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COMMISSIONING AND OPERATING
INSTRUCTIONS OF ONE GALLON (US) MIXER

AR-008-248

P.J. BARRY AND J. LEVERS

MRL-TN-633

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MATERIALS RESEARCH LABORATORY

DSTO

Commissioning and Operating Instructions of One Gallon (US) Mixer

P.J. Barry and J. Levers

MRL Technical Note
MRL-TN-633

Abstract

A one gallon (US) vertical bladed planetary action mixer was installed in Production Development Area No. 2 of MRL, EOD-Salisbury. This report describes the rationale for manufacturing the mixer, along with a description of the equipment installed.

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Commissioning and Operating Instructions of One Gallon (US) Mixer

1. Introduction

Prior to 1986, the development of small scale cast composite propellant formulations in Ordnance Systems Division of Weapons Systems Research Laboratories, Salisbury was carried out using vertical Anchor Blade type mixers. A serious flaw in the performance of this type of mixer limited the range of formulations which could be mixed uniformly to those of relatively low solids loading. Propellants Group wished to increase the performance of the formulations being developed. These formulations required higher solids loadings.

This requirement was catered for in large scale mixing by purchasing a 30 Gallon Baker Perkins vertical bladed planetary action mixer. However, small scale cast composite propellants or polymer bonded explosives could still only be processed using anchor blade mixers of various capacities.

A decision to upgrade the composite propellant facility resulted in the installation of a family of vertical bladed planetary action mixers of increased capacity, so that

- each formulation would receive uniform mixing due to there being no part of the mix which is idle beneath a blade. This uniformity of mixing is a consequence of the planetary action of one mixer blade about the other, relative to a stationary bowl.
- scale up of mix size would present no processing problem.
- each mix would experience similar shear rates due to each mixer having the same design parameters.

Over several years, a 5 US gallon, 1 US gallon and a 1 pint (US) mixer [1] have been obtained and installed. The capacity of these mixers is the volume at normal working level – to the top shoulder of the blades when at rest.

While the five gallon and one pint mixers were purchased second hand from Baker Perkins, the design of the one gallon (US) mixer was determined by staff of Engineering Support Group. This involved interpolation of design parameters of the other three mixers, together with fabrication or purchase of particular parts.

In several cases, the equipment used was specified by the maker in non-SI units. These non-SI units have been retained throughout this report.

2. Siting of Plant

2.1 Control Room

The Control Room for the one gallon mixer, which also contains the controls for the one pint mixer, is located in Bay 2 of Building 123, Contractors Area, Salisbury. This bay has the dimensions 5.87 m $\times$ 5.72 m, and is the closest available bay to each Mixer Bay. Closed circuit television is provided to monitor the activities in the Mixer Bay.

2.2 Plant Shed

The Plant Shed, 6 m $\times$ 6 m, is to the South of Bay 4 of Building 123. It contains vacuum pumps, hydraulic pumps and electronic control rack (see Figs 1 to 3). This equipment supplies three mixers and associated casting equipment in Bays 1 and 5 of Building 123.

2.3 Other Services

The emergency power supply is shared with the one pint mixer and is located in the One Pint Mixer Plant Room in Building 287. The hot water service, drenching system controls and nitrogen supply are located on the South verandah of Building 123, adjacent to Bay 5 (Fig. 4).

2.4 Process Bay

Bay 5, Building 123, which has the dimensions 12.2 m $\times$ 5.72 m, is divided into three mixing areas, each separated from the other by reinforced concrete wall modules. In addition, a vacuum and sample casting facility is provided in this bay (see Fig. 5).

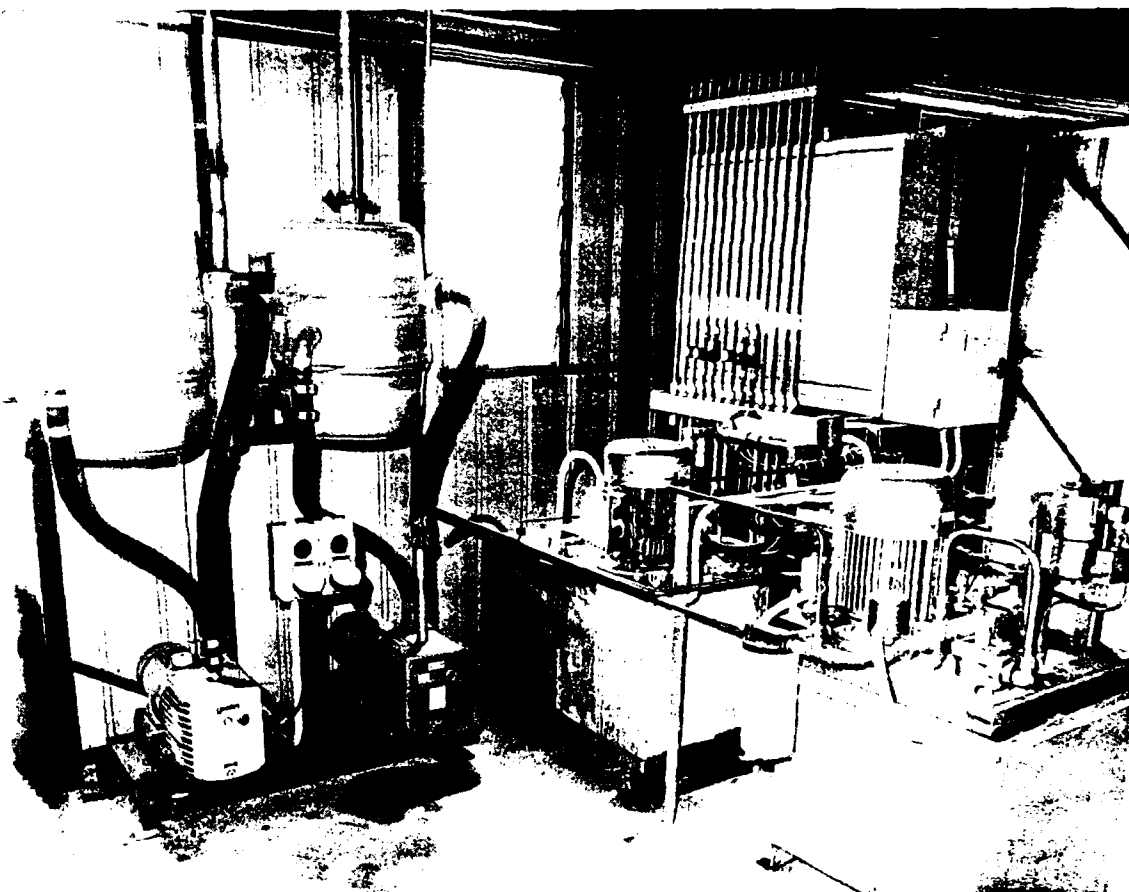


Figure 1: Plant Room: Vacuum interceptors at left, and hydraulic pumps at right.



Figure 2: Plant Room: Electronics rack.

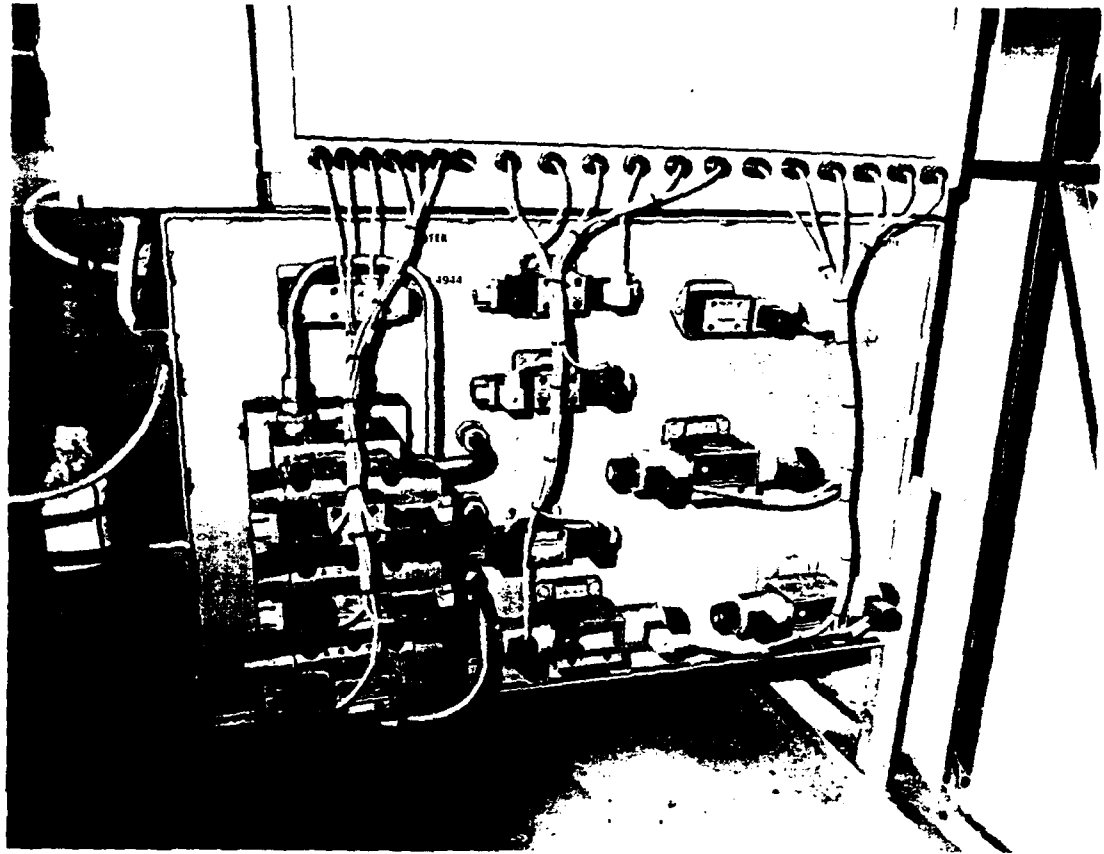


Figure 3: Plant Room: Hydraulic distribution panel.

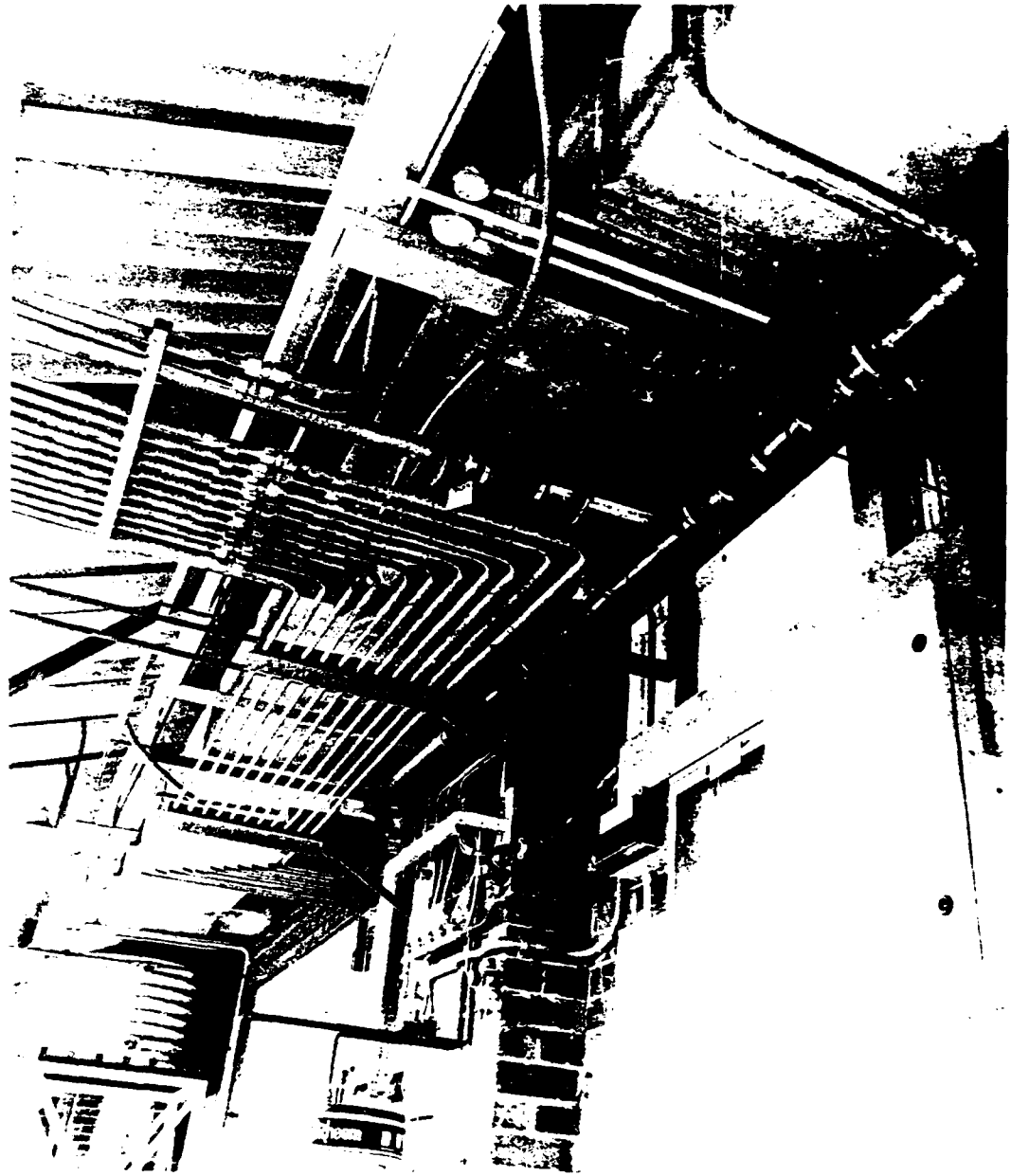


Figure 4: Overhead right: Vacuum lines: Foreground: Isolator and branch to casting
ing. Bay 1: From left: Suction lines from each vacuum pump in Plant Shed: Centre
Background: Isolator and branch to one pint mixer: On wall at right: Dredging
control box and vacuum pump selector box

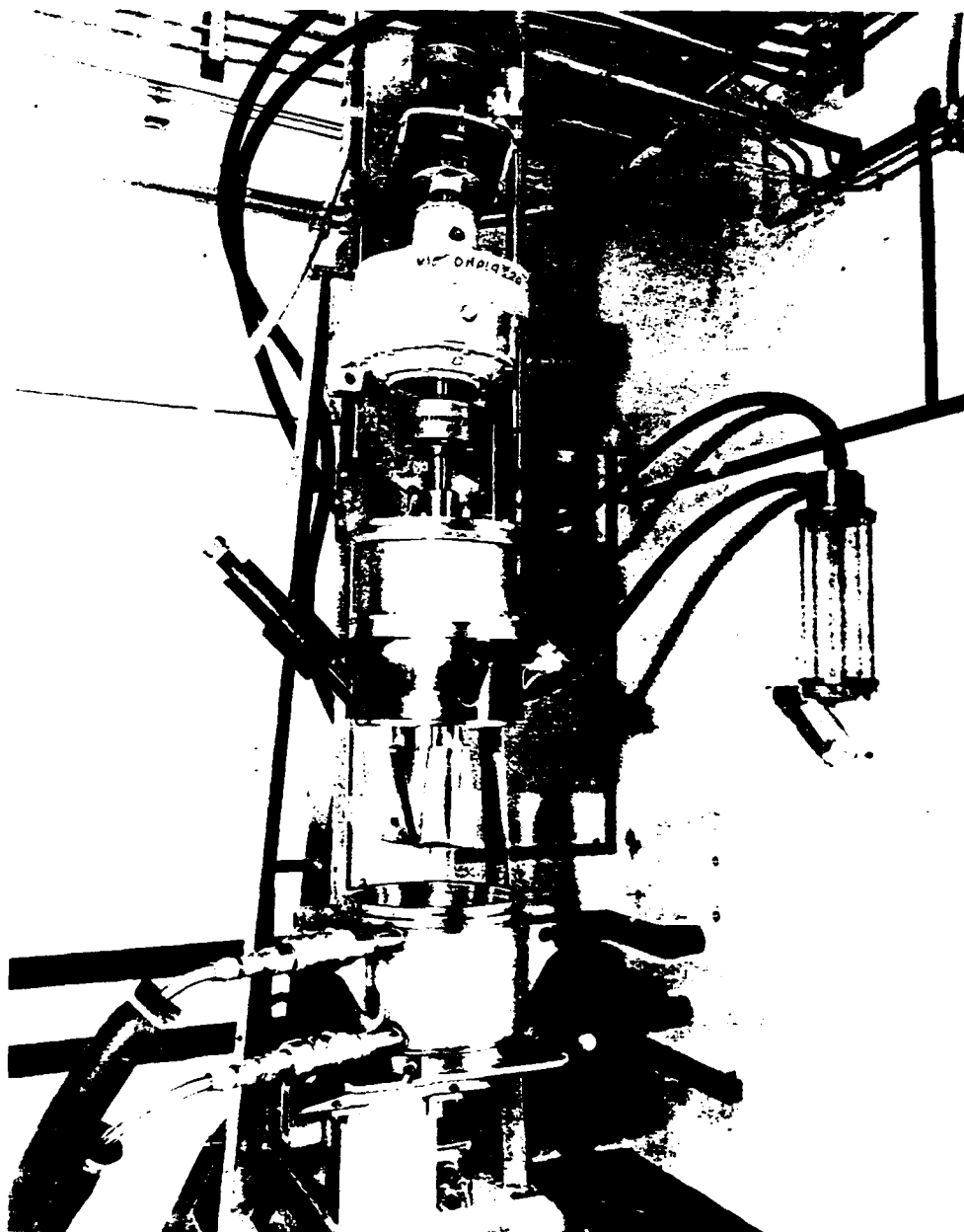


Figure 5: 10-gallon US mixer. Glass vacuum intercenter on tail at right

2.5 Traversing

A 6 kg anchor blade mixer and a slurry mixer are in mixing areas of the bay adjacent to the one gallon mixer. The concrete wall modules which are used to segregate each of the mixers have been shown to substantially contain the blast of a detonation of the contents of a mixer loaded to capacity [2].

2.6 Sharing of Equipment with Other Mixers

Bearing in mind the conflicting requirements of a family of mixers of similar design, and the policy not to operate more than one mixer at a time in a bay, it was decided that the one gallon mixer would share many of the service and control functions provided for the one pint mixer. This has meant the sharing of a common:

- (i) Control Panel
- (ii) Programmable Controller for Automatic Control
- (iii) Emergency Power Backup
- (iv) Deluge and Warning Lights Systems. These two systems each serve all the process equipment in Bay 5, Building 123.
- (v) Vacuum System. In addition to serving all equipment in Bay 5, Building 123, this system serves the casting equipment and 500 g mixer in Bay 1, Building 123.

The Operating Instructions have been written to reflect these situations.

3. Plant Description

3.1 Mixer

One (US) gallon capacity, vertical bladed, planetary action mixer, similar to Baker Perkins Model Type 2 PX.

3.2 Drive System

Hydraulic motor, "Char Lynn" No. 103 with proportional solid state speed control, and "Boston" gear reducer.

3.3 Blade Speed

0 to 100 rev / min, with 5:1 planetary reduction gearing between the blades.

3.4 Temperature Control

The emergency cooling is mains water based, and is only used when the time taken to cool the mix in air would be excessive.

This water supply is controlled by four M.E. Mack air valves, with electric solenoid actuator, which is operated from the "Cool" button on the Mixer Control Panel.

Heating is by means of "Rheem" 50 litre heater of 10.8 kWh capacity.

A remote outlet set point above ambient temperature is taken via a 4 to 20 mA current loop from either the PLC or from Manual Operation at the Control Panel, to give a range of ambient to 65°C maximum.

2.5 Hydraulic Power

3.5.1 Hydraulic Power Unit - Mixing

The power unit for mixing is based upon a 3 hp (5 kW) electrically driven fully compensating hydraulic pump capable of delivering 10 gal/min at 3000 psi. This unit is de-stroked to 5 gal/min at 800 psi.

Flow control is via an hydraulic proportional flow control valve and remote variable DC voltage source.

Speed range at the Charlyn Hydraulic Motor Drive output is 0 to 100 rev/min.

3.5.2 Hydraulic Raise/Lower - Mixer Bowl

The hydraulic raise/lower facility is based on a 3 hp (5 kW) electrically driven fully compensating hydraulic pump, de-stroked to deliver 0.5 gal/min maximum at 1750 psi. The raise and lower action is via remote control directional valves and 18" stroke and 2" diameter hydraulic cylinder, coupled to the bowl carriage.

3.6 Vacuum

The vacuum pumps used are a pair of "General Engineering", Radcliffe (UK) Rotary Vane Pumps, Type GDV 25K, having a displacement of 22.75 cubic metres per hour (ex Javac, Melbourne). These two pumps are connected in parallel to a manifold which serves Bays 1 and 5 of Building 123. "Saunders" Vacuum Isolation Valves, Model ES 61 are used on each branch of the manifold.

3.7 Flame Detection and Drench System

The Deluge system is fed from the 4" water main serving the Processing Area. In the Mixer Bays, the system feeds five "Wormald" high velocity spray nozzles, each of which can deliver 26 gal/min.

Automatic flame detection is by means of two Honeywell "LV Sensors", No. C7035A, through a "Honeywell" flame detector relay, No. R4343D, one of which is mounted adjacent to one of the two inspection windows on the mixer

headworks, while the other overlooks the mixer bay. Each "UV Sensor" is interlocked to an amplifier which, when fired, energises 240 volts to a 2" diameter Danfoss Model O 8Z 6252 valve.

Manual fire detection is by observation of the TV screen above the control panel. An overview of the Process Bay containing the mixer is provided by the TV camera mounted high in the opposite bay to the process bay.

In the event of a fire being observed, the mixer operator activates the Deluge system using the manual deluge switch on the Control Panel.

The pressure switch interlocks the main solenoid valve to the 240 volt power, preventing premature closure of the valve until the water pressure in the system is below a nominated pre-set value (15 psi). This reduces water hammer to a minimum. The 4" external mains are some 45 years old and prone to breakage due to water hammer.

3.8 Warning Lights

The warning lights are red or yellow multi-faceted lens type glass shrouds enclosing 240 volt ES incandescent globes. One red and one yellow light is situated outside each doorway of Bay 5.

3.9 Closed Circuit TV

The closed circuit TV camera is Panasonic WV CL304 closed circuit colour TV, connected to an NEC Model No. N-3430 colour monitor.

3.10 Control System

Programmable logic controller (PLC). Three units are used:

- (i) Toshiba EX40H
- (ii) Struthers Dunn Programmable Controller
- (iii) IBM compatible laser turbo XT/2, with Compal monitor.

3.10.1 Automatic/Manual Controls

When the current system is commissioned, the mixer may be controlled either manually through the control panel or automatically through the laser turbo XT/2 computer.

3.10.2 Plant Shared with One Pint (US) Mixer

The control panel, in both automatic or manual mode, together with the closed circuit TV can be set to operate and monitor either the one pint or the one gallon mixer. The one pint mixer is located in the Process Bay or Building 287. The direct current supply controls in the services bay of the one pint mixer are also common to both mixers.

3.10.3 Electric Power Supply

The electric power supply is 3 phase 415 Volt AC and 110 and 24 Volt DC.

4. Description of Commissioning Activities

4.1 Range of Temperatures

A series of tests was run using water and then the inert ingredient hydroxy terminated polybutadiene (HTPB) to determine the ability of the heating and cooling system to deliver a pre-determined temperature in the range 10°C to 65°C. After formal handover, the control program settings were adjusted to ensure that the system did not overheat due to the mix being smaller in size than envisaged.

4.2 Operating Instructions

Concurrently with the mixing programme described above, operating instructions were developed for the manual mode of each stage of a mix's preparation. Initial documentation was prepared and verified using "Dry Running" of the mixer. Verification proceeded further using the liquid inert HTPB.

Revisions of the draft instructions were required as problems were encountered and solutions to these problems were developed and recorded to enhance operation and safety. The computer programming and instruction preparation for the automatic control of each cycle of operations in the course of preparing a given mix formulation will be developed and debugged when the automatic control system is installed.

Copies of these instructions are available in the Control Bay, at the Supervisor's Office and in the Engineering Support Office.

4.3 Sharing of Controls with Other Mixers

To some extent, there is commonality of control and/or service facilities with other mixers. It is essential to ensure that ALL relevant switches are operated both in startup and shutdown. To minimise these problems, the operating instructions include reference to the location and description of each switch and valve.

4.4 Faulty Light and Hydraulic Controls

For many runs the TEST LIGHTS circuit, and the MIXER START circuit on the Control Panel would not function uniformly, and the handing over of the mixer was delayed significantly. This was because the software for these circuits was

configured for the one pint mixer, while the inputs from field locations for the one gallon mixer were quite different. These differences were progressively rectified.

The TEST LIGHTS circuit indicates that there is power to the lights in buttons on the control panel which control critical operations. It is essential to verify that all such lights are operating correctly prior to commencing mixing operations, so that the operator is assured that all required information will be available throughout the run.

4.5 Leaks in Joints

In an attempt to achieve a pressure in the mixer can not exceeding 5 torr (0.67 kPa), minor leaks were found and eliminated from many joints in the vacuum system which is a shared system supplying both the 6 kg and slurry mixer in Bay 5. This system consists of piping and fittings up to 15 years old.

4.6 Limitations on Use

The mixer is believed to be adequate for the purpose of handling a wide range of mix formulas and process conditions. The use of formulations which involve ingredient's having significantly larger particle sizes, or which involve process conditions with significantly greater viscosity, increases the likelihood of either mechanical damage or explosion. Thus plans to vary these parameters should be checked with the staff of Engineering Support Group.

5. Conclusions

Many of the problems encountered are due to lack of use of the mixer. It is planned to undertake thorough maintenance checks only when a mixing programme is foreshadowed, so that scarce resources are not misdirected.

The one gallon (US) mixer was found to function satisfactorily over the required range of temperatures.

This equipment is considered to be adequate for the purpose of handling a wide range of mix formulas and process conditions, and to provide adequate material for the samples required to verify performance parameters during formulation development.

However, when significant departure from current propellant types or viscosity is envisaged, the equipment may not be suitable. Consultation with Engineering Support Group is thus essential to avoid serious damage to the equipment.

6. Typical Heater Trial Details

Trial No. 1

Date: 20/9/91
Set Point: 60°C
Max Heating Rate: 1.2°C/min
Max Temp: 68°C
New Set Point: 50°C
Time to Respond: 105 min
Corrective Action: Fine tune set points and set second heater cut off at 55°C

Trial No. 3

Date: 27/9/91
Set Point: 50, 55 and 60°C (3 heaters)
Max Heating Rate: 1.2°C/min
Max Temp: 62°C
Time to Respond: 115 min
Corrective Action: Nil
The lesser overshoot of temperature, which was achieved due to the corrective action proposed from Trial No. 1, was considered satisfactory.

7. Acknowledgements

The specification and development of the equipment to its present reliable state of operation has involved many of the personnel of Engineering Support Group, Explosives Ordnance Division, Salisbury.

8. References

1. Barry, P.J. and Levers, J. (1992). *Commissioning and operating instructions of one pint (US) mixer* (MRL Technical Note MRL-TN-634). Maribymong, Vic.: Materials Research Laboratory.
2. Chakrabarti, A. and Bone, M.J. *Evaluation of the blast resistance of a U shaped concrete block*. MRL report to be published.

Appendix 1

The drawings and details of equipment and circuits for the one gallon mixer are contained in the Drawing Series 1G-1-001 to 1G-6-series, which cover Layout and Overview, Electrical Circuit Diagrams, Chassis and Rack Detail and Electronic Circuit and Wiring Detail. These drawings are kept in the Drawing Office of Engineering Support Group, Explosives Ordnance Division, Salisbury.

Appendix 2

OI 5.10
Issue 1
Cover Page

Materials Research Laboratory
Explosives Ordnance Division
Operating Instruction No. 5.10

One Gallon Mixer

This instruction specifies the procedures to be used in operations performed in the One Gallon mixer and associated casting equipment in the complex in PDA2.

Formulation and process parameter details are not included in this instruction. These are specific to the mix being performed and are detailed in Propellant/Explosive Processing Sheets.

Prepared by _____

Authorised by: _____

Head,
Engineering Support

Head,
Propellants

/ /

/ /

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Safety Section

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Propellant Development Area No. 2

Operating Instruction No. 5.10

One Gallon Vertical Mixing Facility

1. Introduction

This instruction specifies the operations to be followed in all phases of processing operations in the One Gallon mixer from preparation to cleaning of contaminated equipment.

2. Location

Industrial Area

- | | |
|--------------------|---------------------|
| (a) Mixing - | Building 123, Bay 5 |
| (b) Casting - | Building 123, Bay 5 |
| (c) Control Cell - | Building 123, Bay 2 |
| (d) Plant Room - | Building 272 |

3. Personnel

- 3.1 Only personnel who have training and experience in explosives handling and have been instructed in the relevant precautions shall be permitted to work in explosives operations.
- 3.2 The personnel who carry out the following operations shall be persons assessed by H Eng or his delegate as competent in operation of the equipment and understanding of the safety requirements of the processes. These persons are listed in Annexe A. The number of personnel in the vicinity of Building 123, Bay 5 shall not exceed 4 during explosives operations.

4. Special Precautions

- 4.1 The requirements of Section 2 of DSTO Safety Regulations shall apply.
- 4.2 Prior to explosives mixing operations, place a warning sign on either side of the Bay 5 doors, both on the clanway in front of Bay 5 and on the rear verandah.
- 4.3 When the mixer is loaded with oxidant or other explosives and the blades are turning, entry into the Mixer Bay, Building 123, Bay 5 is forbidden.

- 4.4 Weighing and handling of ingredients is to be performed using respiratory protective equipment.
- 4.5 No person shall enter Building 123, Bay 5 without permission of the Operator-in-Charge of the Control Cell (Building 123, Bay 2).
- 4.6 No mix is to be prepared without a PROPELLANT/EXPLOSIVES PROCESSING SHEET issued by the Head of Propellants Group or his delegate.
- 4.7 A Mix Log must be completed on the PROPELLANT/EXPLOSIVES PROCESSING SHEET for all mixes. All sequences must be recorded along with any unusual events, no matter how insignificant they might seem to be.
- 4.8 All weighing details shall be entered on an Ingredients/Weighing Check Sheet.
- 4.9 The mixer shall not be used if the clearances between the mixer blades and the mixer can do NOT conform to those approved by the Head of Engineering Support Group.
- 4.10 The Operator-in-Charge of the Control Cell shall ensure that all personnel within the area of the warning signs are in the Control Cell when explosives mixing operations are being carried out.
- 4.11 The Operator-in-Charge of the Control Cell shall call a warning through the intercom before raising or lowering the mixer can.
- 4.12 In the event of the Deluge System being activated, automatically or manually, all personnel in the Control Cell shall remain in the Cell until advised by the Officer-in-Charge that it is safe to leave.
- 4.13 All split ingredients shall be immediately swept up and placed in the appropriate waste bin.
- 4.14 Phosphor-bronze or Velostat spatulas shall be used for the "scrape down" operations specified in the Mixing Procedure.
- 4.15 When explosives are "on site", the amber beacon lights shall be operating.
- 4.16 When explosives are being mixed in the mixer can, the red and amber beacon lights shall be operating.

5. Preparation of Equipment

- 5.1 Collect Control Cell (Building 123, Bay 2) key, and the two System and Operation keys for the Control Panel, Building 123, Bay 2. Also collect the following keys which are labelled for the One Gallon Mixer as well as for other mixers:

Main Hydraulics
Hydraulics Raise/Lower
Vacuum Pump

- 5.2 Unlock Building 123, Bay 2 and switch on bay lights situated outside the bay door. At the top right of the control panel, ensure that the orange control panel isolating switch is on. On the control Panel, ensure that the two mixer can position push buttons (raise and lower) are in the UP position.
- 5.3 Check that the intercom and phone are working.
- 5.4 Insert the two System selection and Operation keys and select Manual mode by turning key clockwise. System 1 refers to the One Pint Mixer, Building 273. System 2 refers to the One Gallon Mixer, Bay 5, Building 123. Insert the three Multi-Mixer keys in the north face of the panel and turn on.
- 5.5 Ensure Deluge Switch is in the off position, i.e. toggle switch down and cover on.
- 5.6 Press the Equipment Power and Camera Control Monitor Power buttons. The vacuum system may vent for 10 s, then close automatically. Ensure that the
- Equipment Power and Camera Control Monitor Power Lights show Orange,
 - PLC Status Low Volts and CPU Run Lights show Green,
 - Mixer Can Operations "Lower" button light is on,
 - Deluge Primed light is flashing, indicating water pressure at the mixer is low or off.
- 5.7 Turn TV monitor power point on wall on. Below the monitor screen, press Power button. The screen will show a number for about 5 s. Now press Video button. The screen will show VIDEO for about 5 s.
- 5.8 Ensure that all other Control Panel lights are off, and that the Mixer Speed and Outlet Temperature Knob controllers are set at Zero.
- 5.9 Ensure Emergency Stop button is in the Up position.

- 5.10 Press the FUNCTION VERIFY and CAN VAC buttons. While you hold BOTH buttons down, the following lights will be ON: Raise, Lower, Run, Red, Amber, Deluge Primed, Fire. The vacuum ballast tank will vent provided it has no signal to prevent this. When the ballast tank has vented fully, as shown by pressing key 7 on the keyboard, ensure that the CAN VAC button is released.
- 5.11 Move to Mixer, Bay 5, Building 123, via the north door. Open both doors and turn the three light switches beside the open right door on (Orange switches). Unlock and unbolt the south doors. Secure doors open if required.
- 5.12 On the nitrogen cylinder against the wall buttress between Bays 5 and 6, ensure that the regulating knob on this cylinder is free to rotate. Open the main valve. Adjust the system pressure to 300 kPa by turning the regulating knob clockwise. Set flow control valve on the wall to 1.5 litre/min.
- 5.13 Move to the switchboards between Bays 4 and 5. On the Vacuum Control Panel, select Vacuum Pump 1 or 2. In the Deluge Control Panel, turn Deluge Power Key on (Red tag). On the buttress edge (upper left of switchboard), ensure the black air valve on the 1/4" copper line is open. On this air line, below the black valve, set regulator to between 300 and 800 kPa. If no air pressure is indicated, turn the compressor on the south verandah of Building 122 on.
- 5.14 On the vacuum manifold (large pipeline) overhead, and above the many hydraulic lines, ensure that the tagged inlet valve from the vacuum pump to be used is open, while that from the other vacuum pump is closed. Face the wall. Ensure that the manually operated outlet valve from the manifold to Bay 5 is open, i.e. the left outlet valve from this manifold. Ensure that the right outlet valve to Bay 1 is closed.
- 5.15 If Drench System Test is to be performed:
- A: Perform the Drench test --
1. LIVE Drench Test.
- Collect the hoses from storage as directed by the O-I-C, PDA2.
 - In the Mixer Bay, untie the cap cord from each drench nozzle. Place the end of a hose on each drench nozzle, and tape securely in position.

- 5.15 - Under the outer edge of the verandah, turn the blue lever of the ball valve to horizontal.
(ctd)
- On the Deluge Control Panel, ensure that Deluge Power is On and that the Bypass key switch is Off (Position 0).
 - As directed by the O-I-C, PDA2, activate the Drench System by EITHER using an ultra-violet light source adjacent to the mixer, OR return to the Control Panel in Bay 2. The Deluge Primed light should be on continuously. Raise the cover on the Deluge Toggle Switch. Move the toggle switch Up and Down once. The flame light on the Control Panel will show red.
 - Move to the Mixer Bay. Check that the System is discharging through the hoses.
 - Under the outer edge of the verandah, SLOWLY turn the blue lever of the ball valve to vertical.
 - On the Deluge Control Panel, ensure that Deluge Power is Off.
 - In the Mixer Bay, ensure that water has stopped running through the hoses. Disconnect the hoses, refit and tie on nozzle caps, and mop up all water in the bay, particularly on the Headworks of the Mixer.
 - Reprime the System as in 5.15B, Section 2.

2. SIMULATED Drench Test

- Under the outer edge of the verandah, ensure that the blue lever of the ball valve is vertical.
- On the Deluge Control Panel, ensure that Deluge Power Key is turned On (red light to right of key). Also ensure that the Bypass key switch is On (Position II) (green light alongside key should be On).
- As directed by the O-I-C, PDA2, activate the Drench System by EITHER using an ultra-violet light source adjacent to the Mixer, OR return to the Control Panel in Bay 2. The Deluge Primed light should be On continuously. Raise the cover on the Deluge Toggle Switch. Move the toggle switch Up and Down once. The flame light on the Control Panel will flash red.
- On the Deluge Control panel, press the Blue reset button and ensure that Deluge Power and Bypass key switches are Off (Position 0).

5.15 B: When directed by the O-I-C, purge the drench lines of air --

1. Check the system as it stands:

- Check that the Bleed Valve, i.e. the white lever valve on the line on the left side of the buttress is closed.
- In the Mixer Bay, ensure that the drench nozzle caps are On.
- Under the outer edge of the verandah, ensure that the blue lever of the ball valve is vertical.
- Return to the Mixer Bay and check that there are no leaks past the drench nozzle caps.

2. Commence the Priming:

- Open the bleed valve, i.e. the white lever on the line on the left side of the buttress.
- Open the main lever valve (blue ball valve) slowly, until just after you hear a click.
- Open the white bypass lever valve (to the left of the main blue valve) slowly until you hear water flowing.
- If water is flowing from any drench head, close the main blue valve and white bypass valve, restore all drench caps over their heads, then repeat the test.
- Check the white bleed valve. When water starts to flow from the drain, close the bypass valve. Leave the blue lever valve open, i.e. horizontal, and the white bleed valve open, i.e. vertical.

5.16 Move to the One Gallon Mixer Control Rack in the Plant Room (Building 272). Check that all 4 adjacent lights on the left of the panel are On. Also check that the card mounted lights as follows are On:

Card	Lights
3	3 single red (one for each phase)
4	1 green (24 v ^{ac})
6	Top and bottom red (240 volt from inverter)

5.17 Ensure that the Circuit Breakers Nos 2, 3, 4 and 12 yellow are On (to centre of switchboard).

5.18 Check the oil level in the vacuum pump to be used and switch this vacuum pump On (pair of orange switches to the south of the vacuum pumps.)

5.19 Go to the Plant Room for the One Pint Mixer (Building 273). On the Inverter panel, check that Input C/B is On, i.e. Up and Red Inverter Light is on. Check that output voltage shows 240 volt and amperage a non-zero value.

- 5.20 On the Standby Battery Charger, ensure power switch and overcharge light are on. Turn the Control Knob to Float Voltage and ensure that a value of at least 27.1 volts appears on the digital display. Return the Control Knob to its original setting.
- 5.21 Press Vacuum Pump and Function Verify switches. On the wall behind the Control Panel, if using Vacuum Pump 1, observe the centre pressure gauge. If using Vacuum Pump 2, observe the right end pressure gauge. These gauges, one for each vacuum pump, show the pressure in the ballast tank or keg.
- 5.22 Close and lock the door of the Control Room. Carry this key with you while working at the mixer (Bay 5).
- 5.23 Return to the Mixer Bay. On the way, check that the Main Drench Isolation valve is open, i.e. lever is horizontal. If directed by the O-I-C place Lutin on sides and bottom of mixer can for a blade clearance test. Keep the mixer lid off. This test is performed after each maintenance or as directed by the O-I-C.
- 5.24 Ensure that the can is in position and each retaining lever is fully home.
- 5.25 Inject one shot of special grease in each upper housing nipple for every 3 hours' mixing. Grease "O-rings". Check that the main sealing ring gasket is in place in the outer edge of the top flange of the mixer can and greased. Repeat for the gaskets in the viewing port cover. Ensure that the Filling Port plug is in place.
- 5.26 Return to the Control Room. Focus the TV camera on the mixer blades, and adjust the camera controls as required.
- 5.27 On the Control Panel, ensure that the Deluge Primed light is On and NOT flashing and that the gas pressure light is on.
- 5.28 As you press each mixer or vacuum function switch, it will flash in parallel with the function verify switch. Press the Function Verify switch to commence the relevant action.
- 5.29 Press the Blue Mixer Operations Run switch and the Function Verify switch On. Adjust the mixer speed control (left black knob) to give 5 to 10 rev/min. The mixer blades will commence to turn.

- 5.30 Observe by the TV screen that no one is at the mixer can. Press the switch on the intercom while calling a warning through the intercom: "Stand clear, can going up".
- 5.31 Press Raise and Function Verify buttons. Ensure that lower button is released. On the TV screen, observe the can rising.
- 5.32 When the can is fully up, press the Can Vacuum and Function Verify switches. Observe the vacuum gauge BETWEEN the two gauges described above.
- 5.33 When vacuum in can reaches a minimum, release can vacuum by pressing Can Vacuum switch again. Reduce the mixer speed to zero and press the Mixer Operations Run switch to stop the mixer. Release the vacuum pump button.
- 5.34 Check the TV screen to ensure that no one is at the mixer can and call through the intercom: "Stand clear, can coming down".
- 5.35 Press the "Lower" switch. Release the Raise switch. Bring the can down by pressing "Function Verify".
- 5.36 Measure the Lutin on bottom and sides of mixer can to check if clearances are according to specifications. Report results to O-I-C, PDA2.
- 5.37 Release both securing levers for the mixer can. Remove Lutin from mixer can and blades and clean with methylated spirit.
- 5.38 Return to the Control Cell. Press Beacon lamp buttons in turn for Amber Flash and Red Flash and check that each beacon light is working, then press each of these buttons to cancel.
- 5.39 Heating and Cooling: Secure the mixer can in place using both levers.
- 5.40 Connect the temperature transducer lead and the water outlet and inlet flexibles. It is very unlikely that both heating and cooling will be required for a given mix. As each of these tests takes some time, touch the can jacket to verify that heating is occurring. Repeat for cooling if required for the mix session.
- 5.41 Return to the Control Boxes on the south verandah, between Bays 4 and 5. Face the wall. Beside the left side of the One Gallon Mixer Heater Control Box, turn the Black Lever Switch On.

- 5.42 Return to the Control Panel in Bay 2.
- 5.43 Adjust the Temperature Control knob to ensure 60 Degrees Celsius on the "Can Temperature" display. Press HEAT button. After several minutes, check the temperature of the jacket with your hand. Press the HEAT button to cancel.
- 5.44 Press COOL button. After several minutes, check the temperature of the jacket with your hand. Press the COOL button to cancel. At the side of the Control Box described in 5.41, turn the switch Off.
- 5.45 In the Mixer Bay, disconnect the water outlet and inlet flexibles to the mixer can.
- 5.46 Uncouple the thermocouple lead.
- 5.47 Return to the nitrogen bottle and turn the main valve off. Release the regulator valve until it is free. Under the outer edge of the verandah, ensure that the Blue Lever of the Ball valve is vertical.
- 5.48 In the Plant Room for the One Pint Mixer, turn off all light switches by the door.
- 5.49 Move to the switchboards between Bays 4 and 5. In the Deluge Control panel, turn Deluge Power Key Off (red tag).
- 5.50 Move to Mixer, Bay 5, Building 123, via the south door. Close and secure both bay doors. Turn the three light switches beside the left outside wall Off (orange switches).
- 5.51 Close the doors of the Plant Room at the One Pint Mixer. Return to the Control Panel. Turn off TV power and power point. Press Equipment Power button. Turn off and remove the three End of Panel keys, and the System Selection and Operation keys. Turn the Orange Control Panel Isolating Switch Off. Close the bay and turn off the lights.
- 5.52 Return all keys to the O-I-C, PDA2's Office (Building 170).

6. Mixing Operations (Manual Control) and Preparation for Automatic Control
 - 6.1 Before mixing operations may commence, the Operator-in-Charge shall have available the PROPELLANT/EXPLOSIVE PROCESSING SHEET approved as in 4.5 above. An INGREDIENTS/WEIGHING CHECK SHEET shall also be at hand.
 - 6.2 Collect the following keys from the Supervisor's Office (Building 170):

Building 123, Bay 2:	Control Cell
	Control Panel - System
	- Operation
One Gallon Mixer and others:	Main Hydraulics
	Hydraulics Raise/Lower
	Vacuum Pump
 - 6.3 Unlock Building 123, Bay 2 and switch on bay lights. At the top right of the Control Panel, ensure that the orange control panel isolating switch is on. On the Control Panel, ensure that the two mixer can position push buttons (raise and lower) are in the UP position.
 - 6.4 Check that the intercom and phone are working.
 - 6.5 Insert the two System selection and Operation keys and select Manual mode by turning key clockwise. System 1 refers to the One Pint mixer, Building 273. System 2 refers to the One Gallon Mixer, Bay 5, Building 123. Insert the three Multi-Mixer keys in the north face of the Control Panel and turn On.
 - 6.6 Ensure Deluge Switch is in the off position, i.e. toggle switch down and cover on.
 - 6.7 Press the Equipment Power and Camera Control Monitor buttons. Ensure that:
 - Equipment Power and Camera Control Monitor Power lights show Orange
 - PLC Status Volts and CPU Run lights show Green,
 - Mixer Can. Operations "Lower" button light is on,
 - Deluge Primed light is flashing, indicating Gas Pressure is low or off.
 - 6.8 Turn TV monitor outlet power point on wall on. Below the monitor screen, press Power button. The screen will show a number for about 5 s. Now press Video button. The screen will show Video for about 5 s.

- 6.9 Ensure that all other Control Panel lights are off, and that the Mixer Speed and Outlet Temperature Knob Controllers are set at Zero.
- 6.10 Ensure Emergency Stop button is in the Up position.
- 6.11 Press the FUNCTION VERIFY and CAN VAC cuttuns. While you hold BOTH buttons down, the following lights will be ON: Raise, Lower, Run, Vacuum Pump, Deluge Primed, Fire, Red and Amber Beacon Lamps. The vacuum ballast tank may vent provided it has no signal to prevent this. Allow ten seconds for this venting to be completed, then ensure that both buttons are released and raised.
- 6.12 Close and lock the door of the Control Room. Carry this key with you while working at the mixer.
- 6.13 Move to Mixer, Bay 5, Building 123, via the north door. Open the door and turn the three light switches beside the open right door on (Orange switches). Unlock and unbolt the south doors. Secure the doors open if required.
- 6.14 On the nitrogen cylinder against the wall buttress, ensure that the Regulating knob on this cylinder is free to rotate. Open the Main valve. Adjust the system pressure to 300 kPa by turning the regulating knob clockwise. On the wall behind the nitrogen cylinder, set the Flow Control Valve at 1.5 litre/min.
- 6.15 Move to the switchboards between Bays 4 and 5. On the Vacuum Control Panel, select Vacuum Pump 1 or 2. In the Deluge Control panel, turn Deluge Power Key On (red tag). On the buttress edge (upper left of switchboard), ensure the black air valve on the 1/4" copper line is open. On this air line, below the black valve, set regulator to 500 kPa.
- 6.16 On the vacuum manifold (large pipeline) overhead, and above the many hydraulic lines, ensure that the tagged inlet valve from the vacuum pump to be used is open, while that from the other vacuum pump is closed. Face the wall. Ensure that the outlet valve from the manifold to Bay 5 is open, i.e. the left outlet valve from this manifold.

- 6.17 Ensure that the white Drench Bleed lever valve on left side of buttress is open. Ensure that the white Drench Bypass lever valve is closed. Turn the Blue lever valve on SLOWLY until you hear a clock, then complete opening this valve.
- 6.18 Ensure drench nozzle caps on overhead red lines in mixer bay are not leaking.
- 6.19 Move to the One Gallon Mixer Control Rack in the Plant Room (Building 272). Check that all 4 adjacent lights on the left of the panel are On. Also check that the card mounted lights as follows are On:

Card	Lights
3	3 single red (one for each phase)
4	1 green (24 volts)
6	Top and bottom red (240 volt from inverter)

- 6.20 Ensure that the Circuit Breakers Nos 2, 3, 4 and 12 yellow are On (to centre of switchboard).
- 6.21 Check the oil level in the vacuum pump to be used and switch this vacuum pump On (orange switch on pedestal).
- 6.22 In the One Pint Mixer Plant Room, on the Inverter panel, check that Input C/B is On, i.e. Up and Red Inverter Light is on. Check that output voltage shows 240 volt and amperage a non-zero value.
- 6.23 On the Standby Battery charger, ensure Power switch and Overcharge light are on. Turn the control knob to Float Voltage. Ensure that a reading of at least 27.1 Volts is displayed. Turn knob back to previous setting.
- 6.24 Return to the One Gallon Mixer (Bay 5) via the Control Panel. If explosives are on site, press the Amber Light button. Press Vacuum Pump button and Function Verify button. Observe the Centre (Vacuum Pump No. 1) OR far right (Vacuum Pump No. 2) pressure gauge on the wall behind the panel. This gauge shows the pressure in the ballast tank or keg. This pressure should reduce to 2 torr over the next few minutes.
- 6.25 If working with automatic control, proceed to Section 7.

- 6.26 Take the lidded mixer can to the balance and load the first ingredient as shown on the PROPELLANT/EXPLOSIVE PROCESSING SHEET. Place the lid on the can and return to the Mixer. Place the can in position, and secure the can by turning the lever on opposite sides of the can through 180°. Ensure that the O-ring vacuum sealing gasket is in position around the mixer flange.
- 6.27 Connect the water outlet and inlet flexibles to the mixer can. Plug in Temperature Transducer. Ensure mixer can lid is off.
- 6.28 Return to the Control Boxes on the south verandah, between Bays 4 and 5. Face the wall. On the left side of the One Gallon Mixer Heater Control Box, turn the Black Lever switch on.
- 6.29 Return to the Control Panel, Bay 2. Ensure that the Deluge Primed light is on and NOT flashing and that the gas pressure light is on. Adjust the TV camera controls as required. Press the Temperature Control "Heat" or "Cool" buttons as required. Adjust the outlet temperature knob as required to ensure that the temperature specified on the PROPELLANT/EXPLOSIVES PROCESSING SHEET is achieved.

Note: When explosives ingredients are "on site", the amber beacon lights should be activated by pressing the Amber button. When explosives ingredients are being mixed, the red beacon lights should be activated by pressing the Red Flash button.

- 6.30 As you press each Mixer or Vacuum function switch, it will flash in parallel with the Function Verify switch. Press the Function Verify switch to commence the relevant action.
- 6.31 Press the Blue Mixer Can Operations RUN switch and the Function Verify switch on. Adjust the Mixer Speed Control knob to give 5 to 10 rev/min. The mixer blades will commence to turn.
- 6.32 Observe by the TV screen that no one is at the mixer can. Press the switch on the intercom while calling a warning through the intercom: "Stand clear, can going up".
- 6.33 Release the Lower button if on, press Raise, and press Function Verify. On the TV screen, observe the can rising. The Raise light will flash while the can is rising.

- 6.34 When the can is fully up, the Raise light will be on steadily. Adjust the mixer speed control to the speed specified on the PROPELLANT/EXPLOSIVES PROCESSING SHEET. If mixing with vacuum is called for press Can Vacuum and Function Verify switches. On the wall behind the panel, observe the pressure gauge in the centre of the right hand group of gauges. This gauge shows the pressure in the Mixer Can. This pressure should reduce to less than 5 torr over the next few minutes.
- 6.35 When the time for mixing as directed has elapsed, reduce the mixer speed to zero and press the Mixer Can Operations RUN switch to stop the mixer. If mixing under vacuum, press the Can Vacuum button to release the vacuum.
- 6.36 Check the TV screen to ensure that no one is at the mixer can and call through the intercom: "Stand clear, can coming down".
- 6.37 Bring the can down by pressing "Lower", releasing "Raise", and pressing "Function Verify" keys. Close and lock the door of the Control Room. Carry this key with you while working at the Mixer.

Note: Weighing and handling of ingredients is to be performed using respiratory protective equipment.

- 6.38 If further ingredient/s are required to be loaded, ensure that each container, scoop and spatula is connected by earthing lead and clamp to the mixer frame. Load mixer can with other ingredient's as called for in the mixing procedure. Record details on the INGREDIENTS/WEIGHINGS CHECK SHEET.
- 6.39 After connecting the spatula provided to earth, scrape down the blades to ensure that all powder ingredients are in the body of the mixer.
- 6.40 Using a clean dry rag, remove any spilled ingredients from top of the mixer can.
- 6.41 Remove empty containers from the mixer bay and close the door. All personnel then retire to the Control Cell, closing the mixer bay door on leaving.
- 6.42 Repeat instructions 6.29 to 6.41 for each subsequent addition of ingredient or further mixing time.
- 6.43 When mixing is completed, release the Lower and Temperature Heat or Cool Control buttons. Leave the vacuum pump on until casting is completed.

- 6.44 Close and lock the door of the Control Room. Carry this key with you while working at the Mixer. Move to the Mixer Bay. At the Control Boxes on the south verandah, between Bays 4 and 5, face the wall. Beside the left side of the One Gallon Mixer Heater Control Box, turn the Black Lever Switch off.
- 6.45 In the Mixer Bay, disconnect the water outlet and inlet flexibles from the mixer can. Uncouple the Temperature Transducer. Using the earthed spatula supplied, scrape the bellant from blades into the mixer can.
- 6.46 Wrap blades with polythene. Remove earthing clip. Place lid on mixer can. Transfer the can to workbench adjacent to the Fume Cupboard.
- 6.47 If working in the Fume Cupboard, turn on Fume Cupboard exhaust fan and perform all casting operations therein. Fill the specified sample boxes and viscosity specimen container using an earthed spatula provided. The viscosity sample requires immediate transfer to the test facility. When casting is completed, switch Vacuum Pump off.
- 6.48 Clean down all equipment. Ensure that the O-Ring in the mixer flange is removed and greased with petroleum jelly, the groove cleaned and the O-Ring replaced.
- 6.49 Return to the nitrogen cylinder on the buttress between Bays 4 and 5 and turn the main valve off. Release the regulator valve until it is free.
- 6.50 Turn off the Blue lever (main water isolation) valve overhead to the south of the Mixer Bay.
- 6.51 In the Plant Bay for the One Pint Mixer, turn off all light switches by the door, and lock the door.
- 6.52 Turn off the Yellow and Red Flashing lights. Release Monitor Power and Equipment Power buttons. Turn off Orange Control Panel Isolating Switch at the top right of Control Panel. Turn off TV monitor power and wall switch. Turn off and remove System Selection and Operation keys, as well as the three keys from the North face of the Control Panel. Close the bay and turn off the lights.
- 6.53 Return all keys to the O-I-C, PDA2's Office (Building 170).

TO BE CHECKED LATER

TO BE CHECKED LATER

7. Mixing Operations (Automatic Control)
 - 7.1 Activate Automatic Control by turning the Control key to Auto (position 1). All panel lights will go out.
 - 7.2 Ensure that wall switch and screen switch for TV monitor are on.
 - 7.3 Turn on the wall switches and computer switch to the Laser Personal Computer. Insert the Floppy Disc to record the mix parameters. The computer will display the message "C\ DSTO". Type DSTO and press Enter.
 - 7.4 When the computer asks for the "user name" code, type and press the Enter key as directed by the O-I-C, PDA2.
 - 7.5 The computer will then ask for a password. Type and press the Enter key as directed by the O-I-C, PDA2. Capital letters **MUST** be used where directed. If this password is not typed and entered within 60 seconds, the screen returns to 7.3 above.
 - 7.6 If there has not been a Deluge Check in the last 28 days, the screen will display: "Deluge Check in Progress".
 - 7.7 As directed by the O-I-C, PDA2, perform the *LIVE* or *SIMULATED* test and purge the lines of air as described in 5.13. Return to the Control Panel. If screen is NOT at Step 04, "Check if Explosives are on site", press F1.
 - 7.8 Press F2. Provided that the Fault light on the panel is off, the screen will ask: "Are Explosives on site?" and invite a "Yes" response. If this is the correct response, press Enter. Check the Control Panel to ensure that the Amber light is on. The screen will now ask: "Are Explosives to be Used?" and invite a "Yes" response. If this is the correct response, press Enter.
 - 7.9 If No is the correct response to either of the above questions, press N and Enter.

- 7.10 The screen will display: "Load Ingredients Now".
- 7.11 Close and lock the door of the Control Room. Carry this key with you while working at the mixer.
- 7.12 Take the Mixer Can to the Balance and load the first ingredient as shown on the PROPELLANT/EXPLOSIVE PROCESSING SHEET. Return to the Mixer Bay. Place the can in position and the Teflon spacer in position below the Mixer. Ensure that the O-ring vacuum sealing gasket is in position around the mixer flange. Remove the mixer can cover.
- 7.13 Using the alligator clip provided, secure the earthing lead from the frame to the body of the mixer can.
- 7.14 Ensure that each container, scoop and spatula is connected by earthing lead and clamp to the mixer frame. Carry out the addition of ingredients as called for on the MIXING PROCEDURE. Record details on the INGREDIENTS/WEIGHINGS CHECK SHEET.
- 7.15 If required, after earthing the spatula provided, scrape down the blades to ensure that all powder ingredients are in the body of the mixer.
- 7.16 Using a clean, dry rag, wipe all spilled ingredients from the top of the mixer can.
- 7.17 Plug in Temperature Transducer and connect water outlet and inlet flexibles to the Mixer.
- 7.18 Remove empty containers from the Building and close the Building door. Return to the Control Cell and unlock the door.
- 7.19 On the Control Panel, ensure that the Vacuum light is on. On the computer, press F2 to continue.

- 7.20 The screen will display the Operating Variables. Some of these are changed for each mix or mix cycle, while others remain the same for many mixes.

Mix Serial Number

Condition	Set Point	Minimum	Maximum
Start Blade Speed			
Mix Blade Speed			
Contents' Temperature			
Mix Time w/o Vacuum			
Mix Time with Vacuum			
Contents' Vacuum			
Ballast Vacuum			
Logging Period			

- 7.21 To enter the values shown in the PROPELLANT/EXPLOSIVE PROCESSING SHEET, press F3. In the order shown on the screen, type in the value required INCLUDING the decimal point and press Enter. If no change to a value is required, accept that value by pressing Enter.
- 7.22 After entering all values, check that they are correctly shown on the screen. If not, continue pressing Enter until you again come opposite a wrongly entered value on the screen. Type in the correct value and press Enter. Repeat as required until all values are correctly shown. Press key F2 to continue.
- 7.23 If you enter a Set Point value which is outside the maximum and minimum values previously set, the screen will display an "Error Message" and return to the Operating Variables Display. Press F3, enter the correct value, and press F2. If the Error Message is still displayed, refer to the O-I-C, PDA2.

- 7.24 The screen will display "Clear Processing Area". Call a warning through the intercom: "Stand Clear, can going up". Press F2. If the can temperature is outside the pre-set limits, the screen will display "Waiting for Temperature" and the pre-set and actual values. If this is the first mix cycle, press F2 to continue. If this message is displayed at the start of ANY later cycle refer to the O-I-C, PDA2, before pressing F2 to continue.
- 7.25 The screen will display "One Pint Mixer Overview". The blades will start to turn. If explosives are being mixed, check that the Red Light is on. At the top left of the screen, the process step in progress will be displayed.

Note: If you wish to stop the mix at any stage, press F1.

During running, the process parameters can be monitored using the keypad. On the top right of the panel, below the Value, will be displayed the Title of the Process Parameter being monitored, together with whether the Set Point Value (SP), or the Process Value (PV), is being displayed.

Normally, the Process Value of a parameter is displayed, and the Set Point Value of that Process Parameter is obtained by pressing the Right hand arrow on the keyboard. The Process Value is re-displayed by pressing the Left hand arrow on the keyboard.

Key Number	Process Parameter
1	Start Speed
2	Mix Speed
3	Contents' Temperature
4	Mix Time without Vacuum
5	Mix Time with Vacuum
6	Contents' Vacuum
7	Ballast or Keg Vacuum
8	Mix Speed
9	Mixer Torque

- | | | |
|-------|--------------------------|---|
| 7.25 | Key Number | Process Parameter |
| (ctd) | | |
| | 9, and Down Arrow Once | Haake Temperature
(Thermocirculator) |
| | 9, and Down Arrow Twice | Bay Temperature |
| | 9, and Down Arrow Thrice | Bay Humidity |
- 7.26 When the blades reach the Start speed specified, observe on the TV screen that the Mixer Bay is clear and call a warning through the intercom: "Stand Clear, can going up".
- 7.27 The Mixer Can will rise. The blades will then accelerate to the Run speed. When this Run speed is reached, the computer will start to count down the Mixing Time without Vacuum, displaying the remaining time on the screen.
- 7.28 When the Mixing Time without Vacuum is completed, and Mixing with Vacuum has been programmed, the vacuum will then be admitted to the mixer can. Check that the Can Vacuum light on the Control Panel is on. The value of vacuum in the system is shown on the left gauge on the wall above the Control Panel, and also by pressing key 6 for digital display on the right hand side of the Control Panel.
- 7.29 When the system reaches the maximum value of vacuum permitted, the computer will start to count down the mixing time with vacuum.
- 7.30 When all the time in this mix cycle has elapsed, call a warning through the intercom: "Stand clear, can coming down". The can will then lower automatically. Check that the Red Light is off.
- 7.31 The screen will indicate "Cycle Complete". Press F1. If a further cycle is required, press F2. Repeat instructions 7.8 to 7.30 for each further mix cycle. But 7.12 and 7.17 should require no action.
- 7.32 If there is no further mixing, press F1. The screen will display "Clean Up Area".
- 7.33 Close and lock the door of the Control Room. Carry this key with you while working at the mixer.
- 7.34 Disconnect the water outlet and inlet flexibles to the mixer can, and uncouple the Temperature Transducer.

- 7.35 Using spatulas supplied, scrape propellant from blades into the mixer can.
- 7.36 Wrap blades with polythene, place lid on mixer can and remove earthing clip. Transfer the can to Building 123, Bay 1.
- 7.37 Turn on Fume Cupboard and perform all casting operations therein. Fill the specified sample boxes and viscosity specimen container using a spatula provided. The viscosity sample requires immediate transfer to the test facility.
- 7.38 Clean down all equipment. Ensure that the O-Ring in the mixer flange is removed and greased with petroleum jelly, the groove cleaned and the O-Ring replaced. Also ensure that the O-Ring on the Viewing Port seal of each Ultra-Violet Detector is lightly greased.
- 7.39 When clean up is complete, press F1. The screen will display "Remove Floppy Disc. Turn Computer Off". Turn computer body switch and two wall switches off. Turn Control key on panel to "Manual".
- 7.40 Press the FUNCTION VERIFY and CAN VAC buttons. While you hold BOTH buttons down, the following lights will be ON: Raise, Lower, Run, Vacuum, Deluge Primed. The Vacuum Ballast Tank will vent provided it has no signal to prevent this. When the ballast tank has vented fully, as shown by pressing key 7 on the keyboard, ensure that the CAN VAC button is released.
- 7.41 Turn off the Main Water Isolation Valve to the south of the Plant Room. Turn off the Cooling Water switch on the south wall outside the Plant Room and the Red Water Isolating Valve.
- 7.42 In the Plant Bay, on the Haake Thermocirculator, turn the front Green power switch off, i.e. Down, and turn the Black switch on the top unit to the "O" position, i.e. Off. Turn the two power point switches off.
- 7.43 On the Centre panel, turn the Rapier Motor Control key to the off position. On the left panel, ensure that the Deluge System key and the Water Power Bypass switch are off.
- 7.44 Turn the Vacuum Pump isolator switch off. Turn off all light switches by the door.

7.45 Close the doors of both bays. Return to the gas bottle and turn the main valve off. Release the regulator valve until it is free. Return with the Danger Signs to the Control Panel. Release Vacuum Pump, Monitor Power and Equipment Power buttons. Turn off:

- Orange Control Panel Isolating Switch at top right of Control Panel.
- TV Monitor Power and wall switches.
- Intercom.

Turn off and remove System Selection and Operation keys. Close the bay and turn off the light. Return all keys to the O-I-C, PDA2's Office (Building 170).

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Commissioning and operating instructions of one gallon (US) mixer

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ABSTRACT

A one gallon (US) vertical bladed planetary action mixer was installed in Production Development Area No. 2 of MRL, EOD-Salisbury. This report describes the rationale for manufacturing the mixer, along with a description of the equipment installed.

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Commissioning and Operating Instructions of One Gallon (US) Mixer

P.J. Barry and J. Levers

(MRL-TN-633)

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