible plug or safety valve. Also, a means of recording pressure should also be part of the system in the form of a gauge.

If practicable there should be a means of isolating the power source to the machine e.g. fitting lockouts to power switches and stopcocks (regulation 19 PUWER98 ACOP).

4.7 Operation

To ensure appropriate and consistent running of the historic machine an operation procedures manual should be created. This should include initial safety checks; start up procedures, instruction on safe operation and emergency procedures (Appendix C)

4.8 High Temperatures

Historic machinery, when operated, will generate heat, both by its power source .e.g. steam or electricity, and by friction. Where practicable engineering measures (guarding/barriers) should be applied to prevent the operator or public being burned (regulation 13 PUWER98 ACOP).

This may not always be possible e.g. where controls become hot. In these cases appropriate measures must be taken to ensure the safety of operators and the public in the form of personal protection, warning signs, alarms, training, supervision and operational procedures.

4.9 Maintenance

Maintenance schedules must be developed for each historic machine to ensure the safety of operators, staff, public and the machine itself (regulation 5 PUWER98 ACOP). The maintenance schedule should include daily, monthly and annual checks and record any issues viewed by the operator (Appendix D).

Detailed records of any work carried out on a working historic machine must be kept (regulation 5 PUWER98 ACOP). Any original parts replaced to ensure the machines continued running must be kept and records maintained.

5. Training

Under the Health and Safety at Work Act 1974, AC-NMW and Regulation 9 of PUWER98 ACOP an employer must provide adequate information, instruction and training to ensure that staff who operate working machines are competent to do so.

Training records need to be produced and kept of all staff that operate historic machinery. Training is subject to review and appropriate refresher is provided by AC-NMW.

6. Emergencies

Historic machines operated by AC-NMW sites are powered by various means, either electricity, steam or water power. In view of this some machines i.e. those powered by water or steam will not be able to be shut down as rapidly as those powered by electricity.

A comprehensive emergency procedure must be included in the operation manual.

All operators should be competent in isolating power from the machines they operate.

A number of staff on site must be able to isolate the power supply to the machine in the event of the operator being injured.

An emergency procedure for the specific machine must be kept near the machine e.g. on the wall near emergency stops, stop cocks or in the on board tool chest of locomotives.

In the event of a sudden mechanical failure the following procedure should be followed:

1. Quickly assess the situation. Ensure that no one, either yourself; staff or public are in any danger.
2. Shut off the power and if possible lock it out.
3. Inform site manager and all staff of the situation.
4. Site managers should prohibit the use of the machine until further notice.

The Emergency Procedure Flow Chart can be found in Appendix E.

When the historic machine is safely isolated the Site Manager should contact the Keeper of Collections Services and the Principal Conservator Industry so that all parties can decide on the course of action to repair the historic machine.

Appendix A - Example Condition Report (Walker Ventilation Fan)

Working Machinery Assessment BP002

1. MACHINE NAME

Walker Ventilation Fan

2. MUSEUM ACCESSION NUMBER

2001.1 /1 21

3. LOCATION

Fan and Compressor House

4. POWER SOURCE

Electricity

5. STATUTORY CONSIDERATIONS

As this machine is for demonstration purposes only there are no legal obligations as regards the frequency of examinations

6. FREQUENCY OF OPERATION

Maximum of 20 minutes daily



CONDITION SURVEY

Description / History

This machine replaced an earlier mine ventilating fan in 1910, it was electrically driven with power to the impeller being transmitted originally by 2 pulleys and a wide flat drive belt. This belt and both flat pulleys were later replaced by 6 narrower link belts and grooved pulleys.

The impeller is 10' in diameter; it has 10 vanes and has a double air inlet. It rotated at 261 revolutions per minute. This Walker fan stopped working in 1975 when a more efficient machine was installed.

In 2003 Conservation work was carried out to both the drive unit and impeller with a new electric drive unit being installed to enable the impeller to rotate at a much slower rate (8 revs / min)

The Impeller was de-scaled using wire brushes and two of the vanes had to be partially renewed as they were severely corroded.

The impeller and drive shaft were then given 2 coats of Red Oxide paint.

Materials

Varied

Component Condition

Electric Motor

415v – 50hz- 3kw. Motor shaft size 1.5"

Motor appears to be in a good condition; however this is checked by the Electrical Dept

Gearbox Coupling (Input) C1

Renold 6 pin Flexible Coupling (5.75" dia.)

Coupling in good condition, 2mm rotational play measured

Gearbox

RADICON, 40-1 reduction

Gearbox is in a good condition, no oil leakage and levels OK. Inspection cover removed and gear wheel checked. No defects found

Gearbox Coupling (Output) C2

Renold 6 pin Flexible Coupling (6.375" dia.)

Coupling is out of line vertically, (0.025"). Fan not to be operated until re-aligned. Light corrosion to be treated

Drive Pulley Bearing (B1)

Coopers split bearing, 5" Journal

Well lubricated, no signs of wear

Drive Pulley + Shaft

6 V Groove Pulley. – 2'4"x1'

Pulley and shaft in good condition, all bolts and keys secure

Drive Pulley Bearing (B2)

Coopers split bearing, 5" Journal

Well lubricated, no signs of wear, grease nipple replaced

Drive Belts

6 V link drive belts

Belts examined (6 off); slight fraying on edges of belts and all steel rivets connecting links showing signs of corrosion. No splits or cracking found.

Driven Pulley Bearing (B3)

Brass shell split bearing- 6" with 2 lubricating Oil Rings

Bearing examined and found to be in good condition, oil lubricating rings turn freely, journals good. In new bearings the amount of this clearance varies according to the service intended, a common rule being one-thousandth of an inch per inch of diameter: rather less than this for large bearings is good practice. Small bearing clearance is generally favourable to the formation of a strong oil wedge and film. So, with this bearing journal being 6" the running clearance should be 0.006". Generally a maximum clearance of up to twice this could be acceptable.

Top shell clearance measured out at 0.020", which shows wear, however due to the very low speed of fan this is acceptable as long as the fan is run periodically.

Maximum tolerance -----0.030"

Driven Pulley Bearing (B4)

Brass shell split bearing- 6" with 2 lubricating Oil Rings

Bearing examined and found to be in good condition, oil lubricating rings turn freely, journals good. In new bearings the amount of this clearance varies according to the service intended, a common rule being one-thousandth of an inch per inch of diameter: rather less than this for large bearings is good practice. Small bearing clearance is generally favourable to the formation of a strong oil wedge and film. So, with this bearing journal being 6" the running clearance should be 0.006". Generally a maximum clearance of up to twice this could be acceptable. Top shell clearance measured out at 0.025", which shows wear, however due to low speed of fan this is acceptable as long as the fan is run periodically.

Maximum tolerance -----0.030"

Driven Pulley

6 V Groove Pulley- 5'2" x 1'

Pulley in good condition, all bolts and keys secure

Impeller and Shaft

Ten foot diameter impeller with 10 vanes

Some corrosion evident on vanes, large areas on vanes corroded, with two being partially replaced. All keys and bolts secure.

Bearing (B5)

Brass bottom shell with 2 lubricating Oil Rings

This bearing is designed with no top shell. Bottom shell thickness measured at 0.725", oil rings turn freely, journal shows signs of corrosion marks in places, no pitting, no excessive wear apparent. Corrosion will require removing from journal

Appendix B – Example Risk Assessment (Walker Ventilation Fan)

The bearings, pulleys and drive belts are in a working condition; however the drive belts are showing slight signs of fraying on the edges. The gearbox to drive pulley is misaligned and will have to be re-aligned. The impeller is sited in the fan drift and the return ventilating warm air passes around it, this causes moisture to form on the steelwork which in turn causes corrosion to the vanes etc. In 2007, a further coat of Red Oxide was applied.

Also, above the impeller in the evasee are a number of wooden planks which form the curved roof, these are in a poor condition

The Fan impeller bearings are showing signs of wear and are above normal working tolerances, but as previously stated due to the very slow speed the integrity of the machine is not affected.

Maximum bearing tolerances are however to be set at 0.030''

The fan should not be run until the following has been addressed:-

1. The gearbox to Drive pulley is re- aligned.
2. The Fan shaft end bearing (B5) has the corrosion removed from its journal.

Recommendations

1. The mine ventilating air should be ducted around the walker fan impeller to combat the corrosion.
2. The timber planking above the impeller should be removed or replaced as this could possibly cause damage to the vanes if they were to collapse when the fan is in motion.
3. To assist it carrying out detailed inspections / examinations of the impeller and H&S, thought should be given to installing FLP lighting in the drift. Electric Mine cap lamps must be used at present.
4. The fraying on the edges of the drive belts must be monitored. If any significant deterioration occurs, then the fan must not be operated.
5. A maximum daily operating time of 20 minutes be adopted.

Health & Safety Risk Assessment

Task Identification: Operating/ Checking Walker Fan

Date Assessment Completed: Sept 08

By: Paul Meredith

Review Date: Sept 09

No	Hazard Identified	Uncontrolled			Control Measure	Controlled		
		L	S	Risk		L	S	Risk
1	Falling into machinery	3	4	12	Install guards	1	4	4
2	Falling into impeller	3	4	12	No entry into LH side of impellor when running	1	4	4
3	Tripping falling in fan drift	3	3	9	Use Cap lamp / Install FLP lighting	1	3	3
4	Moving machinery	3	4	12	Lock out key to be kept in possession when working on MC	1	4	4

Likelihood (L) 1. – Very Unlikely 2. – Unlikely 3. – Likely

4. – Very Likely 5. – Certain

Severity (S) 1. – Work Delay 2. – Minor Injury 3. – Major Injury

4. – Single Death 5. – Multiple Deaths

Risk (L X S) _____

1 to 5 Low Risk (no action required)

6 to 11 Medium Risk (action to be taken to reduce)

12 to 25 High Risk (activity to be stopped until risk lowered)

TASK SPECIFIC RISK ASSESSMENT		
ASSESSMENT CARRIED OUT BY: Paul Meredith		
LOCATION: Fan and Compressor House		
TOPIC / ACTIVITY: Operating the Walker Fan		ASSESSMENT NUMBER TS123
SPECIFIC ASSESSMENTS APPLICABLE (tick relevant box) <input type="checkbox"/> 1. Mechanical lifting <input type="checkbox"/> 2. Working at Height* <input type="checkbox"/> 3. Confined spaces* <input type="checkbox"/> 4. Manual Handling <input checked="" type="checkbox"/> 5. Noise <input type="checkbox"/> 6. Chemicals <input type="checkbox"/> 7. Hand arm vibration <input type="checkbox"/> 8. Young Persons <input type="checkbox"/> 9. Buildings <input type="checkbox"/> 10. Fire <input type="checkbox"/> 11. Legionella <input type="checkbox"/> 12. VDU's	GENERIC ASSESSMENTS APPLICABLE (tick relevant box) <input type="checkbox"/> 1. Excavations* <input type="checkbox"/> 2. Mobile plant <input type="checkbox"/> 3. Shaft work <input type="checkbox"/> 4. Maintenance <input type="checkbox"/> 5. Use of tools <input type="checkbox"/> 6. Violence <input checked="" type="checkbox"/> 7. Slips and trips <input type="checkbox"/> 8. Scaffold towers and ladders <input type="checkbox"/> 9. Adverse weather <input type="checkbox"/> 10. Hot work * <input type="checkbox"/> 11. Asbestos <input type="checkbox"/> 12. Flammable gas / liquid / vapour <input type="checkbox"/> 13. Dust <input type="checkbox"/> 14. Low light levels <input type="checkbox"/> 15. High / Low temperatures <input type="checkbox"/> 16. Pressure systems <input type="checkbox"/> 17. Waste <input type="checkbox"/> 18. Sharps / Needles <input type="checkbox"/> 19. Restricted workspace <input type="checkbox"/> 20. Abrasive wheels <input type="checkbox"/> 21. Electricity <input type="checkbox"/> 22. Manriding <input checked="" type="checkbox"/> 23. Underground Tour / Work <input type="checkbox"/> 24.	
*permit required.		
OTHER CONTROLS DEEMED NECESSARY		
Gates to Fan drive machinery and Telephone exchange to be kept locked when access not required		
Approved underground type cap lamp to be used in the fan drift		
M+Q regs apply in Fan Drift-----No naked lights or contraband		
PERMITS REQUIRED: (tick box)		
<input type="checkbox"/> 1. To Dig <input type="checkbox"/> 2. Hot Work <input type="checkbox"/> 3. Confined Space <input type="checkbox"/> 4. Working at height <input checked="" type="checkbox"/> 5. None		
SIGNED:	DATE: 15-9-08	REVIEW DATE: 15-9-09

Appendix C – Example Operating Procedure (Walker Ventilation Fan)

1. Start Up

- a) Ensure emergency stop button is not pushed in (Note-Re-set key is hanging on board to the left of panel)
- b) Warn any persons in the building that you are about to operate the fan
- c) Unlock gate to Telephone exchange room
- d) Pull out Stop Button on panel, press blue pre-start green button once followed by the blue start button. Fan will start.
- e) Lock gate to telephone exchange room
- f) Complete daily check sheet

2. Shut Down

- a) Unlock Gate to Telephone exchange room
- b) Press red stop button on panel, fan will stop.
- c) Lock Gate.

Report any Defects to the relevant Engineer.

Note-----Only Authorised persons are to operate this Fan



1a) Operators checks daily or before use

- a) Drive unit Guards are secure and undamaged
- b) Pulley Guards are secure and undamaged
- c) Pulleys (P1+P2) for security / damage
- d) Timber planking above impeller are secure
- e) Impeller Vanes for damage and Security
- f) Ensure Emergency Stop button is in the out position

b) To Be Completed when the machine is in motion

Abnormal noise or vibration from Drive unit

Pulleys are rotating freely

Drive belts (6) are not broken/ split/ or badly frayed

Fan Shaft Driven Pulley Bearings (B3+B4) for noise/heat/vibration, Lubricate if necessary

Ensure Fan shaft bearing oil rings (4) are rotating freely and oil levels OK

Fan Shaft end bearing for noise/heat/vibration

Ensure fan shaft end bearing oil rings(2) are rotating freely and oil level ok

Access Gate locked

Appendix D – Example Maintenance Schedule and Log (Walker Ventilation Fan)

Daily Maintenance Log		Week Commencing.				Week No.	
Accession Number. 2001.1/1 21							
No.	<u>WALKER FAN</u>	Enter √ for inspection carried out Enter X if any defects discovered and enter details below					
		M	T	W	T	F	S
	To be completed before starting machine :-						
1	Check all guards for security/damage						
2	Timber planking above impeller are secure						
3	Impeller Vanes for damage and Security						
4	Ensure Emergency Stop button is in out position						
5							
6	To Be Completed when the machine is in motion- ---Check						
7	Abnormal noise or vibration from Drive unit						
8	Drive Pulley Bearings (B1+B2) for abnormal noise/heat/vibration						
9	Pulleys are rotating freely						
10	Drive belts (6) are not broken/ split/ or badly frayed						
11	Fan Shaft Driven Pulley Bearings (B3+B4) for noise/heat/vibration						
12	Ensure Fan shaft bearing oil rings (4) are rotating freely and oil levels OK						
13	Fan Shaft end bearing for noise/heat/vibration						
14	Ensure fan shaft end bearing oil rings(2) are rotating freely and oil level ok						
15	Access Gate locked						
REPORT							
Operators Signature				Date			
Supervisors Signature				Date			

Annual Maintenance Log		Week Commencing.					Week No.	
Accession Number. 2001.1/1 21								
No.	WALKER FAN	Enter ✓ for inspection carried out Enter X if any defects discovered and enter details below						
		M	T	W	T	F	S	S
1	Carry out operators daily checks plus :-							
2	Remove Drive Unit Guard, check gearbox oil level, check for leaks. Check for any Abnormalities							
3	Check security of Gearbox and frame holding down bolts							
4	Check alignment of motor / gearbox coupling and security							
5	Check and record any wear in pin bushes by recording rotational free movement. Max 3mm.							
6	Check alignment of gearbox / pulley coupling and security							
7	Check and record any wear in pin bushes and record rotational free movement. Max. 3mm							
8	Lubricate Drive Pulley Bearings (2), check pedestal for security/damage. Lubricate.							
9	Check Drive Pulley for security and general condition							
10	Ensure Correct tension on Drive belts, check tensioning bolts/frame							
11	Check Fan Shaft Driven Pulley security and general condition							
12	Check Fan Shaft Driven Pulley Bearing holding bolts for security.							
13	Check Fan Impeller condition and protective paintwork							
14	Check all impeller bolts and keys							
15	Remove end bearing cover, check oil level and condition. Re-Fit cover							
16	Re- Fit All guards and test machine							
<u>Report</u>								
Engineers Signature					Date			
Supervisors Signature					Date			

Three yearly Maintenance Log		Week Commencing.					Week No.	
Accession Number. 2001.1/1 21								
No.	WALKER FAN	Enter ✓ for inspection carried out Enter X if any defects discovered and enter details below						
		M	T	W	T	F	S	S
	Carry out Annual checks plus :-							
	Drive Unit							
1	Remove unit drive guard. Replace Gearbox oil							
2	Remove pins/ bushes on motor/gearbox coupling, check for wear. Replace if worn. Max .rotational play 3mm							
3	Remove pins/ bushes on gearbox/ pulley coupling, check for wear .Replace if worn .Max .rotational play 3mm							
	Re- Fit guard							
	Drive Pulley Bearings B1 +B2							
4	Remove Top half of Cooper Bearing cover on Drive pulley(B1) Clean Bearing, examine and re- grease Re fit cover							
5	Remove Top half of Cooper Bearing cover on Drive pulley(B2) Clean Bearing, examine and re- grease Re fit cover							
	Drive Belts							
6	Remove section of Drive belt guard and inspect 6 drive belts for damage/wear/cracking. Re-fit guard							
	Fan Impeller Pulley Bearings B3 +B4							
7	Check clearances on Fan impeller driven Pulley Bearing and record .Max, Clearance 0.030"							
8	Check journal condition and oil rings							
9	Replace oil							
	Fan Impeller shaft end Bearing B5							
10	Check journal condition and oil rings							
	Replace oil							
	Fan Impeller							
11	Clean and Paint Impeller							
<u>Report</u>								
Engineers Signature					Date			
Supervisors Signature					Date			

Appendix E

Working Historic Machinery Emergency Procedure

In the event of a serious mechanical failure follow the procedure below.

