

Operation & Maintenance Manual

Original Instructions

UNIT DVK/Y 400 VANPACK MANUAL & RADIO

Section 1	Contents & Introduction
Section 2	Scope of Supply
Section 3	Technical Data
Section 4	Operation
Section 5	Routine Maintenance
Section 6	Fault Finding
Section 7	Harben P Type Pump
Section 8	Circuit Diagrams
Section 9	Diesel Engine
Section 10	Parts list / Spares / Auxiliary components
Section 11	Service Documents
Section 12	Warranty & Certification
Section 13	Health and Safety Manual

Operation & Maintenance Manual for:

UNIT: UNIT DVK/Y 400 VANPACK

ISSUE DATE: 02/23

AMENDMENTS

Change	Changes	Date	Signature
1	NEW ADDITION	05/2021	JHGS
2	ADDED DVY 400	07-04-22	NJS
3	ADDED 004-430 & 004437	12-12-22	NJS
4	ADDED RADIO VERSIONS	23-02-23	NJS

1. Contents & Introduction

1.1. Contents

2. Contents


<u>1. CONTENTS & INTRODUCTION</u>	<u>3</u>
1.1. CONTENTS.....	3
2.1. INTRODUCTION.....	6
2.2. SCOPE OF THIS MANUAL	6
2.3. THE DVK/Y 400 VANPACK	7
2.4. COMPOSITION OF THIS MANUAL	8
<u>3. SCOPE OF SUPPLY</u>	<u>9</u>
3.1. SCOPE OF SUPPLY	9
3.2. VANPACK ASSEMBLY	9
3.3. DETAILED DRAWINGS	9
<u>4. TECHNICAL DATA.....</u>	<u>11</u>
4.1. UNIT DVK/Y 400 VANPACK	11
4.1.1. MAIN COMPONENTS	12
4.1.2. ANCILLARIES	12
4.1.3. SERVICES REQUIRED	12
4.2. TECHNICAL DESCRIPTION	13
4.2.1. PRIMARY COMPONENTS.....	13
4.2.2. ENGINE MONITORING.....	13
4.2.3. DELIVERY HOSE REEL	14
4.3. INSTALLATION DETAILS	14
<u>5. OPERATION</u>	<u>15</u>
5.1. OPERATING CONDITIONS	15
5.2. DAILY CHECKS	15
5.3. PRE-START CHECKS & PROCEDURES	15
5.4. STARTING THE ENGINE AND SETTING THE OPERATING PRESSURE	16
5.5. TANK WATER LEVEL	16
5.6. EMERGENCY SHUTDOWN.....	16

5.7. OPERATING STARTING PROCEDURE.....	16
5.8. CHECKING OPERATING PRESSURE WITH A NOZZLE FITTED	17
5.9. ENGINE EXHAUST DPF REGENERATION	18
5.9.1. DPF REGENERATION – KUBOTA ONLY	18
5.9.2. DPF REGENERATION – YANMAR ONLY.....	22
5.10. REMOTE OPERATION (IF APPLICABLE).....	26
5.10.1. STARTING THE ENGINE	26
5.11. HARBEN® JUMP JET	28
5.12. RAPID SHUTDOWN ⚠	28
5.13. HOSE REEL WINDING & UNWINDING	29
5.14. FROST PRECAUTIONS.....	30
 <u>6. ROUTINE MAINTENANCE</u>	 <u>31</u>
6.1. MAINTENANCE PROCEDURES.....	31
6.2. DAILY MAINTENANCE	32
6.3. PUMP LUBRICATING OIL	33
 <u>7. FAULT FINDING</u>	 <u>33</u>
7.1. EQUIPMENT FAULT FINDING.....	34
7.2. PUMP FAULT FINDING.....	35
 <u>8. P TYPE PUMP</u>	 <u>37</u>
 <u>9. CIRCUIT DIAGRAMS.....</u>	 <u>38</u>
9.1. HYDRAULIC CIRCUIT – 061-558.....	38
9.2. WATER CIRCUIT	38
9.3. HYDRAULIC CIRCUIT – 061-588	39
9.4. WATER CIRCUIT	40
 <u>10. DIESEL ENGINE.....</u>	 <u>41</u>
 <u>11. PARTS LISTS / SPARES.....</u>	 <u>42</u>
11.1. INTRODUCTION.....	42
11.2. ORDERING SPARE PARTS	42
11.3. SERVICE AND REPAIR PART NUMBERS	43
11.4. CONSUMABLE COMPONENTS	44

11.5. ACCESSORIES.....	44
<u>12. SERVICE DOCUMENTS.....</u>	<u>45</u>
12.1. SERVICE CHECKLIST	45
12.2. SERVICE LOGBOOK.....	46
<u>13. WARRANTY</u>	<u>48</u>
13.1. WARRANTY OF NEW PRODUCTS:	48
13.2. WARRANTY OF SPARE PARTS:	48
13.3. LIMITATIONS OF WARRANTY:.....	49
13.4. DECLARATION OF CONFORMITY	50
<u>14. HEALTH AND SAFETY MANUAL.....</u>	<u>51</u>

2.1. Introduction

Please ensure that you read this Operation & Maintenance Manual in conjunction with the Health & Safety Manual before operation. (section 13)

Within this manual the health and safety risks are highlighted with  and you are required to read the relevant section in the Health & Safety Manual.

Notices

Carefully read the notices of this manual because they give important information concerning safe installation, use and maintenance; familiarise yourself with the workings of the machine in order to rapidly switch it off and eliminate pressure.

This manual is an integral and essential part of the product; it must be consigned to the user in order to ensure the training/information for personnel.

The manufacturer does not assume responsibility for damage caused to persons, property or to the machine, in the case of improper use. Carefully preserve this manual for any further consultation.

Identify the model of your machine by reading the details on the identification plate. Upon delivery, inspect the machine / accessories for any damage, which may occur during transport.

IMPORTANT: Always follow the recommended operating procedures; do not misuse the equipment as this could result in injury or mechanical breakdown!

2.2. Scope of this Manual

This manual provides operation and maintenance instructions for the Unit. Where the unit has been fitted with proprietary components, details of these are also included in this manual.

This manual is compiled to match the Scope of Supply detailed in Section 2. All specifications, descriptions and parts lists refer only to the components in the version of the unit detailed in this scope of supply.

Maintenance instructions included in this manual include:

- Routine maintenance to be carried out at specific times.
- Maintenance of the high-pressure pump.

Repairs to the pump crankcase are not considered maintenance operations as these should be undertaken only by FLOWPLANT, their approved agents, or at least competent automotive engineers.

2.3. The DVK/Y 400 Vanpack

The DVK/Y 400 Vanpack is a highly versatile mobile high-pressure water jetting unit which offers the benefits of proven power pack and pump performance with a comprehensive range of accessories.

Developed for a wide range of water jetting applications, the Vanpack has been meticulously designed for safe and efficient use.

The options fitted to and the accessories supplied with this Vanpack are detailed in Section 3

2.4. Composition of this Manual

This manual comprises the following further sections:

Section 2 Scope of Supply

This section defines the scope of supply of the equipment in compliance with the sales order.

Section 3 Technical Data

This section contains technical information about the unit.

Section 4 Operation

This section describes the recommended operating procedures for the unit.

Section 5 Routine Maintenance

This section details recommended routine maintenance requirements for the pump and unit.

Section 6 Fault Finding

Fault diagnosis tables for the pump, engine and ancillaries.

Section 7 Harben P Type Pump

Details of the pump and gearbox assembly.

Section 8 Circuit diagrams/Electrical Details

This section includes the Hydraulic, Water and Electrical circuits including engine controller & wiring loom.

Section 9 Diesel Engine

This section provides part details of the diesel engine.

Section 10 Parts list / Spares / Auxiliary components

How to identify and order spares / auxiliary components.

Section 11 Service Documents

Service logbook and checklist.

Section 12 Warranty & Certification

Section 13 Health and Safety Manual

3. Scope of Supply

3.1. Scope of Supply

Unit:	UNIT DVK400 VANPACK
Machine Build Code:	004426, 004427, 004430, 004444

Unit:	UNIT DVY400 VANPACK
Machine Build Code:	004434, 004435, 004436, 004437

3.2. Vanpack Assembly

The General Arrangement drawing: 004-375, defines the components of the DVK/Y 400 Vanpack mounted Pump Assembly as follows:

Water is fed from a mains supply into a plastic water storage tank the tank supplies the pump with a positive head of pressure via an inline Hypro strainer that filters the water to approximately 177 microns.

The 'P' Type radial piston high-pressure diaphragm pump is driven by a industrial diesel engine through a reduction gearbox.

The water is directed by a divert valve, to a hydraulically driven hose reel c/w 300' of ½" hose, or at low pressure 'dumped' back to tank.

The system is protected from over pressurisation by a safety relief valve.

The engine and system pressure can be monitored at the control panel situated at the rear of the van.

3.3. Detailed Drawings

Detailed drawings and parts lists for the above components are provided as follows:

The "P" Type pump is detailed in Section 7.

Details of other parts and assemblies are included at Section 10.

[illegible]

4. Technical Data

4.1. UNIT DVK/Y 400 VANPACK

Pump Type	P Type 8 22
Pump width	405 mm
Pump length	385 mm
Inlet	28.6 mm dia
Outlet	G1/2" (1/2" BSP)
Shaft dia	30 mm
Shaft length	65 mm
No. of cylinders	8
Power rating (nominal)	26 kW
Piston diameters	22 mm, 20mm
Shaft speed	1250 rpm
Maximum pressure	275 bar, 345 bar
Nominal Flow rate	Up to 55 lpm (<12.0 igpm)
Crankcase lubrication	Fully immersed
Oil capacity (litres)	5.0 litres
Weight (kg)	80 kg
Recommended crankcase oil	Shell Morlina 150 or Tellus 150 (see section 6)
Max inlet pressure	0.5 bar (5.0 metre head)
Max inlet temp.	25°C <i>Note: Unless 70°C hot water conv' kit is fitted 009-001</i>

4.1.1. Main Components

004-426, 004-430 DVK 400

Engine: Kubota 1803 Stage 5

Gearbox Harben 2.0:1 SAE5

004-434, 004-437 DVY 400

Engine: Yanmar 4TNV88C

Gearbox: Harben 2.21:1 SAE5

4.1.2. Ancillaries

Water tank 400 litres nominal capacity

Supply filter N05105 Hypro line strainer / 80 micro mesh

Safety Relief 067779 SAFETY VALVE VS500

4.1.3. Services required

Mains water supply Positive head capable of delivering greater than 60 lpm.

Note: Water pH value of 5 to 9 is recommended.

4.2. Technical Description

4.2.1. Primary Components

The primary components of the DVK/Y 400 Vanpack are illustrated on dwg. 004-375 which are as follows:

- A prime mover in the form of an industrial diesel engine which drives a Harben 'P' type radial piston diaphragm high-pressure pump.
- The 'P' type pump can raise the water pressure up to 4000 psi or 5000 psi dependent on machine.
- A Hydraulically driven hose reel c/w 91.44 m (300 ft) of 2 wire braid high-pressure hose with either a nozzle or gun attachment to deliver the high-pressure water to the selected working site.
- A plastic water tank A200330, acting as a reservoir, ensures the water is settled and non-turbulent, discharging a smooth lamina flow of uninterrupted air free supply, and a positive head of pressure to the pump inlet, maximising the pumps full potential. The tank can be filled via the inlet reel by connecting to a mains inlet water supply.

Note: Turbulent water will cause the pump to run unevenly and cause excessive wear due to cavitation.

- The 12VDC hydraulic diverter valve, allows water to be directed to either the high-pressure delivery hose or dumped back to the header tank.
- A Hypro 80 micro mesh inline strainer is fitted to the suction line between the tank and the pump inlet.

Note: This is a critical component which ensures that no contaminants are drawn into the pump inlet. This filter must be inspected and cleaned daily, if it becomes blocked it will cause the pump to cavitate)

4.2.2. Engine Monitoring

Engine oil pressure and engine coolant temperature, together with alternator charge rate are continuously monitored. Activation of the engine pressure or temperature switches will cause an engine shutdown and the respective alarm be displayed.

4.2.3. Delivery Hose Reel

The hose reel drum on which the delivery hose is wound is driven by a powerful OMR315 hydraulic motor directly coupled to the hose reel hub. Hydraulic power is obtained from a hydraulic gear pump driven from the engine P.T.O. (*See below*)

Note: 069-363 Hydraulic gear pump detail: -

(Ratio 1:1, Output 6.5 cm³/r, SAE Flange mounting A, 16/32 Spline Pitch, 9 Teeth.)

The speed and direction of the reel is controlled by a manual lever-controlled spool valve c/w safety relief and flow control, this is situated to the left of the hose reel.

4.3. Installation Details


Installation Drawing No. 004-375 provides details of sizes, weight and fixings for the DVK/Y400 Vanpack together with inlet and outlet water connections.

5. Operation

5.1. Operating Conditions

Operators of water jetting equipment should be fully conversant with the 'WJA Code of Practice for the use of high-pressure water jetting equipment', hereafter referred to as 'The Code of Practice'. A copy of The Code of Practice is available upon request.

Please ensure that you read this Operation & Maintenance Manual in conjunction with the Health & Safety Manual before operation (section 13).

Within this manual the health and safety risks are highlighted with  and you are required to read the relevant section in the Health & Safety Manual.




5.2. Daily Checks

- Refer to Pump oil level
- Gearbox oil level
- Water filter cleanliness
- Engine oil level
- Engine coolant level
- Tank water level
- Diesel level

Full maintenance checks are detailed in Section 5 – Routine maintenance

SAFETY RELIEF VALVES MUST BE RECALIBRATED EVERY 6 MONTHS

5.3. Pre-start Checks & Procedures

1. Park next to suitable clean water supply on a level ground. 
2. In cold weather check that machine is not frozen before starting (see Antifreeze section).
Only operate the machine in a well-ventilated area. 
3. Ensure the vehicle hand brake is applied.
4. To fill water tank, connect to water supply, remove the water tank lid when connected to mains supply in order to comply with water authority byelaws. The water will fill the tank via the inlet hose reel when the tank is full it will flow out the overflow.
5. Feed the end of the high-pressure hose through the hose trace on the swinging arm in front of the hose reel.  Do not fit the nozzle or gun at this point!

Do not allow unfiltered water into the pump

5.4. Starting the Engine and Setting the Operating Pressure

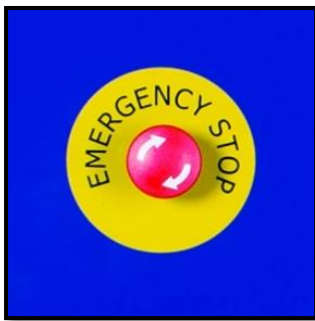
Starting procedures are provided for operation where water to the high-pressure hose is controlled by the operator using the Control box at the instrument panel, and one other in charge of the nozzle or gun.

5.5. Tank water level

Ensure you have an adequate water supply and that the water tank is at least $\frac{1}{2}$ full. The machine WILL NOT RUN if the water tank is empty. It is preferable to have a full tank of water and provide the pump with a good positive head.

NOTE: Do NOT allow unfiltered water into the pump








5.6. Emergency Shutdown



NOTE: At any time during the starting procedure, or during normal jetting operations, an emergency shutdown can be achieved by pressing the E/Stop button.

Fig. 4.1 Estop on control panel. Twist to release

5.7. Operating Starting Procedure

1. Ensure selector valve is in the dump position.
2. Ensure the open ended, high pressure hose is in a safe position, preferable within sight of the operator at the control panel.
3. Using the rocker switch marked Power, energise the Control Panel.
4. Enter the 4 digit PIN using the  &  Arrows and  buttons on the controller.
5. Momentarily press the Green Button on the Control Panel to start the Engine. The Engine will automatically start and hold at Idle Speed.
6. Water should now be circulating through the pump and be diverted back to the tank. Bleed the pump if necessary, using the bleed screws on the front of the pump. Allow the engine 5 minutes to warm up.
7.  To divert water to the high-pressure hose, press Spray Button on the control panel  or if using manual machine use manual selector.
8. Speed / Pressure can be adjusted using RPM+  and RPM- 


9. To shut the system down, reduce the RPM to Idle and turn off the water. Switch the Engine off by momentarily pressing the Red button. The Engine will shut down safely. Use the rocker switch to de energise the control panel. The system is now safely off.
10. In Emergency Situations punch the emergency stop button.

NOTE: Do not exceed the maximum operating pressure of 4000 psi (5000psi if 8x20 pump) by fitting a smaller nozzle than is recommended. This will cause the burst disc to open.

NOTE: If the pressure is significantly lower than expected, turn the unit off and replace the worn nozzle in the gun with a new one

NOTE: Do not exceed the maximum operating pressure by fitting a smaller nozzle than is recommended.

5.8. Checking Operating Pressure with a Nozzle Fitted

1. Fit the correctly sized nozzle to the high-pressure hose.
2. Ensure the nozzle is in a safe position placed inside the pipe to be cleaned and preferably within sight of the operator at the control panel.
3. Start engine.
4.  Move the selector valve to the high-pressure position or use the water on off button.
5. Observe the pressure displayed on the control panel and note the pressure reading. Increase engine speed and pressure until the nozzle travels up the pipe
6. Clean short runs at a time.
7. When finished, reduce the speed of the engine.
8. Move the valve to the 'dump' position.
9. Switch the engine off.



NOTE: Operating the machine with the Jump Jet system turned off can increase the water pressure at the de-silter nozzle by up to 100%. Only do this when you know there is no risk of damage to in-situ

If the pressure is significantly lower than expected, turn the unit off and replace the nozzle with a new one as it may be worn.

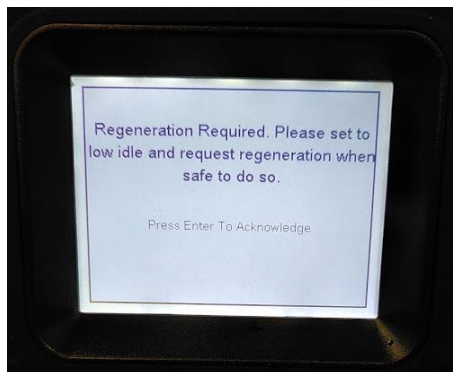
5.9. Engine Exhaust DPF Regeneration

5.9.1. DPF Regeneration – Kubota only

Periodically the Engine will need to perform a DPF Regeneration Cycle.

⚠ Ensure the Unit is parked up with the handbrake applied, in a non-combustible environment. Ensure the Unit is full of water, and on DUMP. As this process is noisy and can take time, it is recommended that it is not undertaken at night.

- 1) The Unit will indicate on the Control Panel when a Regeneration is required by showing the below pop up. This is cleared by pressing enter.



- 2) A slowly flashing symbol shown below continually advises that a Regeneration is a required.

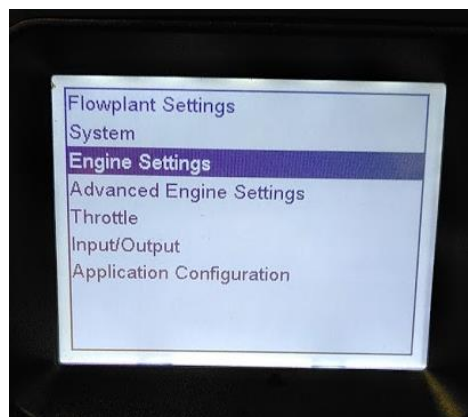
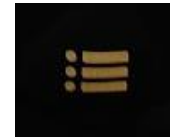


- 3) This requirement for a Regeneration can be confirmed by cycling through to the information screen shown below. A “DPF Level” of 2 or greater needs attention.
 - a. Level 2 – Stationary Regen Required
 - b. Level 3 – Kubota Recall (Service engineer required)
 - c. Level 4 – DPF replacement

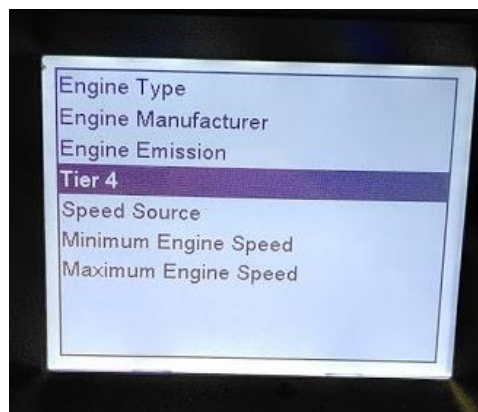
Actual RPM	Target RPM	Engine Battery	Run Hours
1000	1000	14.2 volts	13.10 Hrs
Engine Status	Status Time	Remote	Water
Running Loaded	00:00:00	REMOTE DISABLED	Off
Time 08:59:21 AM Date 27 Jul 20	Unit pressure 0 bar	Engine Temp 33.0 °C	DPF Level 2



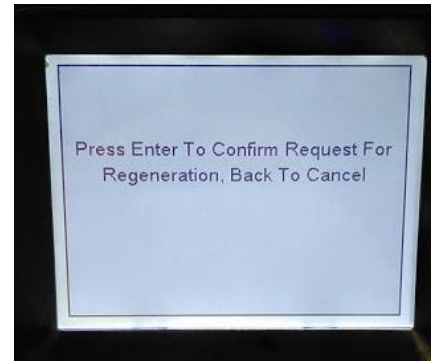
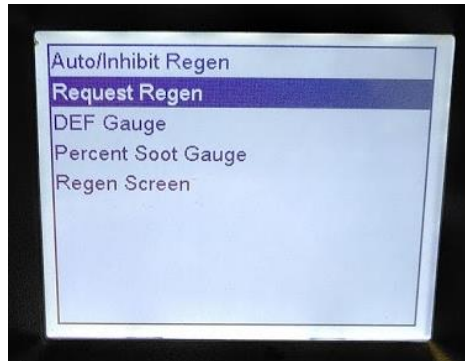
- 4) Apply both the Park and Neutral Toggle Switches to the “on” position.
- 5) Start machine on idle with the water returning to tank.
- 6) Enter the Engineers pages on the Control Panel by selecting.
Input the Password to gain access. 1111.
- 7) Select the “Engine Settings” option within the menu by scrolling and pressing enter.



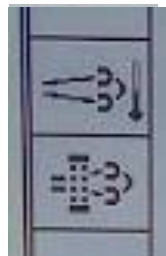
- 8) In the next screen select “Tier 4” within the menu by scrolling and pressing enter.



- 9) After this selection, you will then need to select “Request a Regen”. Press enter to choose this option. You will then be greeted with a confirmation page to initiate the Regeneration. On this screen, press enter to confirm.



- 10) The Engine RPM will then increase automatically to conduct the full Regeneration. The symbol will now be solid.
- 11) The Engine will now run until completion of the Regeneration Cycle. This can take some time. Throughout the Cycle, the following symbols will appear simultaneously.



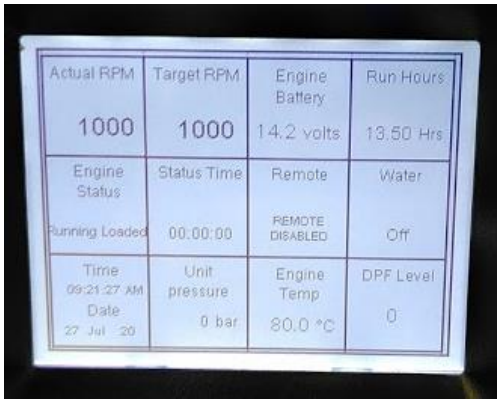
- 12) Once the Regeneration Cycle has finished, the Engine will return to idle. The following message will be displayed. This can be cleared by pressing enter.



- 13) Switch the Park and Neutral switches to the “off” position.

14) A Unit Power cycle (on then off) may be required to clear any remaining Regeneration symbols on the Control Panel screen.

15) To confirm that the Regeneration was successful. Cycle through to the information screen, and check to see that “DPF Level” is now at 0.



Actual RPM 1000	Target RPM 1000	Engine Battery 14.2 volts	Run Hours 13:50 Hrs
Engine Status Running Loaded	Status Time 00:00:00	Remote REMOTE DISABLED	Water Off
Time 09:21:27 AM Date 27 Jul 20	Unit pressure 0 bar	Engine Temp 80.0 °C	DPF Level 0

5.9.2. DPF Regeneration – Yanmar only

Periodically the Engine will need to perform a DPF Regeneration Cycle.

⚠ Ensure the Unit is parked up with the handbrake applied, in a non-combustible environment. Ensure the Unit is full of water, and on DUMP. As this process is noisy and can take time, it is recommended that it is not undertaken at night.

- 1) The Unit will indicate on the Control Panel when a Regeneration is required by displaying an alarm on the screen. The alarm will instruct the user to bring the unit to idle and request a Regen.
- 2) A flashing symbol shown below advises that a Regeneration is required.



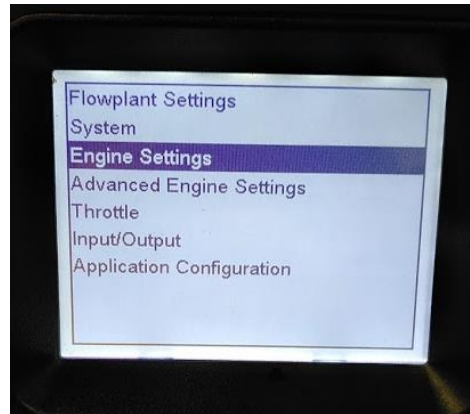
- 3) This requirement for a Regeneration can be confirmed by cycling through to the information screen shown below. A “DPF Level” of 2 or greater needs attention.
 - a. Level 2 – Stationary Regen Required
 - b. Level 3 – Yanmar Recall (Service engineer required)
 - c. Level 4 – DPF replacement

Actual RPM	Target RPM	Engine Battery	Run Hours
1000	1000	14.2 volts	13.10 Hrs
Engine Status	Status Time	Remote	Water
Running Loaded	00:00:00	REMOTE DISABLED	Off
Time 09:59:21 AM Date 27 Jul 20	Unit pressure 0 bar	Engine Temp 33.0 °C	DPF Level 2

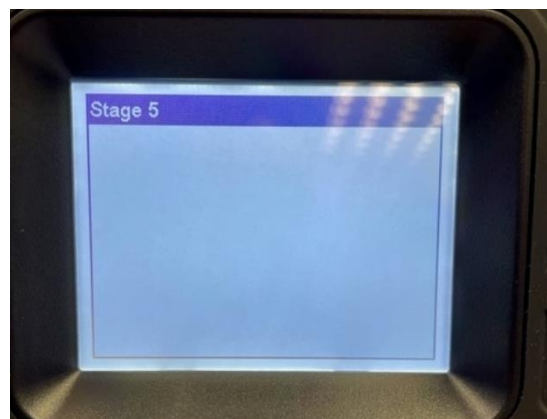
- 4) Switch regen interlock switch on (located on side of control box)
- 5) Start machine on idle with the water returning to tank.
- 6) Engine needs to be running at 60 degrees or more. To achieve this, run with water dumping back to tank on high revs for 5+ minutes. 1500rpm+ will be sufficient to warm the engine in approx. 5 minutes.



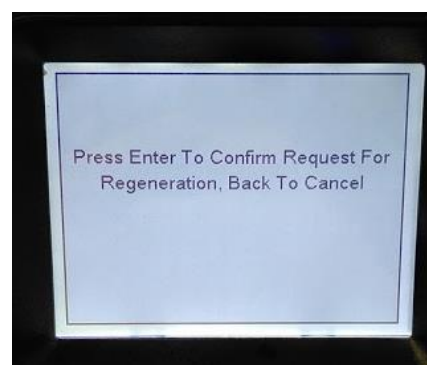
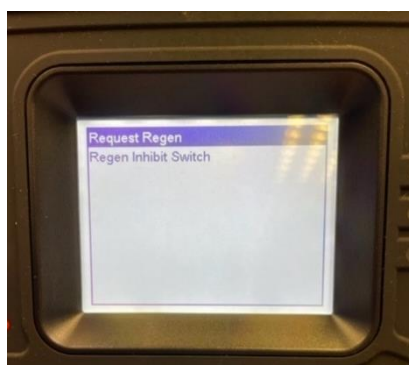
- 7) Enter the Engineers pages on the Control Panel by selecting.
Input the Password to gain access. 1111.
- 8) Select the “Engine Settings” option within the menu by scrolling and pressing enter.



- 9) In the next screen select “Stage 5”



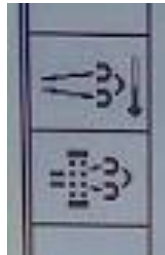
- 10) After this selection, you will then need to select “Request a Regen”. Press enter to choose this option. You will then be greeted with a confirmation page to initiate the Regeneration. On this screen, press enter to confirm.



- 11) The Engine RPM will then increase automatically to conduct the full Regeneration. The symbol will now be solid.



- 12) The Engine will now run until completion of the Regeneration Cycle. This can take some time. Throughout the Cycle, the following symbols will appear simultaneously.



- 13) Once the Regeneration Cycle has finished, the Engine will return to idle. The following message will be displayed. This can be cleared by pressing enter.



- 14) Switch the regen interlock off.
 15) A Unit Power cycle (on then off) may be required to clear any remaining Regeneration symbols on the Control Panel screen.
 16) To confirm that the Regeneration was successful. Cycle through to the information screen and check to see that "DPF Level" is now at 0.

Actual RPM	Target RPM	Engine Battery	Run Hours
1000	1000	14.2 volts	13.50 Hrs
Engine Status	Status Time	Remote	Water
Running Loaded	00:00:00	REMOTE DISABLED	Off
Time	Unit pressure	Engine Temp	DPF Level
09:21:27 AM Date 27 Jul 20	0 bar	80.0 °C	0

IMPORTANT NOTES:

Running unit on idle for prolonged periods will result in build-up of soot and require engine to complete a passive or forced regeneration.

Running the unit on prolonged periods at full load and full speed will clear the DPF and reduce the requirement for passive or forced regeneration.





Ignoring the requirement to complete a forced regen will result in the need for a service visit by a certified Kubota or Yanmar engineer.

Ignoring any warning codes on the engine may result in serious damage.







Incorrect oil will result in premature failure of the engine. Only oil recommended in the user manual must be used.

5.10. Remote Operation (if applicable)

5.10.1. Starting the Engine

1. Switch on the Panel using the I/O Rocker switch.
2. Enter the PIN using the  &  Arrows and  buttons on the controller.
3. Press the remote function on the controller and press  to enable remote. Display will show "Remote enabled" the unit is now ready for remote control.

On the Remote-Control Unit (RCU):

4. Pull out red button on the base of the RCU to switch the handset on.
5. Follow the on screen instructions - Press and hold fully down both buttons 5 + 6 for 3 seconds, a beeping noise will emit from the RCU. RCU & receiver have now 'paired'. See fig 5.
6. Press button 2, the Start / Stop button on the RCU 
7. To increase engine speed,  press the 'engine speed up' button, this is indicated by the symbol of a hare. See fig 5
8. To decrease engine speed, press the  red engine 'speed down' button, this is indicated by the symbol of a tortoise. See fig 5
9. Press button 1, the water ON button, to divert the water to the nozzle or gun. See fig 5 
10. Press button 1 again, this will now divert the water back to tank See fig 5 
11. To stop the engine, reduce the Engine rpm press button 2 the start / stop button on the RCU. See fig 5 
12. **The Remote-control unit will remain connected unless the user disables remote control function at the main controller or system is powered down.

When the engine has be stopped the RCU will turn itself off. To resume return to step 5

If the operator goes out of radio receiving range the system will automatically turn the water OFF (divert back to tank). When the operator steps back into radio receiving range, the status is healthy, and jetting can be resumed.

Turning the RCU ON



- Pull out the red button at the base of the RCU
- Press both buttons 5 & 6 together and hold for at least 3 seconds until a beep is heard. Once connected, the screen should display as per Fig. 5

Turning the remote control OFF

- Turn the handset off by pressing the red STOP button

Button 1 Water on / Water Off.

Button 2  Engine Start Stop

Button 3 HI RPM up

Button 4 LO RPM Down

No lights...RCU off.

Charging Details (See handbook for charging instructions).

5.11. Harben® Jump Jet

The Harben Jump Jet system is a unique and exceptionally effective addition to the Harben high pressure pump which increases the effective duct cleaning distance up to and often beyond 300m. When required the operator can switch on the Jump Jet to create a cyclic vibration in the jetting hose. The vibration travels along the entire length of the hose reducing friction between itself and the duct wall and allowing the de-silting nozzle to continue moving into the duct, cleaning as it goes.

Critically the Jump Jet allows ducts to be de-silted with pressures as low as 140 bar and only 40 l/min meaning that even with fibre optic cable in-situ there is negligible risk of causing any damage.

 To operate the jump jet, open the jump jet valve on the control panel of the unit.

5.12. Rapid Shutdown

Should any unforeseen circumstance arise, including any signs of a leak, the jetting operation should be terminated immediately, and the equipment shut down.

Depress the 'RED' emergency STOP button to shut the engine down. Note: To reset the emergency stop on the control panel twist the button 'clockwise' to release.

Automatic Shutdown

1. The engine will shut down automatically if the monitoring and control system detects a malfunction.
2. Possible reasons for an automatic shutdown are detailed in Section 6 - Fault Finding.
Note: When the engine has been stopped, the RCU will turn itself off, to resume return to section 4.8 and run through the procedure.

5.13. Hose reel winding & unwinding

The high-pressure hose is manually unwound and hydraulically wound by an OMR315 hydraulic motor, which is driven by a gear pump from the engine P.T.O.

The motor is fitted to the hub of the hose reel. The motor speed and direction are controlled via a manually actuated spool valve (018-005 "Hydraulic Directional Control Valve" CV1185 c/w 110bar relief & flow control)

The hose reel motor speed can be adjusted up and down by a flow control knob.

Pushing the lever inwards towards the pump set will wind the hose reel in.

The normal practice is to unwind the hose by hand, only drawing off the required length of hose to reach the work site and then to wind the hose back in using the hydraulic motor.

It should be remembered that the hose cannot be wound using the hydraulic motor unless the engine is running.

Therefore, when a jetting operation is finished, wind in the hose before shutting down the engine. Wind in the hose before you intend to empty the tank.

⚠ If the hose becomes stuck in the drain the hydraulic hose reel should NOT be used as a winch to try and free it and the towing vehicle should NEVER be driven away, in an attempt to drag the hose clear. This will put severe strain on the reel framework which could lead to serious damage.

Hoses that have become stuck can sometimes be pulsed free using the Harben® Jump Jet™ kit or alternatively they should be pulled free by hand.

NOTE: The hose should NEVER be tightly wound onto the hose reel drum when the hose is not pressurised, as might occur when the hose has become trapped. A tightly wound hose can easily crush the hose reel when it is next pressurised. If you have reason to believe that the hose may have been tightly wound onto the reel when unpressurised it should be completely unwound and then rewound loosely before pressurising.

5.14. Frost Precautions

During periods when there is a risk of freezing, the following precautions should be taken:

Before frost

1. Prepare 50% anti-freeze solution.
2. Remove nozzle or gun attachments from the delivery hose.
3. Lower the water level in the tank
4. Pour anti-freeze solution into the anti-freeze tank. This must be a 50:50 mix.
5. Restart the engine, move the "T" valve in the suction line to the upwards position and pump the anti-freeze solution through the high-pressure hose and return line as required.

NOTE: *If the pump is frozen up, on no account should the unit be started until it has been thoroughly thawed.*

6. Routine Maintenance

Table 5.1 provides a basic guide to routine maintenance requirements for the various components of the trailer.

Warning: Maintenance should only be carried out with the engine turned off and when cold.

****Ensure that there is no pressure in the system before attempting any maintenance.**

6.1. Maintenance Procedures

Table 1 indicates recommended routine maintenance tasks cross referenced to maintenance procedures.

Table 5.1 Recommended Routine Maintenance

	GENERAL
Prior to use / Daily / after 8 hours running	<ul style="list-style-type: none"> • In cold weather check machine is not frozen before starting • Check inlet water filter element (Ref Para 5.2) • Check engine oil level on dip stick (Ref section 9) • Check radiator water level • Visual check for hose damage/water leaks • Check emergency stop button operation • Check high-pressure hose condition
Weekly / 24 hours	<ul style="list-style-type: none"> • Visually inspect the machine for safety, checking for any loose, damaged or missing parts. • Check air filter cleanliness (Ref section 9) • Check fuel filter for contamination (Ref section 9)
Three monthly / 50 hours	<ul style="list-style-type: none"> • First service contact Flowplant • Replace Pump Oil (only required for first service only)
Six Monthly / 100 hours	<ul style="list-style-type: none"> • Inspect tanks and fittings for leaks • Tighten any loose joints • Check condition of 12 volt start battery • Grease battery terminals for protection • Grease the hydraulic hose reel bearing blocks
Yearly / 200 hours	<ul style="list-style-type: none"> • Intermediate service of engine, gearbox and pump required (Contact Flowplant) • Closely inspect the structural integrity of the framework for signs of stress and cracking • Carry out detailed inspection of pipes, hoses and fittings. • Check unloader valve operation.
Two Yearly / 400 hours	<ul style="list-style-type: none"> • Major service of engine, gearbox and pump required (Contact Flowplant) • Check wiring terminals/connections and continuity of electrical earth.

For a detailed guide to pump maintenance and overhaul procedures refer to [Section 7](#).

For routing engine maintenance please refer to the engine handbook supplied with the unit.

6.2. Daily Maintenance

The following must be completed daily with the jetter switched **OFF**.

1. Check condition of inlet water filter & element. Clean or replace. (Flowplant part no. N05105). Unscrew the bowl to remove the mesh (Flowplant part no. N06021). Take precautions so as not to lose the sealing ring (Flowplant part no. N05108).



Fig. 6.1 - Inlet Filter

2. Visually inspect all hoses for signs of chaffing or leaks. Report any damage immediately to supervisor or manager.

With the machine running:

3. Make further inspection for leaks. If a leak is observed, shut down immediately and report the leak to a supervisor or manager.

6.3. Pump Lubricating Oil

Manufacturer	Type
ESSO	Nuto H150
GULF	LP 150
MOBIL	DTE Extra Heavy
ROC	Kiron 150
TEXACO	Rando HD 150
BP	Energol HLP 150
AGIP	OSO 105
SHELL	Tellus/Morlina 150
CENTURY OIL	PWLM
PETROFINA	Hydran 51
CASTROL	Hyspin AWS 150

Oil Capacity (litres)			
Number of Cylinders			
3-cyl	4-cyl	6-cyl	8-cyl
6.5	6.0	5.75	5.0

7. Fault Finding

Most of the problems experienced during jetting operations are likely to be caused by the pump or the associated hoses.

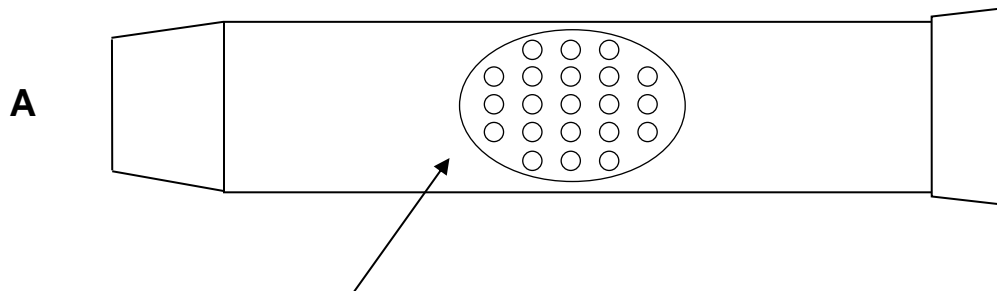
7.1. Equipment Fault Finding

Problem	Possible Cause	Recommended Action
Low system pressure	1 Worn or incorrect size of cutting nozzle. 2 Engine speed slow. 3 Leaks from hose. Pipes and connections. 4 Blocked inlet filter. 5 Inlet hose too long. 6 Loss of water through dump line of selector valve or gun when high-pressure selected. 7 Loss of water through dump line of remote-control kit, if fitted.	Replace the old jetting Nozzle with a new one. Adjust to correct speed. Check the connections for tightness, replace if needed Clean or replace element. Shorten hose length. Check seats and seals. Check seats and seals.
High System Pressure	1 Blocked nozzle, selector valve or gun. 2 Incorrect nozzle size. 3 Incorrect bore size. 4 Engine speed high. 5 Crushed delivery hose. 6 Two-gun choke left in gun when operating as single gun unit.	Clean the items and flush out the delivery line. Replace the nozzle. Replace the hose. Adjust to correct speed. Replace if necessary. Replace with standard choke.
Low Water Level	1 Blocked or dirty pre-filters. 2 Faulty ball valve assembly. 3 Wrong seat in ball valve assembly. 4 Low inlet pressure.	Clean or replace elements. Replace if necessary. Replace the seat if necessary. Increase pressure.
Pump Not Running Evenly (also refer to pump faults).	1 Air in water. 2 Air in crankcase oil. 3 Worn drive coupling. 4 Faulty inlet or delivery valve. 5 Valve nut over tightened.	Water bleed pump. Oil bleed pump. Replace flexible elements and examine coupling. Check valve condition. Check tightness of inlet & delivery nut
Burst Disc failure or Safety Relief Valve Operating (also refer to high system pressure problem).	1 Incorrect burst disc. 2 Incorrect valve setting. 3 Faulty Valve. 4 Faulty or fatigued burst disc.	Replace with correct disc. Check certificate/setting. Repair or replace if required. Replace with new disc.

7.2. Pump Fault Finding

Problem	Possible Cause	Recommended Action
1 Mixing of Oil and Water in crankcase 2 Loss of pressure 3 Pump not running evenly	1 Worn or damaged delivery valves. 2 Damaged filter element allowing debris to jam delivery valve.	1 Check all delivery valves – replace as necessary. 2 Check all diaphragms – replace as necessary. 3 Replace oil. 4 Check filters – replace as necessary.
1 Loss of crankcase oil through high pressure hose 2 Loss of pump pressure 3 Pump not running evenly	1 Inlet restriction may have been caused through; <ul style="list-style-type: none"> a. Blocked filters b. Kinked inlet hose c. Worn or damaged inlet valves d. Excessive inlet hose length 2 Pump has been frozen	1 Clear restriction. 2 Check inlet valves – replace as necessary. 3 Check diaphragms – replace as necessary. 4 Replenish oil.
1 Mixing of Oil and Water in Crankcase	1 Diaphragm failure (may have been through fatigue from excessive running hours).	1 Check all diaphragms – replace as necessary.

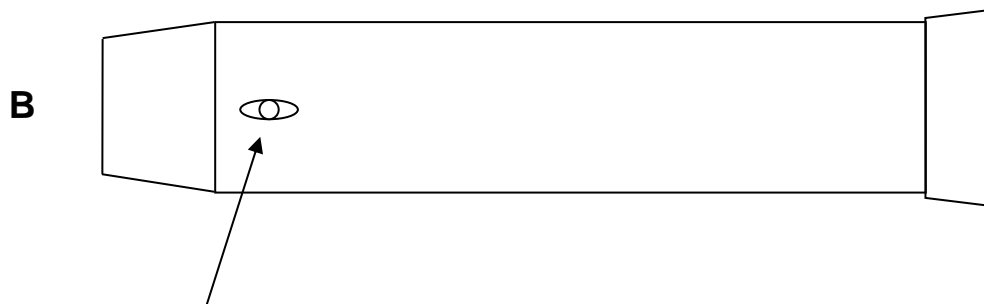
DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM



Impression of the baffle on diaphragm

Reason: Delivery valves worn or blocked

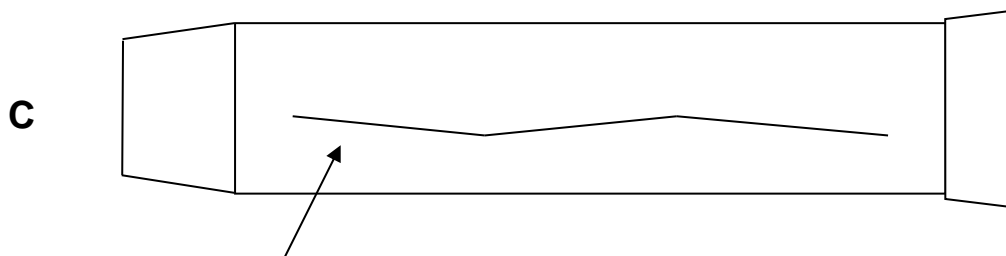
DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM



4 small impressions cause more damage on the inside, than on the outside.

Reason: Water filter blocked, or inlet valves blocked.

DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM

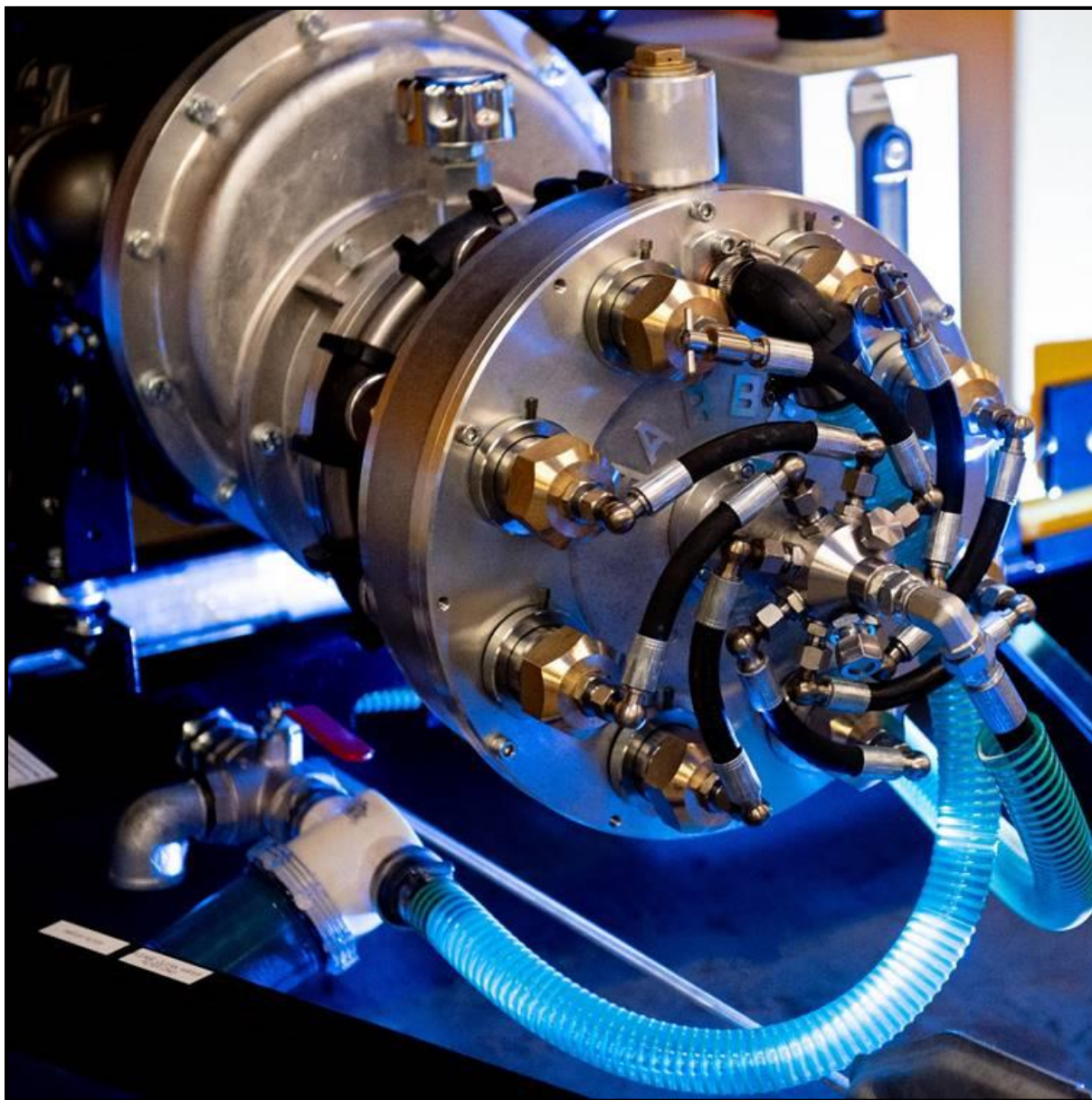


Shear through wall of diaphragm

Reason: Pump operated whilst frozen or wear and tear after several thousand hours

8. P Type Pump

Refer to the P Type Pump Service Manual, part no. 061-352, included with the unit.



9. Circuit Diagrams

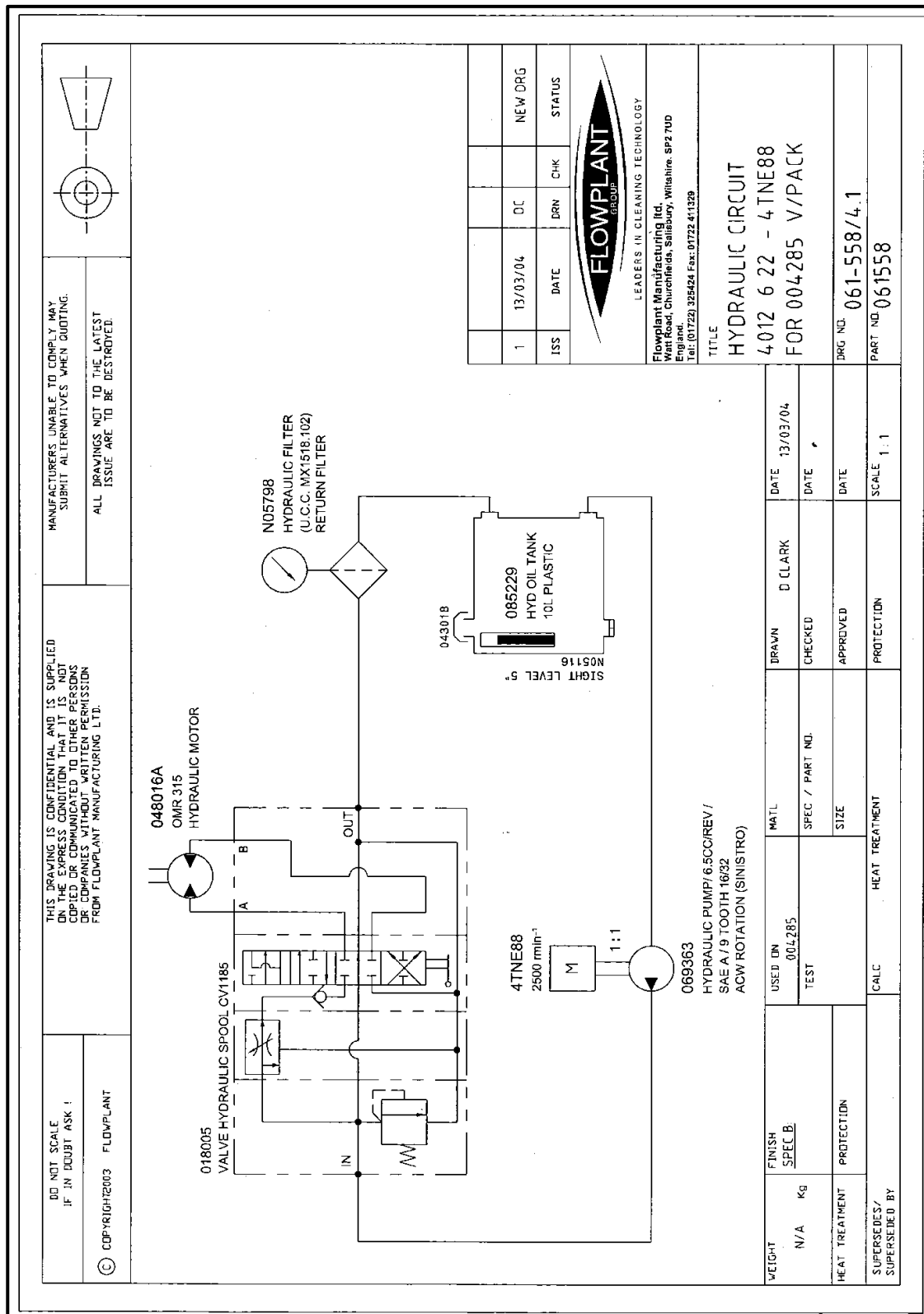
9.1. Hydraulic circuit – 061-558

This provides details of the unit's hydraulic circuit, the function of which is to power a hydraulic motor driven hose reel, winding high-pressure hose in or out whilst carrying out drain cleaning or other high-pressure water jetting applications.

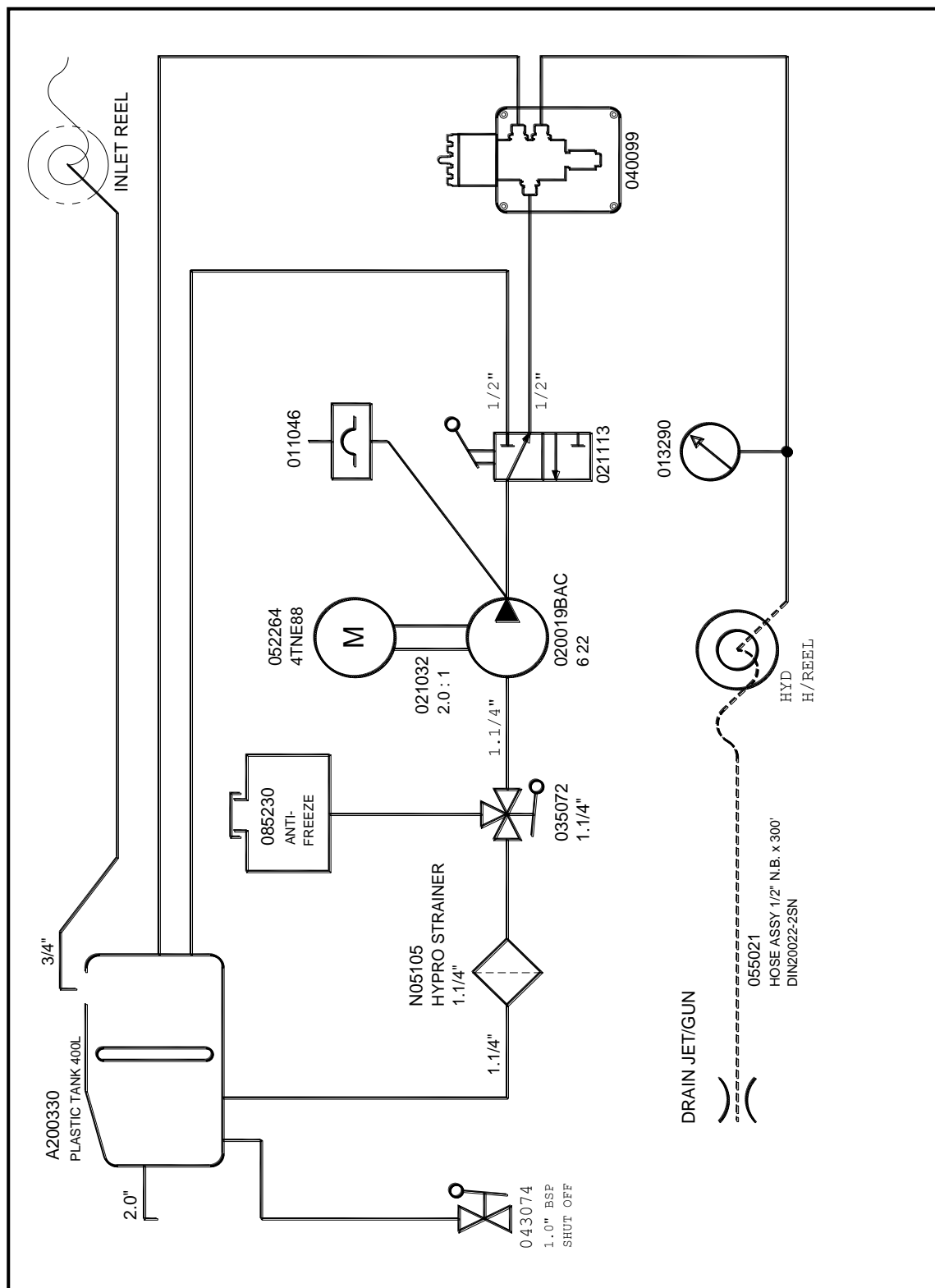
9.2. Water Circuit

This provides details of the water circuit, starting with the supply and ending with the delivery to the jetting application.

9.3. Hydraulic Circuit – 061-588



9.4. Water Circuit



10. Diesel Engine

A copy of the Diesel Engine Manufacturer's Operators Handbook is supplied with this equipment. The information contained within this section is only designed to complement the handbook and is for general use only.

If you require any further help with service or parts information, please contact the relevant department. It is recommended that the user records the engine serial number in the box below at the earliest opportunity. This will provide assistance in identifying the correct spare or replacement parts for this specific engine.

Engine Serial no:	
-------------------	--

11. Parts Lists / Spares

11.1. Introduction

This section includes advice on obtaining spare parts.

To identify consumable items and service kits you require you should use the information in this section. To identify components for the pump or engine etc, refer to the relevant parts in this manual.

11.2. Ordering Spare Parts

Order spare parts from:



Flowplant Group Ltd

Gemini House, Brunel Road, Churchfields Industrial Estate

Salisbury, Wiltshire, UK, SP2 7PU

Tel. +44 (0)1722 325424 – Fax. +44 (0)1722 411329

sales@flowplant.com

www.flowplant.com

11.3. Service and repair part numbers

DVY 400 (004-426)

ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
1	051-1077	Engine Oil Filter	1	SSP
2	051-1078	Engine Fuel Filter	1	SSP
3	051-1079	Engine Air Filter Inner	1	SSP
4	051-1080	Engine Water Temp Sensor	1	SSP
5	051-1081	Alternator Fan Belt	1	SSP
6	051-1090	Engine Air Filter Main	1	SSP
7	051-1091	Engine Oil Separator	1	SSP
8	054-125	Engine Oil	6 L	SSP
9	054-003	Gearbox Oil	5 L	SSP
10	054-003	Pump Oil	1.5 L	SSP
11	054-111	Antifreeze Solution	2.0 L	SSP

DVY 400 (004-434)

ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
1	051-1119	Engine Oil Filter	1	SSP
2	051-1120	Engine Fuel Filter	1	SSP
3	051-1121	Engine Fuel Filter Water Separator	1	SSP
4	051-1122	Engine Air Filter Element	1	SSP
5	051-1123	Alternator Fan Belt	1	SSP
6	051-1124	Engine Water Temp Sensor	1	SSP
7	054-125	Engine Oil	6 L	SSP
8	054-003	Gearbox Oil	5 L	SSP
9	054-003	Pump Oil	1.5 L	SSP
10	054-111	Antifreeze Solution	2.0 L	SSP

11.4. Consumable Components

N06021 80 MESH FOR LINE STRAINER N05105 177 MICRON

11.5. Accessories

Ancillary Equipment

055-021 HOSE ASSY 1/2" 91.44M STR/STR 1/2"BSPF DIN 20022 2SN

Guns/Lance

031-040 GUN MARK 2 SAFETY 6000 PSI (OPTIONAL)

Jet Inserts

056-026 JET HIGH VELOCITY 2.1MM

056-180 JET FAN 15 DEGREE 15125 1/4 NPT S/S

General Accessories

056-097 JET DRAIN 1/2"BSP 3 x 1.0MM @ 30 DEGREES

056-413 JET DRAIN 1/2"BSP 3Rx1FWD DIAMETER 1.0 at 30 DEG

056-584 JET DRAIN 1/2" BSPM 6R X 0.8MM @ 30DEG HARBEN

013-290 PRESSURE GAUGE 10,000 PSI

055-093 HOSE ASSY LEADER 1/2"BSPM 1/2"BSPF 3.05M SAE100R8

023-227 MINI JET KIT 20'COMPLETE MAX. W.P. 6000 PSI

060-133 JET DRAIN H/E 6 x 0.8MM REAR


056-671 JET HE 1/2" 3 REAR x 0.8, 0.9 FWD

057-041 KIT JUMP JET 6 & 8 CYL PUMPS `P`TYPE VANPACKS


055-027 HOSE 3/4" P.V.C. CLEAR BRAIDED [PER METRE]


12. Service Documents

12.1. Service Checklist

SERVICE CHECK LIST											
Serial Number -										<i>Sht 1 of 2</i>	
Unit Number -											
Date -											
Hours Run -											
Engineer -										ESR -	
I - Intermediate service				Y - Yearly service				R - Customer request			
Engine				Hydraulics				Water tank			
	I	Y	R		I	Y	R		I	Y	R
1 Check oil level				34 Check oil level				63 Clean water filter			
2 Change oil				35 Change oil				64 Change water filter			
3 Change oil filter				36 Change filter				65 Check hoses & fittings			
4 Clean air filter				37 Inspect hoses				66 Check tank security			
5 Change air filter				38 Inspect reel				67 Check tank integrity			
6 Change fuel filter				39 Grease reel bearings				68 Check A/Freeze			
7 Clean water trap				40 Check reel mountings				69 Check Inlet ball valve			
8 Check coolant level & A/F mix				41 Check operation				OMO Foot pedal			
9 Inspect radiator				42 Check for leaks					I	Y	R
10 Inspect hoses				Electrics/Controls				70 Check cable & plugs			
11 Check fan belt					I	Y	R	71 Test operation			
12 Check engine mounts				43 Check battery				72 Check safety button			
13 Check exhaust				44 Check/grease terminals				Pressure Hose			
14 Check throttle cable				45 Check charge system					I	Y	R
15 Check for leaks				46 Check wiring connections				73 Check for wear / damage			
Gearbox				47 Test/check operations				74 cuts / tears			
	I	Y	R	48 Test remote control unit				75 Braiding showing			
16 Check oil level				Vanpack frame				76 Any Joins in single length			
17 Change oil					I	Y	R	77 Fittings in good order			
18 Check for leaks				49 Check for cracks/damage				78 Leader hose satisfactory			
				50 Check fixing bolts & brackets				Hot Wash			
Pump				51 Check safety straps					I	Y	R
	I	Y	R	Trailer				79 Check fuel pump pressure			
20 Check valves (Inlet/delivery)					I	Y	R	80 Clean fuel filter			
21 Replace valves (Inlet/delivery)				52 Check for cracks/damage				81 Check swirl plate adjustment			
22 Check diaphragms				53 Check wheels/tyres/pressure				82 Check electrode gap			
23 Replace diaphragms				54 Check brake operation				83 Check air flow			
24 Change oil				55 Check lights/reflectors				84 Check thermostat operation			
25 Check hoses/fittings				56 Check tow hitch/lubricate				85 Check low water level switch			
26 Check working pressure				57 Check safety cable				86 Check unloader valve			
27 Check working temp				58 Check jockey wheel condition				87 Check burner is running clean			
28 Check smooth running				Gun & Lance				Remote Control			
29 Change Burst Disc (Must be changed every 6 months)					I	Y	R		I	Y	R
30 Set Safety Relief Valve (Must be set by manufacturer/authorised agent and reset/certificated every six months)				59 Check for leaks on pressure				88 Check handset operation			
30 Check main pressure gauge				60 Check for damage				89 Check Antenna			
31 Check burst disc fitted				61 Check operation				Other			
32 Check jump jet operational				62 Check jets are correct					I	Y	R
33 Pressure gauge reading correctly								90 Test emergency stop button			
I Intermediate Service								91 Check safety decals visible			
Y Yearly Service								92 Check ID plate condition			
R At Request of Customer								93 Clean & tidy appearance			
NA - Not applicable, A - Adjusted, ✓ - Satisfactory, R - Repair required, O - Observation										FLOW 0321 Iss 3	
Note - If 'Adjusted' or 'Repair required' please describe issue on sht 2											

12.2. Service Logbook

Flowplant Unit Log Book		
Serial Number -		
Unit Number -		
Date of Manufacture -		
		Sht 1 of 2
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Type of service - Intermediate, Yearly		FLOW 0322 Iss 1

Flowplant Unit Log Book		
Serial Number -		
Unit Number -		
Date of Manufacture -		Sht 2 of 2
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
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Engineer		
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Engineer		
Type of Service	Please state if other Service provider used	
Date	Official Flowplant Stamp and Signature	<div style="border: 2px solid red; width: 100px; height: 50px;"></div>
Engineer		
Type of Service	Please state if other Service provider used	
Type of service - Intermediate, Yearly		FLOW 0322 Iss 1

13. Warranty

13.1. Warranty of new products:

Equipment manufactured and supplied by Flowplant is warranted to be free from defects in materials and workmanship. The warranty includes both parts and labour necessary to correct any such defects. The warranty period for new products is twelve months from date of despatch from our factory. We shall repair or, at our option, replace free of charge any product, part(s) or component(s) manufactured by Flowplant which fail due to faulty manufacture or material within the warranty period.

13.2. Warranty of spare parts:

The warranty for new spare parts is six months from date of despatch on materials and workmanship.

The warranty for reconditioned spare parts is 90 days from date of despatch on materials and workmanship.

Provided always that:

- They are returned to Flowplant for inspection (carriage paid), along with a copy of the original part(s) sale invoice (where necessary); and
- All terms agreed by Flowplant for payment of such goods have been complied with; and
- If a defect/failure is discovered before the expiration of the warranty, notification must be given to the Flowplant service department immediately
- Any claim hereunder is made within 30 days of the date of discovery of the defect/failure.

Provision of this warranty shall not apply to any Flowplant product which has been:

- Used for a purpose for which it is not designed for; or
- Applied to a use which has not been approved by Flowplant; or
- Subject to misuse, negligence, lack of maintenance or accident; or
- Repaired or altered in any way so as, in the judgement of Flowplant, to adversely affect its performance and reliability

13.3. Limitations of warranty:

The new product and spare parts warranty is limited to defects in material or workmanship of the product. It does not cover loss of time, inconvenience, property damage or any consequential damages. Repair or replacement of the product is your exclusive remedy. Our liability under this clause shall be in lieu and to this exclusion of any warranty or conditions implied or expressed by law as to the quality or fitness for purpose of any goods supplied hereunder PROVIDED THAT nothing in this clause shall operate so as to exclude liability for death or personal injury arising from the negligence of the company or its employees.

Our obligations as aforesaid shall constitute the full extent of our liability in respect of any loss or damage sustained by the purchaser whether caused by any breach of this contract or by our negligence or otherwise and we shall not be liable to make good or pay for loss of use of the goods, loss of revenue, loss of profit or goodwill or any direct or consequential losses howsoever caused and the purchaser undertakes to indemnify us against any such claims against us by third parties.

In order to comply with the provision of the Health and Safety at work etc. Act 1974 in respect of articles manufactured, supplied or installed for use at work we test all our products before they leave our factory and supply them with adequate instructions for their proper use. Further copies of these instructions are available from us upon request.

13.4. Declaration of Conformity

14. Health and Safety Manual

Please refer to appended Health and Safety Manual 061-956.

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HEALTH AND SAFETY MANUAL – Issue 1



Read before operating equipment



Flowplant high pressure jetters and systems have been designed to the highest standards so that they will work safely and reliably for many years. It is important that you take time to read the safety information provided here so that you understand how to make the most of the equipment and how to use it safely. Flowplant jetters are powerful pieces of industrial equipment and should only be operated by competent users who understand that serious injury or death can occur through misuse.

The jetters described here are intended to be used for high pressure jetting and pumping applications.

Additional accessories can be purchased from Flowplant, such as: floor cleaners, jetting guns and jet pumps which extend the range of work that can be carried out with the jetter. Safety information relating to individual accessories is provided later in this section.



Throughout this manual there are various warnings marked with this icon. Where shown, failure to follow the instruction can result in serious injury or even death.

Change	Changes	Date	Signatu
1	NEW ADDITION	09/19	SAS
2	GENERAL EDIT	01/20	DMM

Contents

1. General Safety Information	4
2. General use of High Pressure Jetters	5
3. Hazards Associated with the misuse of High-Pressure equipment	6
4. Personal Protective Equipment	9
5. Pressure Safety Devices	10
6. High Pressure Hoses	11
7. Pump Bleed Screws	12
8. Exhaust Gases & Fire Prevention	13
9. Freezing Conditions	14
10. Adequate Drainage (Wastewater)	15
11. Daily Checks	16
12. Explosive Atmospheres	17
13. Trailer Jetters	18
14. Jetting Applications and Accessories	19
15. Drain & Pipe Cleaning	20
16. Jetting Guns	22
17. Tube Cleaning	24
18. Floor Cleaners	25
19. Jet Pumps	26
20. Dry Shut Guns & Foot Valves (Additional to Jetting Guns Info)	27
21. Electric Machines	28
22. Hot Water Machines	29

1. General Safety Information

- Safety procedures throughout this manual must be adhered to. In the case of conflicting or ambiguous instructions contact your Site Manager or Safety Manager before commencing work.
- Any person operating, working with, or passing near the jetter must wear the appropriate Personal Protective Equipment (PPE).
- The jetting supervisor should make this safety manual available to operators or persons working with the jetter and should ensure they read and understand it prior to operating the jetter.
- Prior to any adjustments being carried out the jetter must be shut down, de-pressurised and equipment isolated.
- All maintenance requirements in this manual should be adhered to as minimum maintenance requirements. Maintenance records should be kept up to date at all times. Maintenance should be carried out by competent persons only
- Guards which are located within the jetter must be fitted and must not be loosened or removed whilst the jetter is operational. Should it be necessary to remove any guard for access, it must be re-fitted and secured before start-up.



2. General use of High Pressure Jetters

- All persons using high pressure jetting equipment must be fully conversant with relevant operating instructions, safety notes and codes of practice.
- Operators must be competent in all aspects of jetter use.
- Erect suitable cordons at least 10m from the jetting operation to restrict all unauthorised access.
- All high-pressure water jetting operations should be under the control of a fully trained supervisor, who is aware of the potential hazards to operators and passers-by.
- Check the makeup of the jetting team complies with the relevant WJA Code of practice.
- Warning notices, 'DANGER - HIGH PRESSURE JETTING' should be displayed at all possible access points to the jetting area.
- Before starting the jetter, ensure that you, and anyone else who may be in control at any time, are fully aware of its controls and their function.
- ⚠ It is especially important that operators know how to stop the jetter in case of an emergency.
- Ensure that all the pre-operational checks have been completed.
- Do not operate the jetter near any persons or animals
- ⚠ Before starting the machine perform a safety training session at the machine and refer to all safety aspects.
- Legionnaire's Disease – leaving warm water in jetter tanks to stagnate for long periods could create conditions for Legionnaire bacteria to multiply. Clean jetter tanks out at least every 6 months with water above 70c (160F) to prevent algae and bacteria forming.

3. Hazards Associated with the misuse of High-Pressure equipment

- Never use a jetter that isn't regularly serviced according to the manufacturer's recommendations.
- When a jetter is used to clean drains & sewers that are contaminated with a hazardous substance it is possible these may be entrained in the resulting aerosol and inhaled by operators. Consider using respiratory protection.
- ⚠ Do not spray flammable liquids – there is a risk of explosion.
- ⚠ Ensure the correct fuel is used on all occasions or there is a risk of explosion.
- Never start the jetter when it may be frozen. Operating a jetter whilst frozen could cause high speed ice bullets to be ejected from the jetter hose on machine start up.
- Never start jetting a drain, sewer or pipe unless the jet nozzle is safely inside the drain and pointing in the direction that you intend it to travel.
- When drain jetting a drain, sewer or pipe whose inside diameter is not small enough to prevent the hose from turning back on itself, a drain jet extension (a piece of straight rigid tube equivalent to the pipe diameter) should be fitted between the end of the hose and the nozzle.
- Always use a safety leader hose at the beginning of the main jetting hose to alert operators when the jet nozzle is nearing the manhole entrance.
- Always consider the use of a tiger tail hose feed guide to protect the jetting hose from abrasion and prevent premature failure.
- Be aware that high pressure hoses can generate static electricity which may need to be controlled when working in hazardous areas.
- ⚠ Never direct a high-pressure water jet at electric power lines or electrical equipment as serious injury or death from electrocution could occur.
- When jetting drains or pipes if there is a danger to the general public from hoses laying across public walkways, they must be covered in such a way as to protect against injury from hose failure and tripping hazards.
- Before starting work, check and ensure the drain jets have no blocked holes or nozzles as this may cause the pumping system to over pressurise which could result in burst disc failure or bursting the jetting hose.
- ⚠ Never attempt to unblock a fully choked drain or pipe before considering the consequence of releasing the blockage (e.g. flooding, explosive ejection, drain nozzle ejection) and having a plan to safely deal with it.

- Never attempt to clean drains or pipes in one pass because this could lead to debris build up behind the jet nozzle causing a pressure build up in the drainage system. Be aware that a pressure build-up in the drain or pipe could cause the jet nozzle to be unexpectedly ejected back towards the operator.
- ⚠ Never enter the manhole to either place the jet nozzle into or extract it from the drain entrance unless the required confined space regulations have been met.
- ⚠ Never work in a manhole where explosive gases may be present with a radio remote control transmitter that is not designed for use in hazardous areas.
- Never use the hydraulic hose reel facility as a winch to retract a jetting hose that has become stuck in the drain or pipe. Damage to the hose could be caused that will make subsequent hose failure more likely.
- Never operate the hydraulic hose reel with the trailer disconnected from the towing vehicle.
- ⚠ Never allow jetting hoses to become kinked and always remove from service any jetting hose with an outer cover that has worn through to the reinforcing braid.
- Never use the high-pressure jetting hose for any purpose other than sewer, drain or pipe cleaning, e.g. winching vehicles or other plant.
- Only use jetting nozzles and/or accessories that have been calibrated for the jetting machine pump performance or else unexpected system over pressurisation could occur.
- Never attempt to clean a drain or pipe with a nozzle that has more forward force than rear force. It will be ejected back toward the operator and could cause injury.
- Never attempt to clean a drain or pipe with a chain flail type jet that has unequal chain lengths as this could lead to severe vibration and high-pressure hose failure.
- When using a venturi jet pump never place your fingers into the pump inlet as they could be trapped by the vacuum and cause injury. Always secure the free end of the pump hose securely and ensure adequate drainage is in place to deal with high volumes of pumped water.
- Never use a dry shut type jetting gun or foot control valve on a jetter that does not have a pressure unloader valve as this could result in burst disc failure or bursting the jetting hose.
- When using a dry shut type system be aware that high pressure can be retained in the jetting hose even after the machine has been shut down. Always discharge pressure in a safe manner after machine shut down.
- ⚠ Never point the gun at anyone as injury from high pressure water will occur if the jet stream comes into contact with body parts.
- Never work on a slippery surface because the reaction force of the jetting gun could cause you to become unstable and lose your footing.

- Never work from a ladder as the reaction force of the jetting gun could cause the ladder to fall backwards from the working area causing possible injury.
- Never work from scaffolding unless it is designed, erected and managed by competent persons and it is adequately secured to prevent it being pushed over by jetting gun reaction forces.
- When using the jetting gun to clean hard surfaces be aware that splash back could contain hard debris travelling at high speed.
- When using the jetting gun to clean contaminated surfaces be aware that splash back could contain dangerous contaminants.
- Never use the jetting gun to clean a surface that could be damaged by the water jet.
- Always ensure that an adequate area is cordoned off around the working zone so that flying debris and contamination cannot injure passers-by.
- Be aware that water jetting guns fitted with oscillating or rotating jet heads can produce higher hand arm vibration levels than simple fixed head jets. Monitoring these levels may be required under national health and safety regulations.
- When using a jetting gun or nozzle to clean at floor level wear suitable protective footwear.
-  Never use a high-pressure jetting gun to clean down PPE whilst you or others are still wearing it as serious injury and death could result.
-  Never use a high-pressure jetting gun to wash or cool down livestock as serious injury and death could result.
- Drainage systems may carry bacteria which can cause severe illness or death. Avoid exposing eyes, nose, mouth, ears, hands, cuts or abrasions to wastewater or faecal matter during drain cleaning operations. After working around drainage systems help protect yourself by always washing hands, arms and other areas of the body with hot, soapy water and, if necessary, flush mucous membranes with clean water. Disinfect soiled equipment by washing surfaces with a hot soapy wash using a strong detergent.

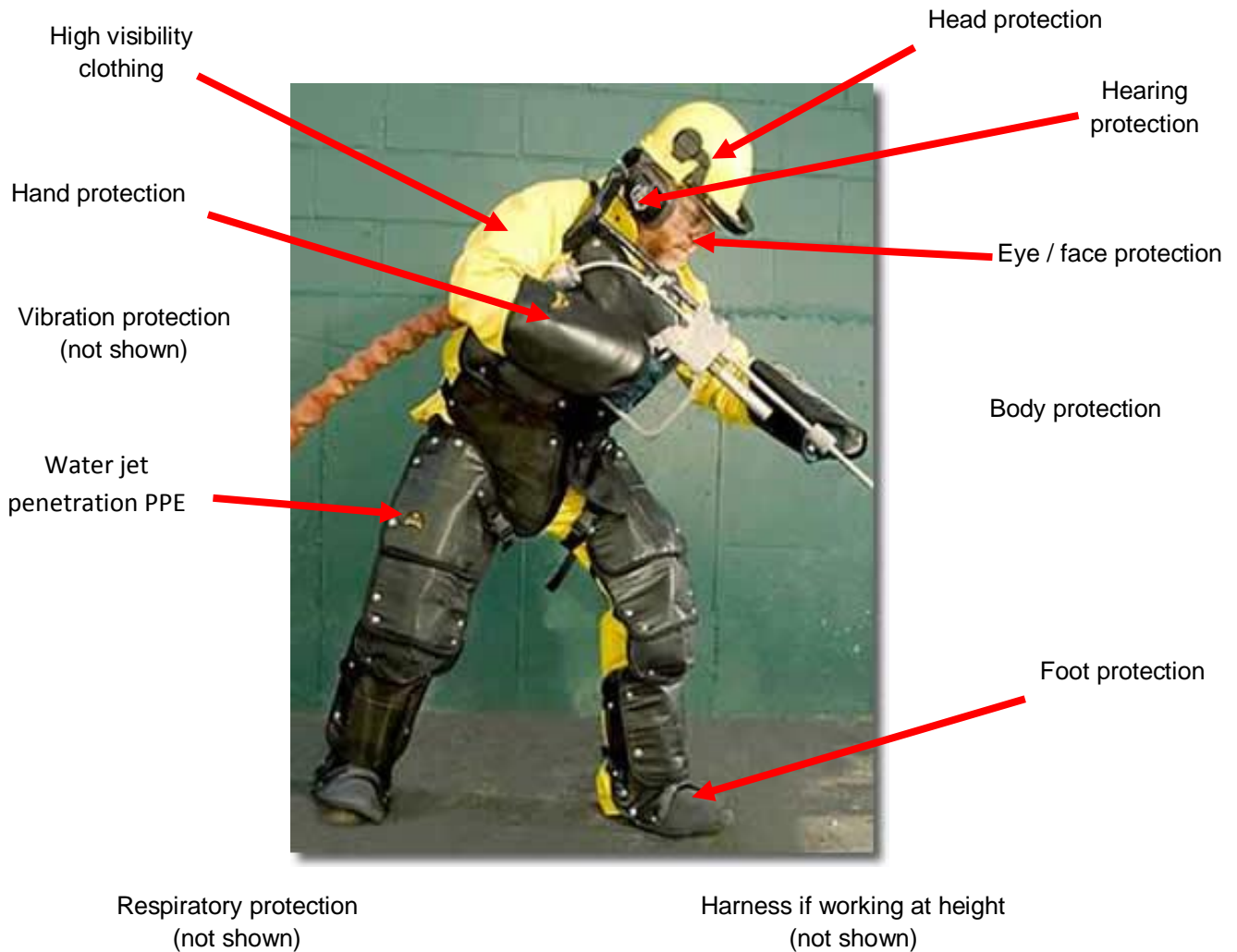
4. Personal Protective Equipment

Before operating jetting equipment all persons must carry out a risk assessment to determine the type and level of PPE required by each member of the jetting team. This could include:

- Ear protection – noise levels can be high
- Head and eye protection – a helmet with chin guard and visor is recommended
- Waterproof hand protection
- Waterproof clothing
- Waterproof safety boots with toe protection



A risk assessment must be completed to analyse which PPE must be worn. Specialist PPE is available which offers enhanced protection against water jet injuries.



5. Pressure Safety Devices



- Pressure relief valves should be checked for functionality and certified by the manufacturer or their authorised representative at least every 6 months.
- Pressure discs (burst discs) should be replaced at least every 6 months to ensure continued safe operation and only manufacturer's original replacements should be used.
- Under no circumstance should a fake part be used in place of a manufacturer's pressure disc (burst disc).

6. High Pressure Hoses

Hose assemblies require careful handling to provide long service life and to guard against potentially dangerous failure. Serious injury and death can result from the failure of a hose assembly that is damaged, worn out, wrongly assembled or installed incorrectly.

- Do not kink the hose
- Do not pull on loops
- Do not excessively stretch the hose
- Do not squash the hose
- Do not twist the hose
- Do not cut the hose
- Use a hose feed guide
- Do not kink the hose at the hose fitting

The following checks must be made before use:



-  High pressure jetting hoses must be checked along their entire length at the start of each shift to ensure that they are free from external damage. Hoses with exposed or broken reinforcing braid or damaged couplings may fail without warning and should be replaced immediately.
- Before use check end fittings and couplings for damage to threads, sealing faces and rounding of connection nuts. Only use the correct size spanner to tighten the hose fitting. Pipe wrenches or adjustable spanner type tools with serrated teeth must not be used.
- Hoses that have been used must not be re-ended under any circumstances. (Check national regulations which may vary)
-  Water appearing from the hose, coupling or connector, often first sighted as a fine mist, indicates the hose is damaged and could burst or a joint is loose or defective. Stop the jetter immediately. No attempt should be made to adjust any hose, coupling or connector whilst that part of the system is under pressure.

7. Pump Bleed Screws


- Never open pump bleed screws when pump is running on high pressure. High pressure fluid will jet from the bleed screw hole and it could cause injury.

8. Exhaust Gases & Fire Prevention

Our jetters use diesel or petrol (gas) powered engines

-  Engine exhaust fumes can be very harmful if allowed to accumulate in enclosed areas. Only run the engine in a well-ventilated location.
- The exhaust gas from the muffler is very hot. To prevent a fire do not expose dry grass, mowed grass, oil or any other combustible materials to exhaust gas. Always keep the engine and muffler clean.
- To avoid a fire be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.
- When running van pack jetters always ensure that the rear of the van is well ventilated and that the side and rear doors are always open.
-  Ensure the correct fuel is used on all occasions or there is a risk of explosion.

9. Freezing Conditions

- If the equipment has been frozen, it is essential that the whole system is first thoroughly thawed, then cautiously flushed without any nozzle or other restriction attached to the high-pressure hose.
-  Ice Bullets – ice may be trapped in the system. No attempt should be made to force the ice out by starting the engine. Ice can be ejected from the hose at high speed as the pump is started. Ice “bullets” can be ejected from the hose at speed with possible lethal consequences.

10. Adequate Drainage (Wastewater)

- Ensure that there is adequate drainage of the jetted water. Large puddles should never be allowed to accumulate, particularly on suspended floors.
- The weight of accumulated waste water can create a hazard.

1,000 litres of water weighs 1,000 kgs

300 gallons (US) of water weighs 2,500 lbs


11. Daily Checks

To ensure the equipment is safe to use carry out all daily checks before you operate the jetter. These can include the following:

- Water filter cleanliness
- Fuel level
- All jets are clean and free from debris
- All jetting hoses are free from damage and abrasion
- Wheel nuts are tight
- Loose parts are secured
- Tyres are not worn
- Tyre pressure is correct
- Towing hitch is not worn
- Pump oil level
- Gearbox oil level
- Engine oil level

Please refer to the Operation & Maintenance Manual for specific details

12. Explosive Atmospheres

 Water jetting within enclosed areas that have not been gas-freed or inerted may create a risk of ignition of flammable vapour by an electrostatic charge generated by the action of the water jet.

- Equipment used in explosive atmospheres must be certified to the correct ATEX level. Check before commencing work.
- Check earthing (grounding) requirements for machines & hoses before use.

13. Trailer Jetters

- Always park the trailer on level ground
- Always put the handbrake on or chock the wheels before removing from the towing vehicle
- Never operate the hydraulic hose reel unless the trailer is hitched to the towing vehicle
- If the trailer is fitted with prop stands, always deploy and secure stands before use.

14. Jetting Applications and Accessories

All our jetting accessories are designed to be safe in operation, but operators must be aware that misuse could cause serious injury. In the following sections we have noted hazards specific to the misuse or those arising from general use of various accessories.

15. Drain & Pipe Cleaning

- When a jetter is used to clean drains & sewers that are contaminated with a hazardous substance it is possible these may be entrained in the resulting aerosol and inhaled by operators. Consider using respiratory protection.
- Never start jetting a drain, sewer or pipe unless the jet nozzle is safely inside the drain and pointing in the direction that you intend to travel.
- When drain jetting a drain, sewer or pipe with an inside diameter that is not small enough to prevent the hose from turning back on itself, a drain jet extension (a piece of straight rigid tube equivalent to the pipe diameter) should be fitted between the end of the hose and the nozzle.
- Always use a safety leader hose at the beginning of the main jetting hose to alert operators when the jet nozzle is nearing the manhole entrance.
- Always consider the use of a tiger tail hose feed guide to protect the jetting hose from abrasion and prevent premature failure.
- Be aware the high-pressure hoses can generate static electricity which may need to be controlled when working in hazardous areas.
- When jetting drains or sewers if there is a danger to the general public from hoses laying across public walkways, they must be covered in such a way as to protect against injury from hose failure and tripping hazards.
- Before starting work, check and ensure the drain jets have no blocked holes or nozzles as this may cause the pumping system to over pressurise which could result in burst disc failure or bursting the jetting hose.
- ⚠ Never attempt to unblock a fully choked drain or pipe before considering the consequence of releasing the blockage (e.g. flooding, explosive ejection, drain nozzle ejection) and having a plan to safely deal with it.
- Never attempt to clean drains or pipes in one pass because this could lead to debris build up behind the jet nozzle causing a pressure build up in the drainage system. Be aware that a pressure build up in the drain or pipe could cause the jet nozzle to be ejected at speed back towards the operator.
- ⚠ Never enter the manhole at either place the jet nozzle into or extract it from the drain entrance unless the required confined space regulations have been met.

- ⚠ Never work in a manhole where explosive gases may be present with a radio remote control transmitter that is not designed for use in hazardous areas.
- Never use the hydraulic hose reel facility as a winch to retract a jetting hose that has become stuck in the drain or pipe. Damage to the hose could be caused that will make subsequent hose failure more likely.
- ⚠ Never allow jetting hoses to become kinked and always remove from service any jetting hose with an outer cover that has worn through to the reinforcing braid.
- Never use the high-pressure jetting hose for any purpose other than sewer, drain or pipe cleaning e.g. winching vehicles or other plant.
- Only use jetting nozzles and / or accessories that have been calibrated for the jetting machine pump performance or else unexpected system over pressurisation could occur.
- Never operate the hydraulic hose reel with the trailer disconnected from the towing vehicle.
- Never start the jetter when it may be frozen. Operating a jetter whilst frozen could cause high speed ice bullets to be ejected from the jetter hose on machine start up.
- Never attempt to clean a drain or pipe with a nozzle that has more forward force than rear force. It will be ejected back toward the operator and could cause injury.
- Never attempt to clean a pipe with a chain flail type jet that has unequal chain lengths as this could lead to severe vibration and high-pressure hose failure.
- Drainage systems may carry bacteria which can cause severe illness or death. Avoid exposing eyes, nose, mouth, ears, hands, cuts or abrasions to wastewater or faecal matter during drain cleaning operations. After working around drainage systems help protect yourself by always washing hands, arms and other areas of the body with hot, soapy water and, if necessary, flush mucous membranes with clean water. Disinfect soiled equipment by washing surfaces with a hot soapy wash using a strong detergent.
- One-man operations should only be attempted when the jetter is fitted with a suitable remote-control system that allows the operator to control the machine & the water jet stream.
- The use of “jump or pulse jets” in drain cleaning applications may expose the operator to vibration levels in excess of the exposure limits action value if the jetting hose is handled. Water jetting hose should not be handled whilst the “jump or pulse jet” is in operation for more than 25 minutes per 8-hour day.

16. Jetting Guns

- Never exceed the recommended maximum for reaction force (250N with shoulder stock & 150N without shoulder stock). Other national standards may apply.

Current guidance in the USA is that reaction forces should not exceed 1/3rd of the operator's bodyweight for extended periods of time.





- Never shorten the barrels of the jetting gun below 1-1m from the nozzle tip to centre of the trigger assembly.
- Never lock the safety trigger in the ON position
- Never point the gun at anyone as injury from high pressure water will occur if the jet stream comes into contact with body parts.
- Never work on a slippery surface because the reaction force of the jetting gun could cause you to become unstable and you could lose your footing.
- Never work from a ladder as the reaction force of the jetting gun could cause the ladder to fall backwards from the working area causing possible injury.
- Never work from scaffolding unless it is designed, erected and managed by competent persons and it is adequately secured to prevent it being pushed over by jetting gun reaction force.
- When using the jetting gun to clean hard surfaces be aware that splash back could contain hard debris travelling at high speed.
- When using the jetting gun to clean contaminated surfaces be aware that splash back could contain dangerous contaminants.

- Never use the jetting gun to clean a surface that could be damaged by the water jet.
- Always ensure that an adequate area is cordoned off around the working zone so that flying debris and contamination cannot injure passers-by.
- Be aware that the use of water jetting guns fitted with oscillating or rotating jet heads can to produce higher hand arm vibration levels than simple fixed head jets. Monitoring these levels may be required under national health and safety regulations.
- Never work on a slippery surface.
- When using a jetting gun or nozzle to clean at floor level wear suitable protective footwear.
- ⚠ Never use a high-pressure jetting gun to clean down PPE whilst you or others are still wearing it as serious injury and death could result.
- ⚠ Never use a high-pressure jetting gun to wash or cool down livestock as serious injury and death could result.
- ⚠ Never direct a high-pressure water jet at electric power lines or electrical equipment as serious injury or death from electrocution could occur.
- ⚠ Do not spray flammable liquids – there is risk of explosion.

17. Tube Cleaning

- Manual tube cleaning is not recommended by Flowplant.
- If our jetting units are used to power automatic & semi-automatic tube cleaning equipment specific safety instructions must be obtained from the tube cleaning equipment manufacturer prior to use.


18. Floor Cleaners

- Never adjust the operating pressure when the unit is running.
- Never use the floor cleaner over uneven or damaged surfaces.
-  Never raise the floor cleaner from the floor when under pressure.
-  Over pressurising the floor cleaner could lead to it becoming dangerously unstable.


19. Jet Pumps

- When using a Venturi jet pump never place your fingers into the pump inlet as they could be trapped by the vacuum and cause injury. Always secure the free end of the pump hose securely and ensure adequate drainage is in place to deal with high volumes of pumped water.





20. Dry Shut Guns & Foot Valves (Additional to Jetting Guns Info)

-  When using a dry shut type system, be aware that high pressure can be retained in the jetting hose even after the machine has been shut down. Always discharge pressure in a safe manner after machine shut down.
- Never use a dry shut type foot control valve on a jetter that does not have a pressure unloader valve as this could result in burst disc failure or bursting the jetting hose

21. Electric Machines

- Flowplant electric machines operate at voltages of up to 690 volt and 200amps. Only trained, competent electricians should install units and carry out any maintenance works.
- If working on any maintenance schedules related to the electrical installation, the electrical supply must be isolated. Lock and tag if necessary.
-  Do not get water within the electrical cabinet. If water may have entered the electrical cabinet, the power should be isolated immediately and an investigation carried out via a trained operator.
- Care should be taken when working around any electrical cables. If any of the cables are damaged, the power should be isolated immediately and an investigation carried out via a trained operator.

22. Hot Water Machines

- Only trained, competent operators to use Flowplant hot water machines.
-  Flowplant hot water machines will operate at temperatures over 90 degrees centigrade. Care must be taken to not come into contact with any of the operating fluids.
-  Components that come into contact with the heated water will hold excess temperatures (hoses, metallic fittings, pressure gun). Care must be taken not to come into contact with these hot surfaces.
-  Boiler surfaces will reach temperatures in excess of 50 degrees centigrade. Care should be taken not to come in the contact with these surfaces.
-  Within the boiler, a naked flame powered by the diesel tank will heat water to the required temperatures. Only trained operatives should access the boiler for any required maintenance.
- As a by product of the boiler combustion, carbon dioxide is produced from the boiler flue. The unit must be operated in a well ventilated area.
- Exhaust gases will exit boiler flue at temperatures of up to 220 degrees centigrade. Care must be taken not to come into contact with these gases.