

# Operation & Maintenance Manual

Original Instructions

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## **003301 – 320 SERIES DESILTER VANPACK**

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## Operation & Maintenance Manual for:

**UNIT:** Unit 320 Series Desilter Radio Control

**ISSUE DATE:** 10/2020

### AMENDMENTS

Change	Changes	Date	Signature
1	FIRST ISSUE	10/20	JHGS
2	HAV INFORMATION ADDED TO SECTION 4 PLUS HOSE SAFETY INFORMATION	05/21	SAS

# 1. Contents & Introduction

## 1.1. Contents


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## 1.2. Introduction

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

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!

### 1.3. 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.

### 1.4. The 320 Series Desilter Vanpack

The 320 Series Desilter 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 Unit has been meticulously designed for safe and efficient use.

## **1.5. 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 assembly.

### **Section 8     Engine**

D1105 engine

### **Section 9     Circuit Diagram**

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

### **Section 10    Parts list / Spares**

How to identify and order spares

### **Section 11    Service Documents**

Service logbook and checklist.

### **Section 12    Warranty & Certification**

- Warranty policy
- Declaration of Conformity

### **Section 13    Health & Safety**



## 2. Scope of Supply

### 2.1. Scope of Supply

Unit:	UNIT 320 SERIES DESILTER RADIO
Machine Build Code:	003301 & 003302

### 2.2. Vanpack Assembly

The General Arrangement drawing: 003-301, defines the components of the 320 Series Desilter Vanpack mounted Pump Assembly as follows:

Water is fed from a “mains” supply through a manual low-pressure inlet hose reel 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 **Harben P-Type** high-pressure plunger pump is driven by a **Kubota D1105-E4B-EU-X1 18.5kW Stage 5** industrial diesel engine through a **Harben 2.6:1 Gearbox**.

The water is directed by an electrically controlled Hydraulic diverter valve, to a hydraulically driven hose reel c/w 300’ of ½” hose, or at low pressure ‘dumped’ back to tank.

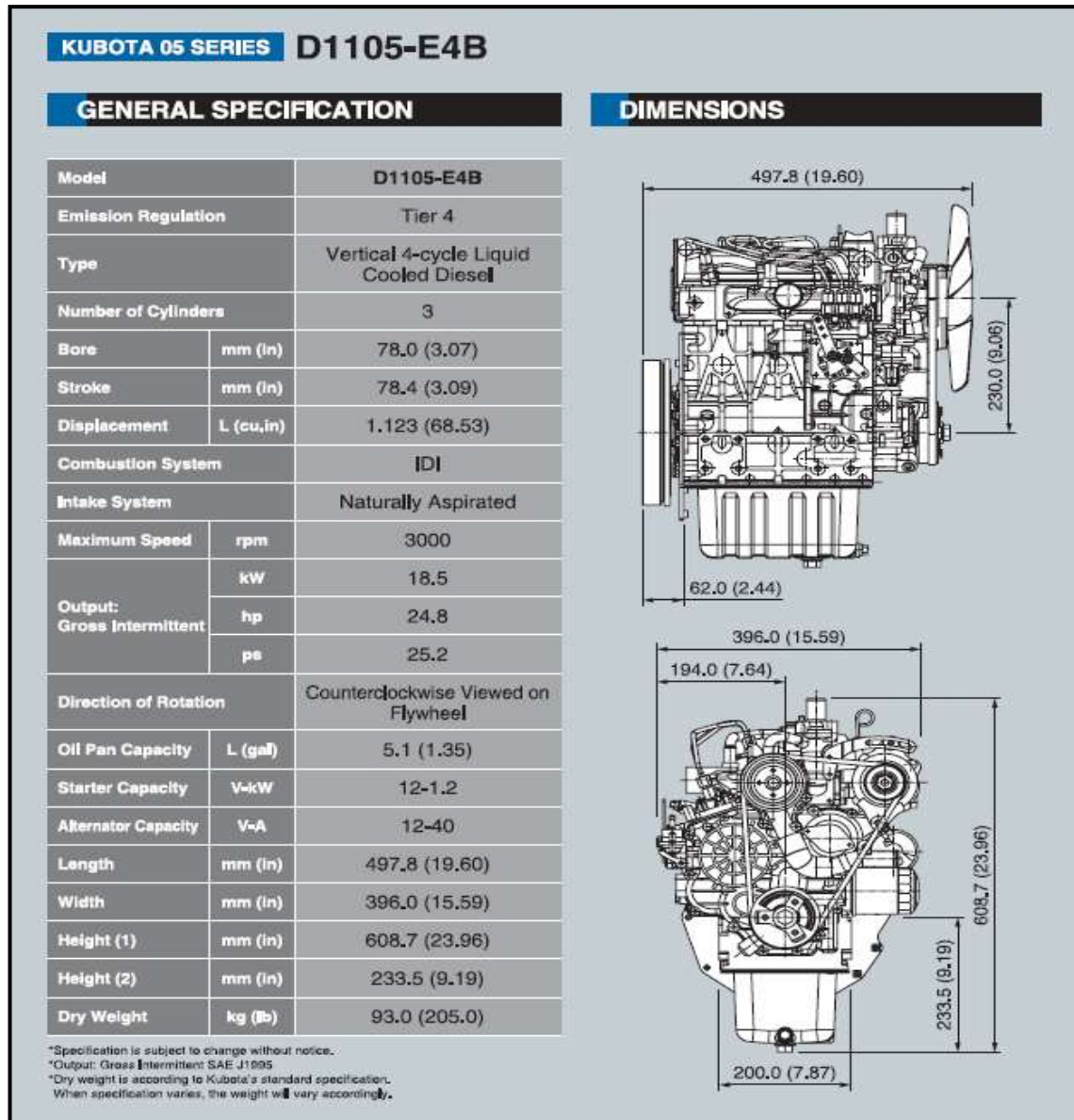
The system is protected from over pressurisation by means of a Relief Valve. The system pressure can be adjusted by means of an Unloader Valve.

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

## 2.3. Detailed Drawings

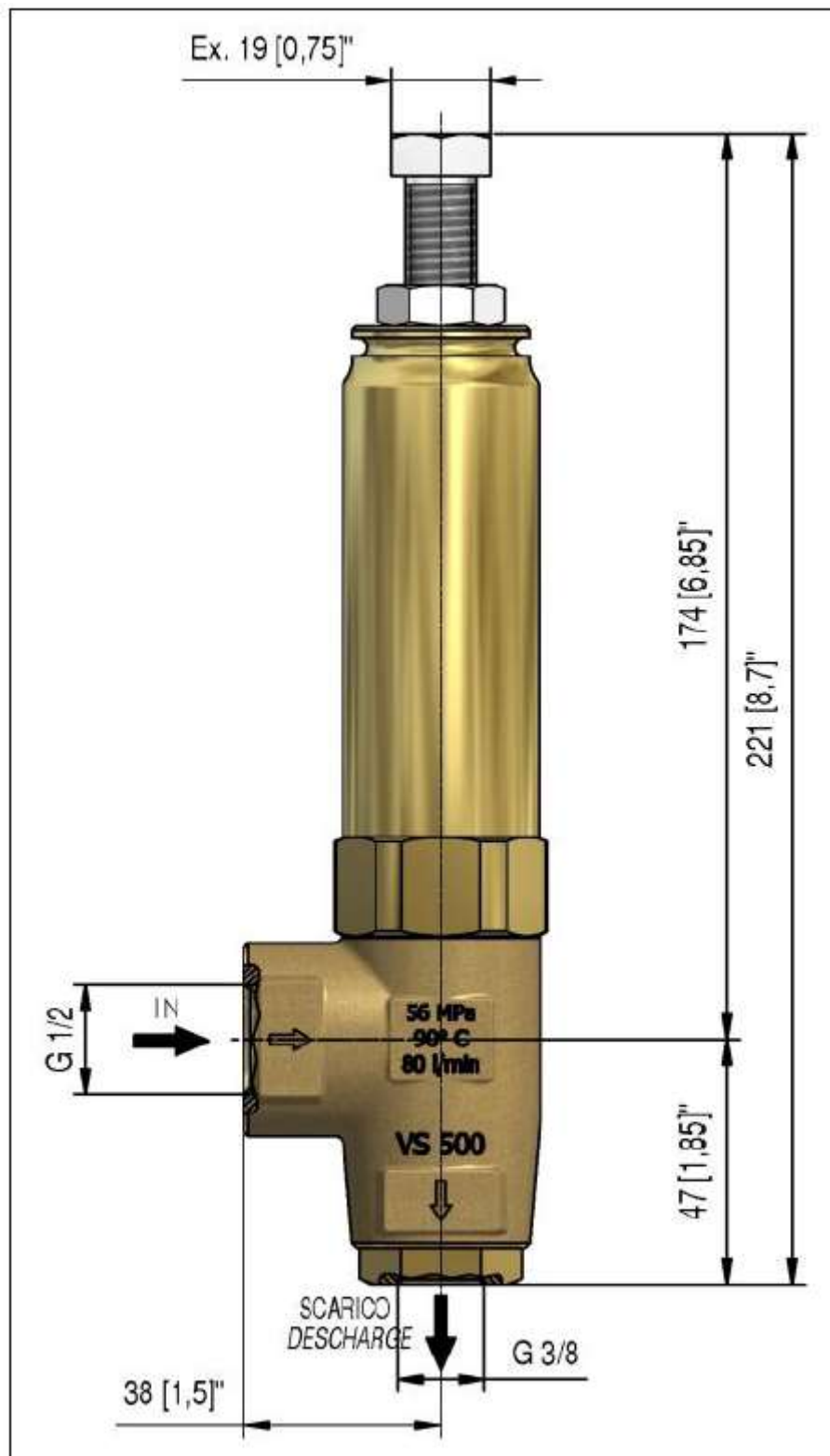
Detailed drawings and parts lists for the above components are provided as follows:

The P-Type Pump is detailed in Section 7.





PA Safety Relief Valve 067779



### 320 Series Desilter Van Pack

- Compact Design to Suit Smaller Vans
- Complies with the Latest Emissions Standards (\*Jan 2020)
- Lightweight Safety Enclosure
- Radio Remote Control Operated (With Integrated LCD Display)
- Reduced Noise Levels
- Automatic SRV (Safety Relief Valve)



## 3. Technical Data

### 3.1. Technical data

#### 3.1.1. Pump Data

Pump Type	P Type 6 22 (See Section 8)
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	6
Piston diameters	22 mm
Maximum pressure	200 Bar
Nominal Flow rate	45 lpm
Crankcase lubrication	Fully immersed
Oil capacity (litres)	5.75 litres
Weight (kg)	80 kg
Recommended crankcase oil	Shell Morlina 150 or Tellus 150 (see
Max inlet pressure	0.5 bar (5.0 metre head)
Max inlet temp.	25°C

**Prime Mover** Kubota D1105-E4B-EU-X1 18.5kW Stage 5

**Drive** Gearbox Harben (2.6:1)

**Water Tank** 88 gals. (400 litres)  
144 gals. (650 litres)

**Supply Water Filter** N05105 Hypro line strainer / 177 micro mesh

**Pressure Gauge** Digitally Displayed

**Safety Relief** PA (Automatic SRV)

**Mains Water Supply** Positive head.

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



## 3.2. Technical Description

### 3.2.1. Primary Components

The primary components of the 320 Series Desilter Vanpack are as follows:

1. A prime mover in the form of a Kubota 3-cylinder water-cooled diesel engine which drives a Harben P type high-pressure pump.
2. The pump is capable of raising the water pressure up to 200bar.
3. 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.
4. A plastic water tank acting as a reservoir, ensures the water is settled and non-turbulent, discharging a smooth lamina flow of uninterrupted air free supply, a positive head of pressure to the pump inlet and 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.

5. Water is diverted to the hose reel either using a 12VDC hydraulic diverter.
6. A Hypro 177Micron mesh inline strainer is fitted to the suction line between the tank and the pump inlet.

Note: The filter 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.

### 3.2.2. 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 'FAULT' to be displayed on the control unit.

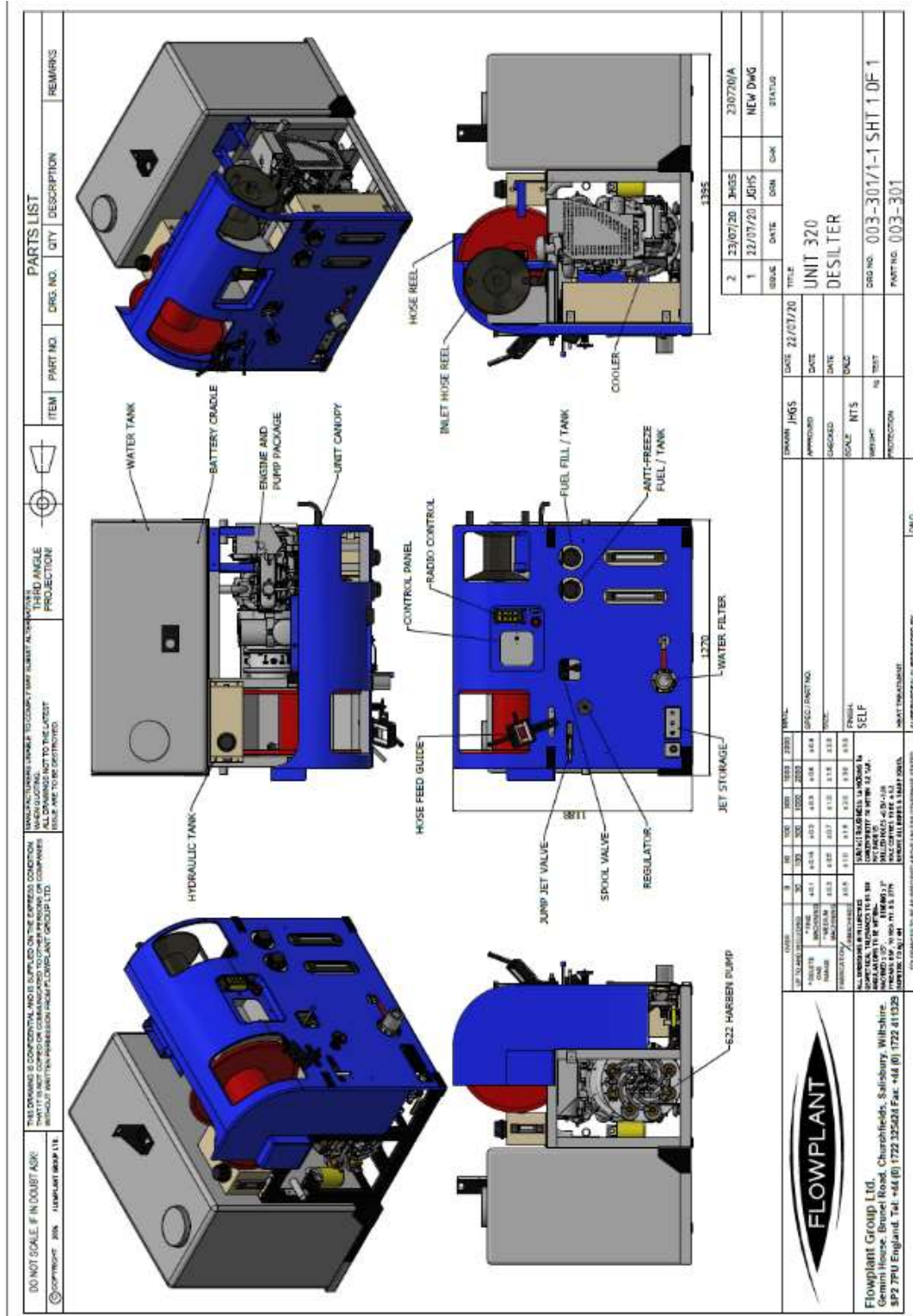
Alternator failure will be displayed on the control unit.

### 3.2.3. 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)

### 3.3. Installation details

Installation Drawing No. 003-301 provides details of sizes, weight and fixings for the 320 Series Desilter Vanpack together with inlet and outlet water connections.






## 4. Operation

### 4.1. Operating Conditions

Operators of water jetting equipment should be fully conversant with the Water Jetting Association '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.

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.


### 4.2. Daily Checks

Refer to Section 5


If the unit has previously been in operation for more than 50 hours, other routine maintenance checks may need to be carried out. Refer to section 7 and 8.

Do not drop the handheld "radio control unit" (RCU) down a manhole as this could cause it permanent damage. Please use the lanyard provided

### 4.3. Pre-start checks & bleed procedure

- In cold weather check that machine is not frozen before starting (see Antifreeze section). Only operate the machine in a well-ventilated area. 
- Park next to suitable clean water supply on a level ground
- Ensure vehicle handbrake is applied
- To fill water tank, connect to water supply. The water will fill the tank via the inlet hose reel when the tank is full it will flow out of the overflow.
- 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!**
- In order to avoid an interruption to the jetting operation please ensure that the hand held 'radio control unit' is fully charged, this is to ensure the radio signal is at full strength and not compromised while the unit is being operated in 'remote' mode.

#### 4.4. Starting the engine & setting the operating pressure

The Vanpack is supplied with a Radio Control System allowing One-man operation 'OMO' (in accordance with the 'Single Person Operation as detailed in the Code of Practice. 

Starting procedures are provided for 'Local' operation where water to the high-pressure hose is controlled by the operator using the Control unit at the machine, and for 'remote' operation where water to the high-pressure hose is controlled by the hand-held radio control unit 'RCU'.

While the remote-control facility is provided for single person jetting operation, it should be noted that initial pressure check **must** be made at the pump set. Hence, even with the 'remote' enabled, all initial pressure checks must be made

Either:

With a single operator and 'radio control unit' (RCU) adjacent to the pump set and with the nozzle secure in a drain or pipe or the gun firmly held in the hand.

Or:

With two people, one at the pump set and one in charge of the nozzle or gun.

Once the required operating pressure has been set, remote operation can be safely conducted by one person using the handheld 'radio control unit (RCU)

#### Tank water level

Ensure you have an adequate water supply and that the water tank is at least  $\frac{1}{2}$  full. 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

#### Emergency Shutdown

Fig. 4.1 Estop on control panel. Twist to release


At any time during the starting procedure, or during normal jetting operations, an emergency shutdown can be achieved by switching off the engine with the key or pressing the E/Stop button.



## 4.5. Pre-start Checks & Procedures

### 4.5.1. Starting the engine





#### Pre-start Checks

Ensure the open-ended high-pressure hose is in a safe position, preferably within sight of the operator at the control panel. 

#### Indirect Injection Diesel Engine Key Start Module Operating Procedure



1. Rocker Switch (Bottom Right of Panel) is the Master On/Off (0)
2. In position (1) (On) auxiliary circuits will be energized, screen will be illuminated.
3. Enter the 4-digit PIN using the up and down arrows to select numbers and the enter button to select

4. Momentarily press the Green button on the Controller, this will automatically run through pre-heat and auto start. Engine will start automatically and idle at a pre-determined engine rpm. Water will now be circulating through the pump and be diverted back the water tank 
5. To divert water to the High-Pressure hoses, press the water on button  on the control panel. Speed / Pressure can be adjusted using RPM +  and RPM -  buttons.
6. Use the “Hare” button to raise the RPM and in-turn raise the water pressure
7. To shut the system down, reduce the RPM to idle speed and turn off the water. Switch the engine off by momentarily pressing the red button. The engine will shut down safely. Switch the master switch to 0. The system is now safely off.
8. In emergency situations press the E-stop button on the main control panel.

#### 4.5.2. Checking the operating pressure with a nozzle fitted






1. Fit the correctly sized nozzle to the high-pressure hose.
2. Ensure the nozzle is secured in a safe position, preferably within sight of the operator at the control panel. 
3. Press the water ‘ON’ button  at the control panel. Select the required speed.
4. Observe the pressure displayed on the control panel screen and note the pressure reading (See fig. 3). Press the water ‘off’ button and select idle. Note: If the pressure is significantly lower than expected, turn the unit off and replace the nozzle with a new one.



Fig 3 Pressure Gauge Display

Do not exceed the maximum operating pressure of 200Bar by fitting a smaller nozzle than is recommended, as this will cause the Pressure relief valve & or Safety relief valve to dump the excess pressure. The maximum engine speed is governed to 3150 rpm.

#### 4.5.3. Checking the operating pressure with a gun fitted

1. Fit the gun (with the appropriately sized H.V. (pencil) or Fan Jet), to the high-pressure hose.
2. Ensure the gun is held firmly in the hand. 
3. Start the engine.
4. Press the  button to divert the water to the gun. Use the  button to raise the engine speed.
5. Pull the gun trigger and observe the pressure gauge mounted on the instrument panel, note the pressure reading (See fig. 3). Press the 'water off' button and return the unit to the idle position

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!

#### 4.6. “Remote” Operation starting procedure

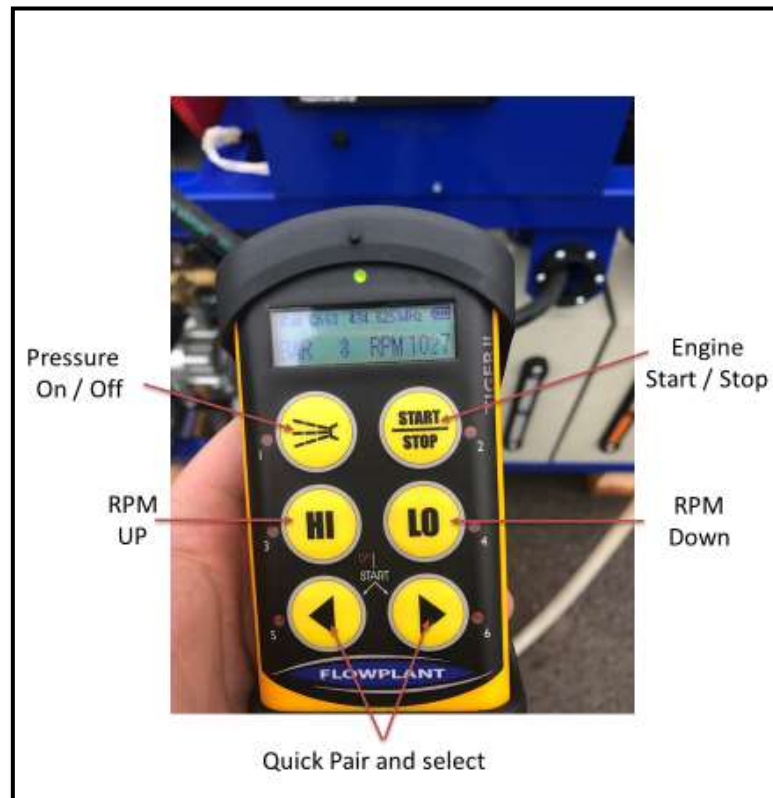







Fig 4. Operating with the Radio Remote



##### 4.6.1. Starting the Engine

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

##### a. On the 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.
8. To decrease engine speed, press ‘speed down’ button.



9. Press button 1, the water ON button, to divert the water to the nozzle or gun. 
10. Press button 1 again, this will now divert the water back to tank
11. To stop the engine, reduce the Engine rpm then 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.

If the operator goes out of radio receiving range the engine will automatically turn off

### Turning the unit 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

Fig. 5 Handheld RADIO Control Unit (RCU)

- 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).

#### 4.7. Rapid Shutdown

⚠ Should any unforeseen circumstances arise, including any signs of a leak, the jetting operation should be terminated immediately, the equipment shut down and the relevant managers informed.

#### 4.8. Automatic Shutdown

The engine will shut down automatically if the monitoring and control system detects a malfunction.

#### 4.9. 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.

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.

*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 fibre optic cables.*

#### 4.10. Hose reel winding and 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 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.

Attempt to free the hose using the Harben® Jump Jet whilst reeling in. Do not attempt to hold the hose at this stage and do not stretch the hose.

If you are unable to free the hose using the Jump Jet only,

- Reduce engine speed to tick over.
- Switch jump jet off.
- Whilst operating the machine on and off pressure, with slack hose and with slack removed, attempt to twist the hose free.
- **Important - Do not exceed 140 bar operating pressure.**

If broken duct is suspected – dig up might be only option to retrieve hose. Coil up hose and leave in box.

*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.*

*NOTE: More tips on safe handling of hoses can be found on the Flowplant website. See link below.*

<https://www.flowplant.com/wp-content/uploads/2021/05/Hose-safety.pdf>

#### 4.11. Frost Precautions

*If the pump is frozen up – it should on no account be started. Operating the machine frozen will damage the pump and damages caused by misuse will not be covered under warranty.*

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

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. Fill the anti-freeze Tank to maximum with the 50% solution.
5. Move the 'T' Port valve in the suction line to the upwards towards the antifreeze position and remove the lid from the Anti-freeze tank.
6. Ensure you hold the end of the jetting hose firmly in your hand.  
Start the engine and immediately press the water on button. Water will exit the hose instantly & the level on the antifreeze will begin to decrease rapidly.  
When the water runs blue insert the end of the hose into the Antifreeze tank.
7. Allow the antifreeze to circulate for a minimum of 30 seconds.
8. Operate the jump jet kit for a few seconds to antifreeze the jump jet circuit
9. Shut down the engine.
10. Select freewheel on the hydraulic lever Manually rewind the hose reel.
11. Secure the hose end in the correct place on the frame.
12. Ensure the hydraulic valve is taken out of the freewheel position.
13. Replace the antifreeze tank lid.
14. Isolate the machine

## 5. Routine Maintenance

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

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

### 5.1. Maintenance Procedures

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

	GENERAL
Prior to use / Daily / after 8 hours running	<ul style="list-style-type: none"> <li>• In cold weather check machine is not frozen before starting</li> <li>• Check inlet water filter element (Ref Para 6.2)</li> <li>• Check engine oil level on dip stick (Ref section 10)</li> <li>• Check radiator water level</li> <li>• Visual check for hose damage/water leaks</li> <li>• Check emergency stop button operation</li> <li>• Check high-pressure hose condition</li> <li>• Check for any loose nuts and bolts or damaged items</li> </ul>
Weekly / 24 hours	<ul style="list-style-type: none"> <li>• Visually inspect van pack for security checking for any loose, damaged or missing parts.</li> <li>• Check for any leakage</li> <li>• Check air filter cleanliness</li> </ul>
Three monthly / 50 hours	<ul style="list-style-type: none"> <li>• First service contact Flowplant Service</li> </ul>
Six Monthly / 100 hours	<ul style="list-style-type: none"> <li>• Inspect tanks and fittings for leaks, thoroughly clean &amp; flush through</li> <li>• Tighten any loose joints</li> <li>• Grease the hydraulic hose reel bearing blocks</li> <li>• Check condition of 12volt start battery</li> <li>• Grease battery terminals for protection</li> <li>• Check alternator belt</li> </ul>
Yearly / 300 hours	<ul style="list-style-type: none"> <li>• Intermediate service of engine, gearbox and pump required (Contact Flowplant)</li> <li>• Closely inspect the structural integrity of the framework for signs of stress and cracking (Specifically welded joints)</li> <li>• Check hydraulic filter gauge. If it reads in the red replace the filter and oil (Shell Tellus 22)</li> <li>• Carry out detailed inspection of pipes, hoses and fittings. (Specifically looking for perished rubber and damage)</li> </ul>
Two Yearly / 400 hours	<ul style="list-style-type: none"> <li>• Major service of engine, gearbox and pump required (Contact Flowplant)</li> <li>• Check wiring terminals/connections and continuity of electrical earth.</li> </ul>

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

For a detailed guide to engine maintenance and overhaul procedures refer to [Section 8](#).

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

## 5.2. Daily Maintenance


The following must be completed daily with the trailer 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.

### 5.3. Pump Lubricating Oil Chart

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	<b>5.75</b>	5.0

#### 5.4. Safety Relief Valve ⚠



The 320 Desilter vanpack is fitted with a safety relief valve which will lift at 15% working pressure. This will protect the machine and will lift before the rated pressure of any component on the trailer.

The vanpack working pressure is 200bar (4000psi) and the safety relief valve will lift at 230bar (3,335psi).

Pressure relief valves should be checked for functionality and certified by the manufacturer or their authorised representative at least every 12 months.

**NOTE: The relief valve is on the unit to protect the machine. The relief valve is not set up to protect to the duct of any item within.**

### 5.5. General Torque Settings

Fastener  Nominal Dia (mm)	TORQUE SETTING (Nm)				
	Carbon Steel			Stainless Steel	
	Grade 8.8	Grade 10.9	Grade 12.9	Grade A2.5	Grade A2.7
5	6	8	10	4	6
6	11	14	16	7	10
8	27	33	40	17	23
10	53	66	79	33	46
12	92	115	138	58	81
16	229	286	344	143	200
20	447	559	670	279	391

The above Torque settings are for lightly oiled threads. **IMPORTANT! DO NOT USE** for DRY THREADS. ALL THREADS MUST BE LIGHTLY OILED, unless specified otherwise.

Where the nut material is softer than the bolt, this **must** be considered and a lower torque figure calculated. (Contact: Technical Dept).

The above Torque settings are to be used when no other specific torque is quoted. **ALWAYS CHECK** if a specific torque figure is available.


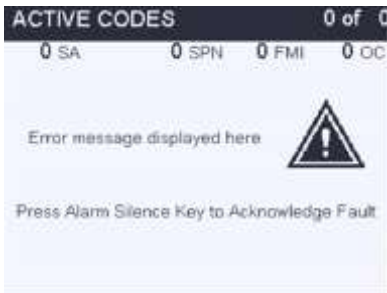
## 6. Fault Finding

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



These types of problems are covered in the pump fault finding chart, which is repeated overleaf for convenience.

Also covered overleaf is a diagnosis of selector valve problems.

The table below indicates potential problems and suggests an appropriate course of action.

Lamps	Condition	Solution
	<p><b>Low oil pressure shutdown.</b></p>	<p><b>Check oil level &amp; top up if necessary.</b></p> <p><b>Check and replace switch if faulty.</b></p> <p><b>Check the oil pressure, if the pressure is low</b></p> <p><b>Refer to the handbook for further advice.</b></p>
	<p><b>Water/coolant temperature shutdown.</b></p>	<p><b>Check Coolant level &amp; content top up if necessary</b></p> <p><b>Check and replace switch if faulty.</b></p> <p><b>Check the water temp in the radiator, if the temp is abnormally hot, Refer to the engine handbook for further advice.</b></p>



	<p><b>Emergency stop button in</b></p>	<p><b>Twist to release the button.</b></p> <p><b>Note: The engine will not start in this condition, do not continue to crank the engine, as this will damage the starter due to over cranking!</b></p>
	<p><b>Charge warning indication</b></p>	<p><b>Check the alternator 'V' belt tension, tighten the belt if it is slack and slipping.</b></p> <p><b>Check the connecting terminals to the alternator.</b></p> <p><b>Check the engine idle speed, reset if necessary.</b></p> <p><b>Refer to engine handbook for further advice.</b></p>

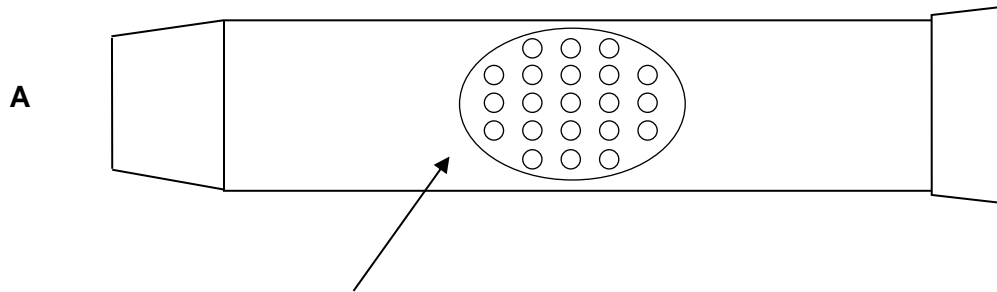
## 6.1. Equipment Fault Finding

Problem	Possible Cause	Recommended Action
<b>Low system pressure</b>	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.
<b>High System Pressure</b>	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.
<b>Low Water Level</b>	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.
<b>Pump Not Running Evenly (also refer to pump faults).</b>	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
<b>Burst Disc failure or Safety Relief Valve Operating (also refer to high system pressure problem).</b>	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.

<b>1 Mixing of Oil and Water in crankcase</b> <b>2 Loss of pressure</b> <b>3 Pump not running evenly</b>	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.
<b>1 Loss of crankcase oil through high pressure hose</b>  <b>2 Loss of pump pressure</b> <b>3 Pump not running evenly</b>	1 Inlet restriction may have been caused through; 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.
<b>1 Mixing of Oil and Water in Crankcase</b>	1 Diaphragm failure (may have been through fatigue from excessive running hours).	1 Check all diaphragms – replace as necessary.

## 6.2. Pump Fault Finding

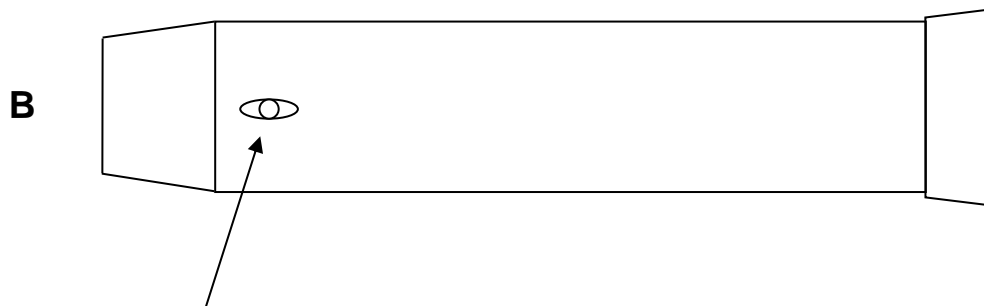
### DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM



Impression of the baffle on diaphragm

Reason: Delivery valves worn or blocked

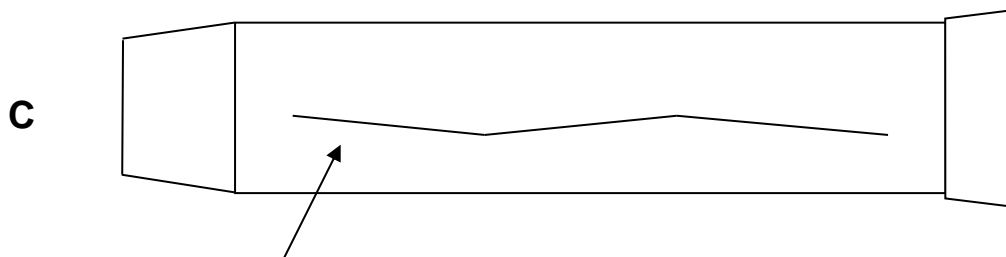
### DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM



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

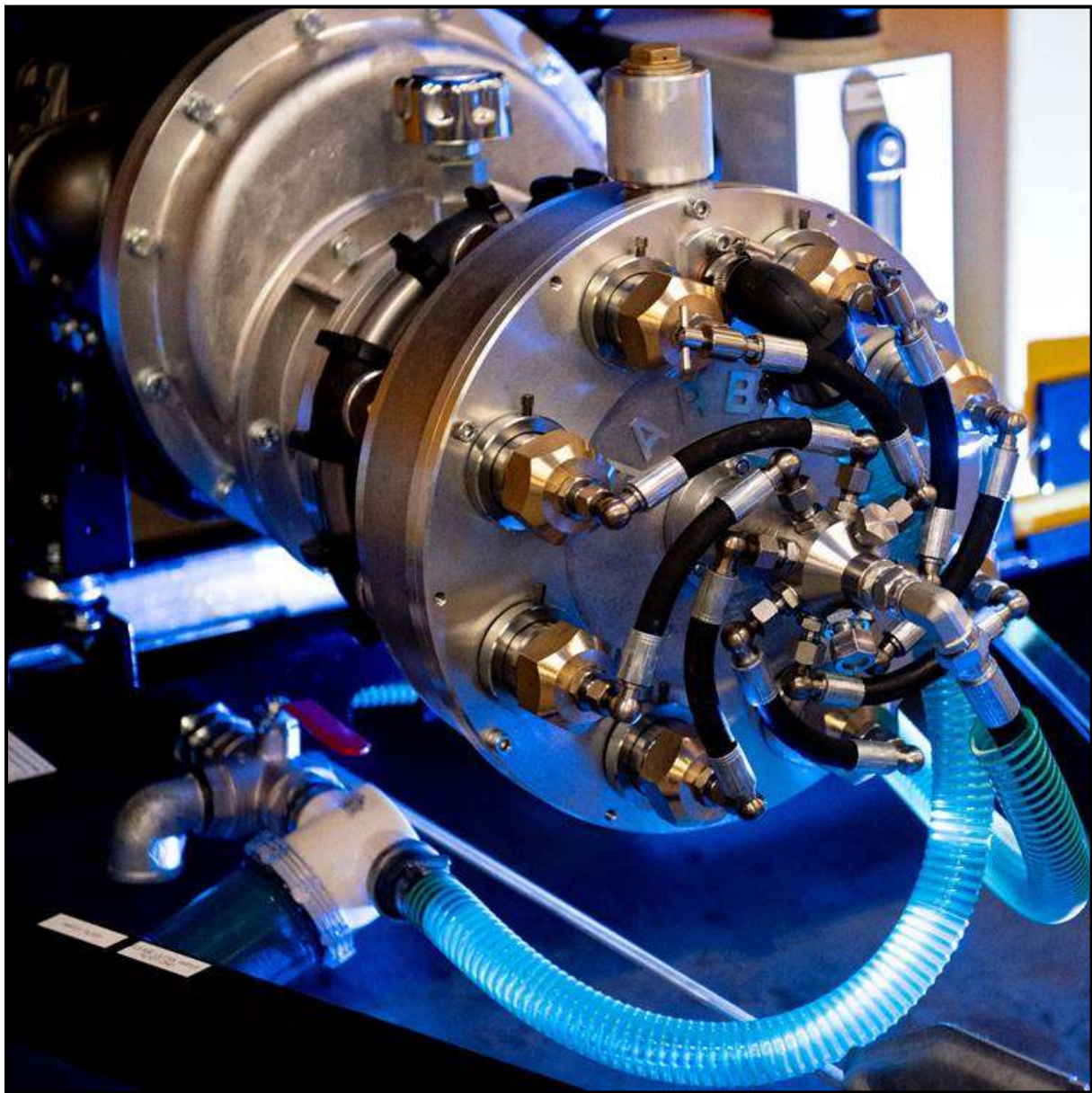


Shear through wall of diaphragm

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

## 7. Pump

Flowplant offer a detailed manual with the Harben P Type Pump and this will be accompanied by this manual.





## 8. Engine

Kubota offer a detailed manual with the **Kubota D1105-E4B-EU-X1 18.5kW Stage 5 C-TXT** engine and this will be accompanied by this manual.



### Basic engine noise levels

Engine RPM	1500	2000	3000
AT 1 METRE FULL LOAD db (A)	84	87	94
AT 7 METRE FULL LOAD db (A)	67		77

### Replacement filters may be obtained from Flowplant

Flowplant PART No.	ITEM
051-1057	ENGINE OIL FILTER
051-1058	ENGINE FUEL FILTER
051-1059	ENGINE AIR FILTER
054-020	ENGINE OIL
054-047	GEARBOX OIL
054-047	PUMP OIL

## 9. Circuit and Wiring Diagrams

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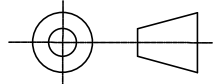
DO NOT SCALE, IF IN DOUBT ASK!

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THIRD ANGLE PROJECTION!



PARTS LIST

ITEM	PART NO.	DRG. NO.	QTY	DESCRIPTION	REMARKS
------	----------	----------	-----	-------------	---------

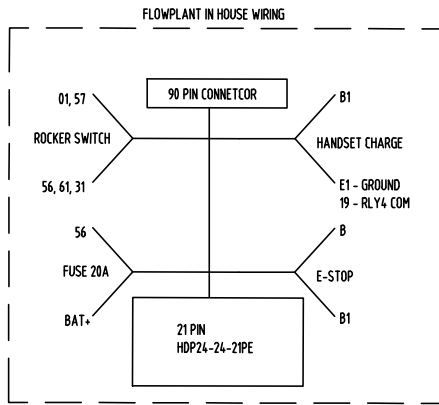
- NOTES:
- HEAT SHRINK ALL CONDUIT ENDS TO AID IN WATER INGRESS PROTECTION
  - CLIP ON TEES AND CROSSES TO BE USED AT ALL JUNCTIONS
  - SLIDE ON CABLE MARKERS TO BE USED ON ALL WIRE TERMINATIONS

- NOTES
- ALL TAILS 50mm UNLESS STATED OTHERWISE

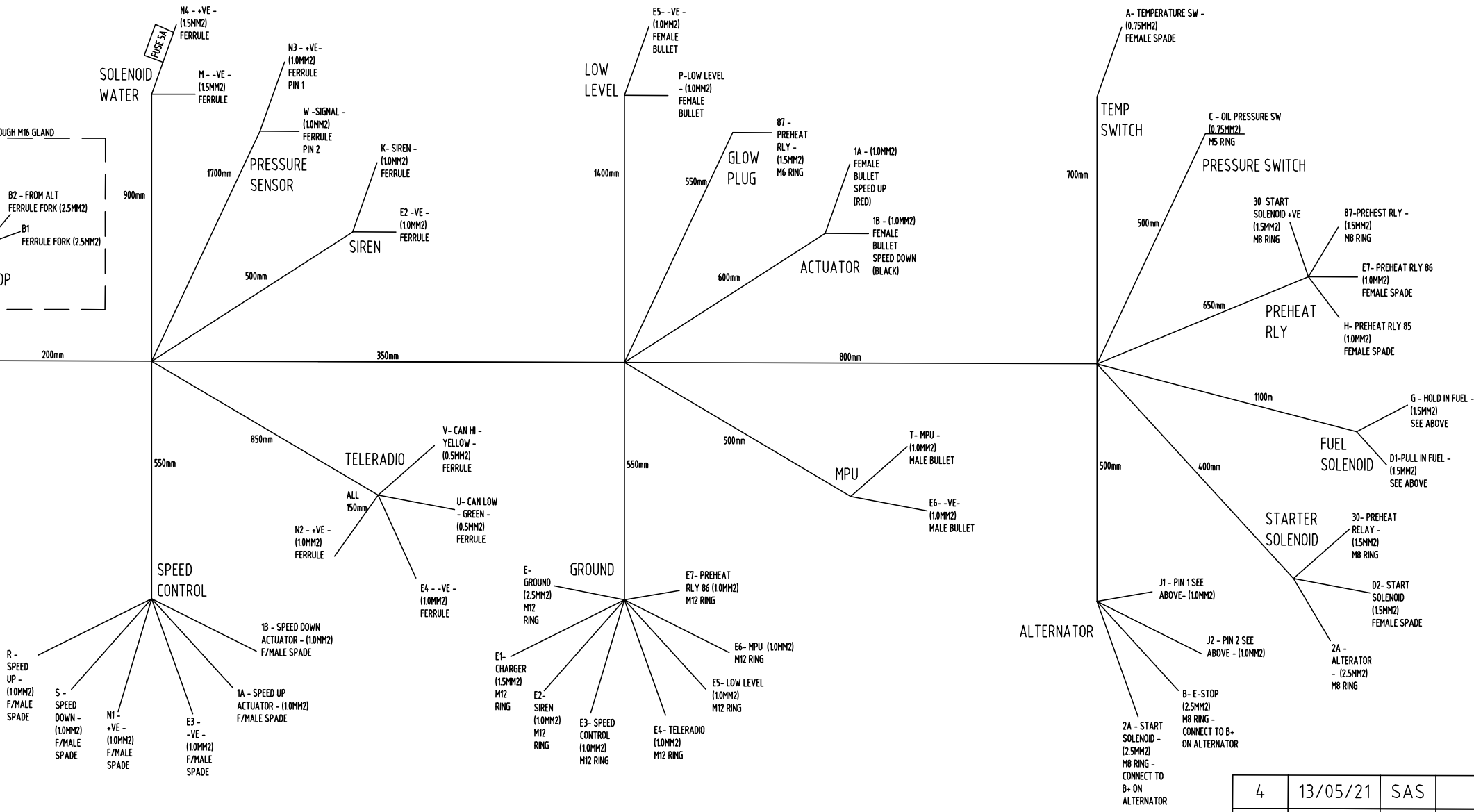
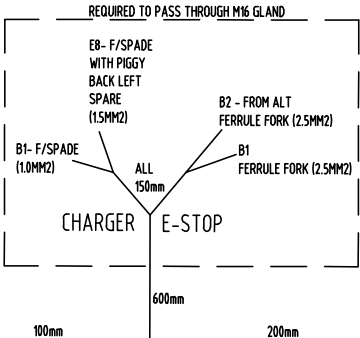
CONNECTORS

ALTERNATOR KIT  
SUMITOMO - 3-AC137 - AUTOCLOCK - 6189-0443

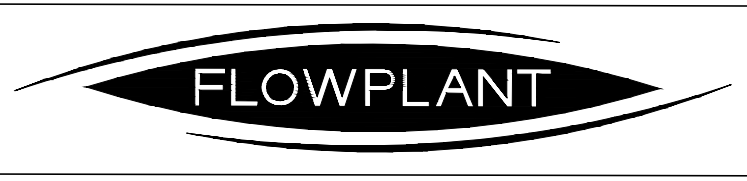
FUEL CONNECTOR KIT  
SUMITOMO - 6195-0003



- 21 PIN  
HDP26-24-21SN  
A - TEMPERATURE SW - (0.75MM2)  
B1 - E-STOP - (2.5MM2)  
C - OIL PRESSURE - (0.75MM2)  
D1 - FUEL SOLENOID - (1.5MM2)  
D2 - STARTER SOLENOID - (1.5MM2)  
G - HOLD SOLENOID - (1.5MM2)  
E - BAT - E (2.5MM2)  
H - PREHEAT RLY - (1.0MM2)  
J1 & J2 - ALT EXCIT - (1.0MM2) - LINKED  
K - SIREN - K (1.0MM2)  
M - WATER SOLENOID - (1.5MM2)  
N1 - SPEED CONTROL - (1.0MM2)  
N2 - TELERADIO - (1.0MM2)  
N3 - 4-20Ma - (1.0MM2)  
N4 - WATER SOLENOID - (1.5MM2)  
P - LOW LEVEL - (1.0MM2)  
R - SPEED UP - (1.0MM2)  
S - SPEED DOWN - (1.0MM2)  
T - MPU - (1.0MM2)  
U - CAN LOW - U (TWISTED PAIR)  
V - CAN HI - V (TWISTED PAIR)  
W - WATER PRESSURE - W (1.0MM2)



4	13/05/21	SAS		130521/C
3	14/01/21	JHGS		140121/B
2	10/11/20	SAS		101120/B
1	01/08/20	SAS		NEW DRG
ISSUE	DATE	DRN	CHK	STATUS



Flowplant Group Ltd.  
Gemini House, Brunel Road, Churchfields, Salisbury, Wiltshire. SP2 7PU England. Tel:  
+44 (0) 1722 325424 Fax: +44 (0) 1722 411329

OVER		0	30	100	300	1000	2000	MATL.
UP TO AND INCLUDING		30	100	300	1000	2000		
* DELETE ONE RANGE	* FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8	SPEC / PART NO.
	* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0	SIZE.
FABRICATION		± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0	FINISH.
UNMACHINED								

ALL DIMENSIONS IN MILLIMETRES  
GEOMETRICAL TOLERANCES TO BS 308  
ANGULAR DIMS TO BE WITHIN-  
MACHINED ± 0.5°, BENDING ± 2°  
THREADS: BSP, TO MED. FIT. B.S. 2779  
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 16 MICRONS Ra  
CONCENTRICITY TO WITHIN 0.2 T.I.R.  
M/C RADI 15  
DRILLED HOLES +0.13/-0.00  
HOLE CENTRES TO BE ± 0.2  
REMOVE ALL BURRS & SHARP EDGES.

TOLERANCES TO BE AS SPECIFIED ABOVE UNLESS OTHERWISE STATED

DRAWN SAS	DATE 01/08/20
APPROVED	DATE
CHECKED	DATE
SCALE	CALC
WEIGHT Kg	TEST
PROTECTION	
HEAT TREATMENT.	
SUPERSEDES/ SUPERSEDED BY	CALC

TITLE	D1105 WIRING LOOM RADIO (320) SHT 1 OF 2
DRG NO.	071-1395/3 - 4
PART NO.	0711395

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THIRD ANGLE PROJECTION!

PARTS LIST

ITEM	PART NO.	DRG. NO.	QTY	DESCRIPTION	REMARKS
------	----------	----------	-----	-------------	---------

SOLENOID WATER

PRESSURE SENSOR

SOLENOID WATER

TELERADIO

PREHEAT RELAY

FUEL (PRE WIRED)

E-STOP

CHARGER

SPEED CONTROL

LOW LEVEL

EARTH POINT

TEMP SWITCH

ACTUATOR

MPU

STARTER MOTOR

PRESSURE SWITCH

PREHEAT RELAY

STARTER MOTOR

Flowplant Group Ltd.  
Gemini House, Brunel Road, Churchfields, Salisbury, Wiltshire. SP2 7PU England. Tel: +44 (0) 1722 325424 Fax: +44 (0) 1722 411329

OVER	0	30	100	300	1000	2000	MATL.
UP TO AND INCLUDING	30	100	300	1000	2000		
* DELETE ONE RANGE	* FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8
	* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0
FABRICATION							
UNMACHINED	± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0	

ALL DIMENSIONS IN MILLIMETRES  
GEOMETRICAL TOLERANCES TO BS 308  
ANGULAR DIMS TO BE WITHIN-  
MACHINED ± 0.5°.    BENDING ± 2°  
THREADS: BSP, TO MED. FIT. B.S. 2779  
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 16 MICRONS Ra  
CONCENTRICITY TO WITHIN 0.2 T.I.R.  
M/C RADI 15  
DRILLED HOLES +0.13/-0.00  
HOLE CENTRES TO BE ± 0.2  
REMOVE ALL BURRS & SHARP EDGES.

TOLERANCES TO BE AS SPECIFIED ABOVE UNLESS OTHERWISE STATED

SUPERSEDES/ SUPERSEDED BY

CALC

DRAWN SAS

DATE 01/08/20

TITLE

D1105 WIRING LOOM

RADIO (320)

SHT 2 OF 2

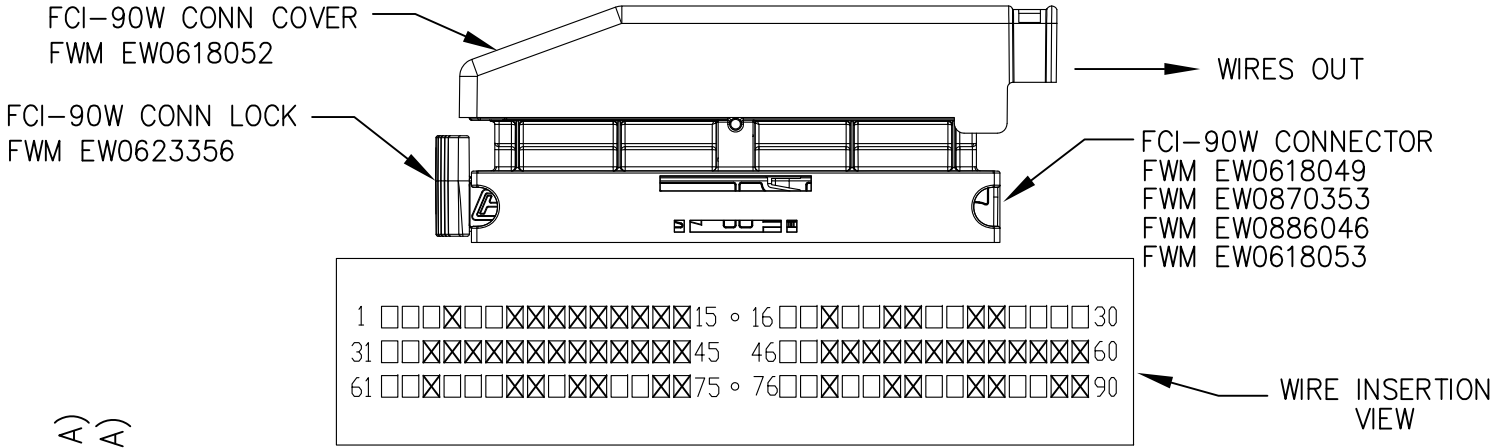
DRG NO. 071-1395/3 - 4

PART NO. 0711395

ISSUE	DATE	DRN	CHK	STATUS
4	13/05/21	SAS		130521/C
3	14/01/21	JHGS		140121/B
2	10/11/20	SAS		101120/B
1	01/08/20	SAS		NEW DRG

NOTES:

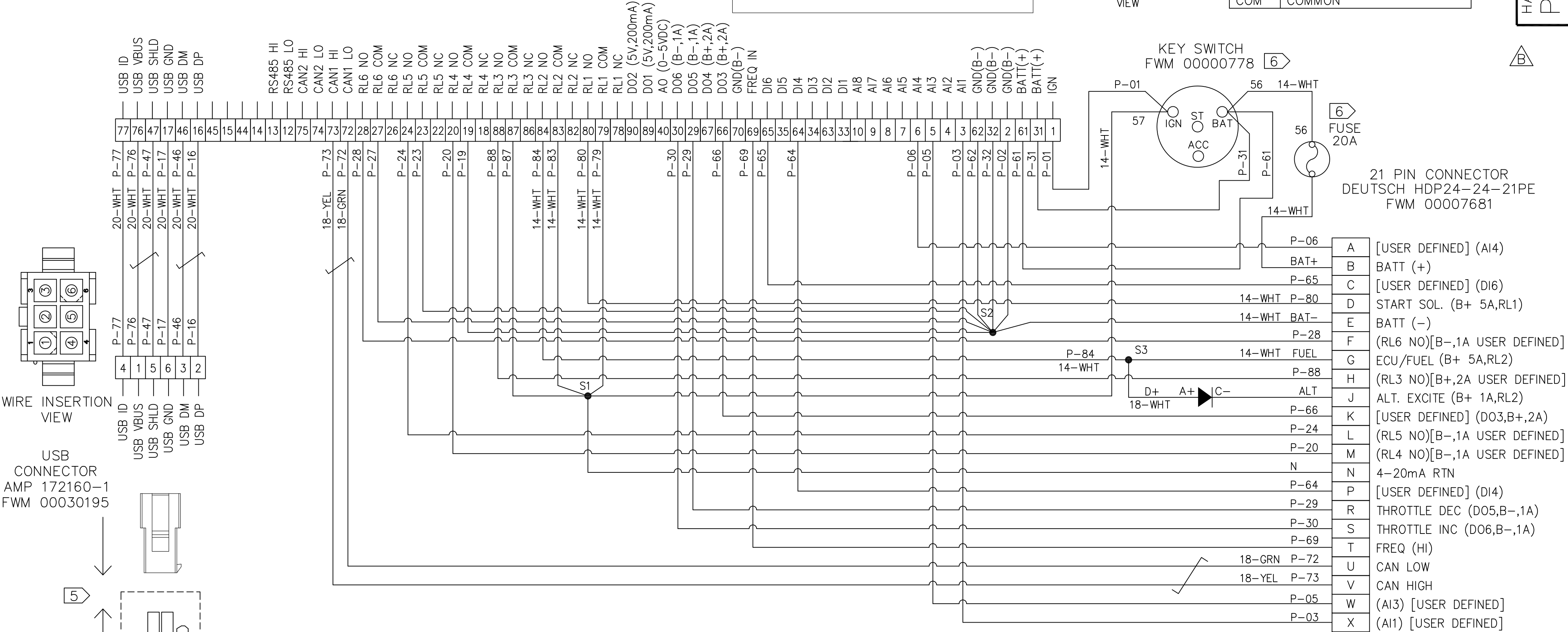
- 1. ALL WIRE TO BE 18 GAUGE, WHITE, TXL OR UL, UNLESS SPECIFIED OTHERWISE.
- 2. ✓ = TWISTED WIRES APPROXIMATELY ONE TWIST PER INCH.
- 3. MAXIMUM CURRENT 10AMP FOR RL1 TO RL6 (ALL RELAYS), BUT RL1, RL2 AND RL3 COMBINED CURRENT NOT TO EXCEED 15AMP.
- 4. ALL FUNCTIONS LISTED IN [ ] CAN BE CONFIGURED, REFER TO MPC-20 MANUAL.
- 5. PLUG PROGRAMMING HARNESS 40000566 MATING CONNECTOR INTO CONNECTOR 00030195.
- 6. KEY SWITCH, FUSE & HOLDER SHIPPED LOOSE, CUSTOMER TO INSTALL.




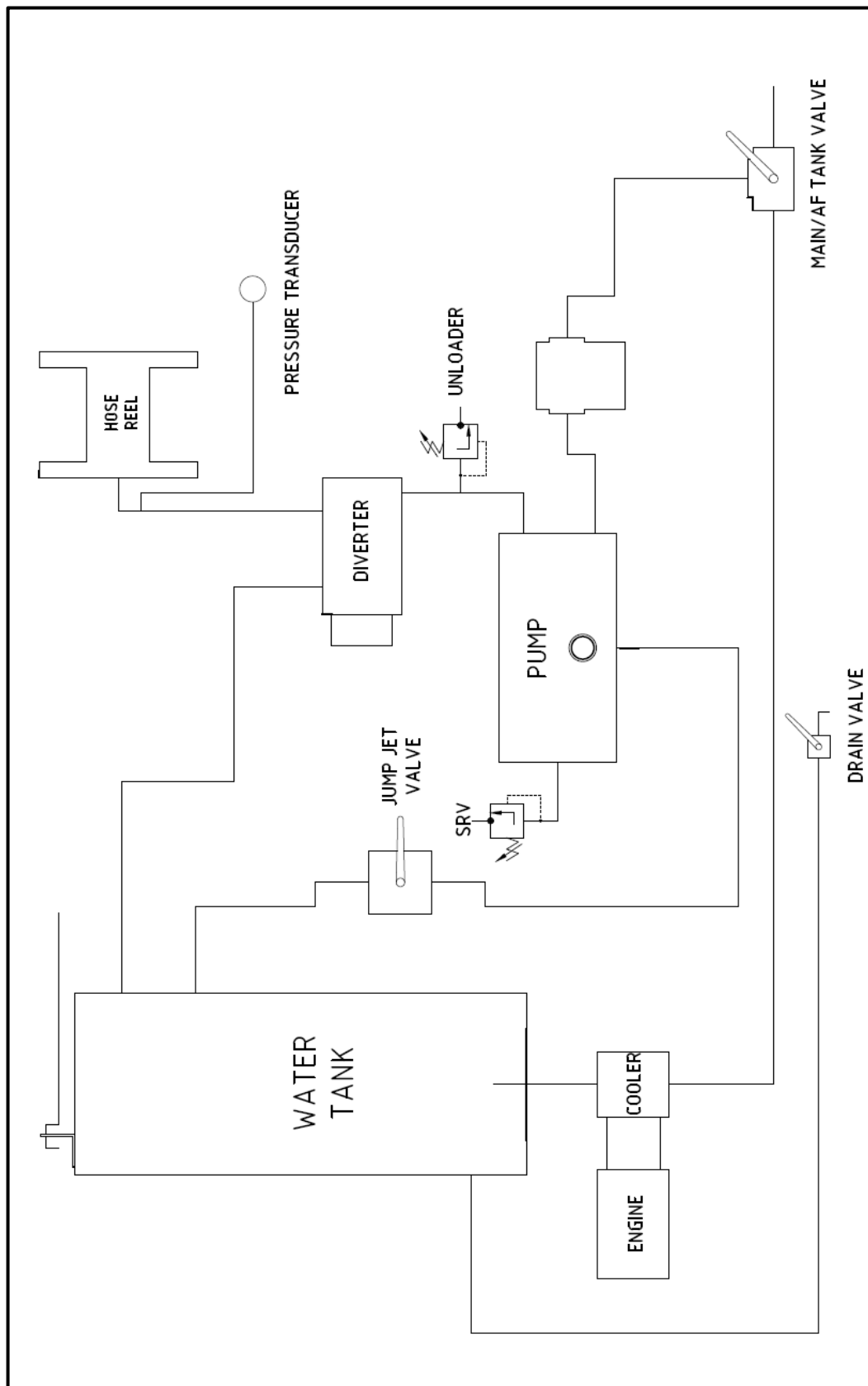
INPUT/OUTPUT ABBREVIATIONS	
AI	ANALOG/DIGITAL INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
RL	RELAY
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
COM	COMMON

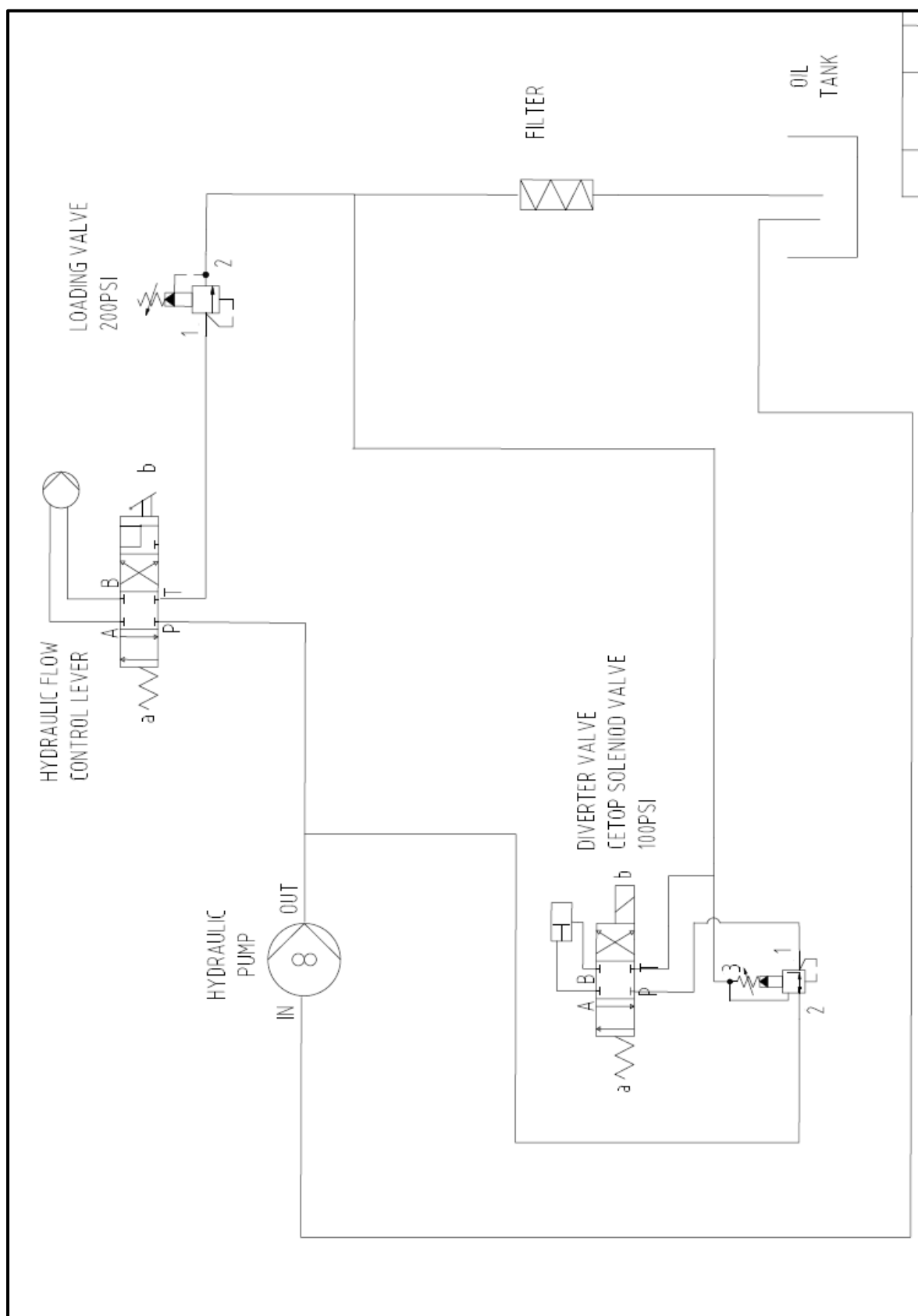
HARBEN/FLOWPLANT

P/N



B	UPDATED CUTLIST AFTER 1ST ETO.		
	(1/16/19) WW (IPD)		AU
REV.	CHANGES MADE		
<div> by <b>INNOVATION CONTROLS</b></div>			
DRAWN BY: MR		E.R.NO. IPD	
DATE: 10/16/2018		CHKD. BY: AU	APPD. BY: AU
MODEL: KIT, MPC-20 HARNESS HARBEN/FLOWPLANT			
DRAWING NO.		SHEET 1 OF 1	SIZE
40-35-1453			C
			REV.
			B





## 10. Parts Lists / Spares

### 10.1. 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.

### 10.2. 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](mailto:sales@flowplant.com)

[www.flowplant.com](http://www.flowplant.com)

ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
1	051-1057	Engine Oil Filter	1	SSP
2	051-1058	Engine Fuel Filter	1	SSP
3	051-1059	Engine Air Filter	1	SSP
4	051-1060	Engine Water Temp Switch	1	SSP
5	051-1061	Engine Oil Pressure Switch	1	SSP
6	051-1065	Alternator Fan Belt	1	SSP
7	054-123	Engine Oil	5.75 L	SSP
8	054-003	Gearbox Oil	1.5 L	SSP
9	054-003	Pump Oil	0.9 L	SSP
10	054-111	Antifreeze Solution	2.0 L	SSP



ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
11	023-011	Angle Swivel Joint 90 deg	1	RSP
12	024-184	Diverter Valve Seal Kit	1	RSP
13	035-185	Unloader Valve UL221/200H	1	RSP
14	035-235	3/8" Ball Valve	1	RSP
15	035-255	Diverter Valve Assembly	1	RSP
16	051-1062	Engine Alternator	1	RSP
17	051-1092	Engine Starter Motor	1	RSP
18	051-1064	Fuel Stop Solenoid	1	RSP
19	020-144	Gearbox 2.6:1	1	RSP
20	067-779	Safety Relief Valve	1	RSP
21	069-581	Diverter Valve Installation	1	RSP
22	071-1240	Teleradio Control System	1	RSP
23	071-1242	Pressure Transmitter (Transducer)	1	RSP
24	071-1382	320 Murphy Control Panel	1	RSP
25	071-1383	Internal Harness	1	RSP
26	071-1392	Magnetic Pick-up	1	RSP
27	071-1395	External Harness	1	RSP
28	071-1408	Rocker Switch On/Off Switch	1	RSP
29	071-1413	5 Amp Fuse Solenoid	1	RSP
30	071-1433	20 Amp Fuse Murphy	1	RSP
31	071-1433	20 Amp Fuse Murphy	1	RSP
32	071-1471	Transmitter	1	RSP
33	071-1496	Receiver	1	RSP
34	071-355	Heavy Duty Battery	1	RSP
35	071-367	E-Stop Twist to Release	1	RSP
36	071-786	Relay 12v 120amp	1	RSP
37	071-886	Float Switch Horizontal 1/2" NPT	1	RSP
38	071-901	Electrical Piston	1	RSP
39	071-902	Electrical Control Unit	1	RSP
40	020-019AAB LB	Pump 622	1	RSP
41	078-393	Cable Grip Holder	1	RSP


ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
42	A030784	Hydraulic Cylinder	1	RSP
43	N05-105	Line Strainer 1 1/4"	1	RSP
44	N05-108	Line Strainer O'ring/Seal	1	RSP
45	N06-021	Line Strainer Element	1	RSP

## **11. Service Documents**

### **11.1. Service Checklist**

SERVICE CHECK LIST																			
Serial Number -										<div>Sht 1 of 2</div> <div>Engineer -</div> <div>ESR -</div>									
Unit Number -																			
Date -																			
Hours Run -																			
In: - Initial Service					1Y:- 1 Yearly Service					2Y:- 2 Yearly Service					O:- Other Services				
Engine					Hydraulics*					Water/Anti-freeze tanks									
	Mins	In	1Y	2Y	O		Mins	In	1Y	2Y	O		Mins	In	1Y	2Y	O		
1	Check oil level	1				36	Check oil level	1				68	Clean water filter	5					
2	Change oil	10				37	Change oil	10				69	Change water filter	2					
3	Change oil filter	5				38	Change filter	5				70	Check hoses & fittings	2					
4	Clean air filter	10				39	Inspect hoses	5				71	Check tank security	2					
5	Change air filter	5				40	Inspect reel	1				72	Check tank integrity	2					
6	Change fuel filter	10				41	Grease reel bearings	1				73	Check Anti-Freeze	1					
7	Clean water trap	10				42	Check reel mountings	1				74	Check inlet ball valve	1					
8	Check coolant level & Anti-freeze mix	3				43	Check operation	1				Pressure Hoses							
9	Replace coolant	15				44	Check for leaks	1					Mins	In	1Y	2Y	O		
10	Inspect radiator	2				Electrics/Controls					75	Check for wear / damage	5						
11	Inspect hoses	5					Mins	In	1Y	2Y	O	76	Cuts / tears	2					
12	Check fan belt	2				45	Check battery	2				77	Braiding showing	2					
13	Replace fan belt	30				46	Check/grease terminals	2				78	Any joins in single length	1					
14	Check engine mounts	1				47	Check charge system	5				79	Fittings in good order	1					
15	Check exhaust	1				48	Check wiring connections	10				80	Leader hose satisfactory	1					
16	Check throttle cable / lever	1				49	Test/check operations	10				Hot Wash*							
17	Check for leaks	2				50	Test remote control unit*	5					Mins	In	1Y	2Y	O		
Gearbox					Vanpack frame					81	Check fuel pump pressure	10							
	Mins	In	1Y	2Y	O		Mins	In	1Y	2Y	O	82	Clean fuel filter	5					
18	Check oil level	2				51	Check for cracks/damage	5				83	Check swirl plate adjustment	5					
19	Change oil	10				52	Check fixing bolts & brackets	5				84	Check electrode gap	10					
20	Check for leaks	1				53	Check safety straps*	1				85	Check air flow	10					
Pump					Trailer					86	Check thermostat operation	5							
	Mins	In	1Y	2Y	O		Mins	In	1Y	2Y	O	87	Check low water level switch	5					
21	Check valves (Inlet/delivery)	15				54	Check for cracks/damage	5				88	Check unloader valve	1					
22	Replace valves (Inlet/delivery)	60				55	Check wheels/tyres/pressure	5				89	Check burner is running clean	1					
23	Check diaphragms	30				56	Check brake operation	2				90	Decoke coil	120					
24	Replace diaphragms	60				57	Check lights/reflectors	5				91	Decoke and clean coil	240					
25	Change oil	15				58	Check tow hitch/lubricate	5				Remote Control*							
26	Check hoses/fittings	2				59	Check safety cable	1					Mins	In	1Y	2Y	O		
27	Check working pressure	1				60	Check jockey wheel condition	1				92	Check handset operation	5					
28	Check pump working temp	2				Gun & Lance*					93	Check Antenna	1						
29	Check smooth running	1					Mins	In	1Y	2Y	O	Other							
30	Change Burst Disc (Must be changed every 6 months)	2				61	Check for leaks on pressure	1					Mins	In	Y	2Y	O		
31	Set Safety Relief Valve**	30				62	Check for damage	1				94	Test emergency stop button	1					
32	Check main pressure gauge / display	1				63	Check operation	1				95	Check safety decals visible	1					
33	Pressure gauge / display reading correctly	1				64	Check jets are correct	2				96	Check ID plate condition	1					
34	Check burst disc fitted	1				OMO Foot pedal*					97	Clean & tidy appearance	1						
35	Check jump jet operational	1					Mins	In	1Y	2Y	O								
In	Initial Service (After First 50 Hours or 3 Months)	65	Check cable & plugs	5															
1Y	Yearly Service (300 Hours or 1 Year)	66	Test operation	5															
2Y	2 Yearly Service (600 Hours or 2 Years)	67	Check safety button	1															
O	Other Year Service (1000 Hours or 5 Year)																		
N/A - Not applicable, A - Adjusted, v - Satisfactory, R - Repair required / made, O - Observation																			
Note - If "Adjusted" or "Repair required", please describe issue on sheet 2																			
* If fitted ** Must be set by manufacturer/authorised agent and reset/certificated every twelve months																			
FLOW 0321 Iss 7																			

## 11.2. 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 .....	
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

## 12. Warranty

### 12.1. 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 discretion, 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.

### 12.2. 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

### **12.3. 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.



## 12.4. Declaration of Conformity



## EC Declaration of Conformity

In accordance with BS EN ISO/IEC 17050-1:2010

We: Flowplant Group Limited, Gemini House, Brunel Road, Churchfields Industrial Estate  
Salisbury, Wiltshire, UK, SP2 7PU

hereby declare that the machinery

Type: UNIT 320 Desilter  
Model: 003-301  
Serial Number 2503810  
Year of Manufacture: 2021

has been manufactured using the following transposed harmonised European Standards and technical specifications:

*BS EN 809:1998: Pumps and pump units for liquids-Common safety requirements*

and within the limits specified for the machinery is in conformity with :

*The Machinery Directive 2006/42/EC*

*The Noise Emission in the Environment By Equipment for use Outdoors Directive 2000/14/EC*

Has been designed and manufactured to the following standards :

*BS EN ISO 9001:2015*

For and on behalf of the Company

Mr S Smith, Director of Engineering

Certificate No. FPEC1197

Date: 22/06/2021

## **13. Health and Safety Manual – 061956**

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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



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# 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.



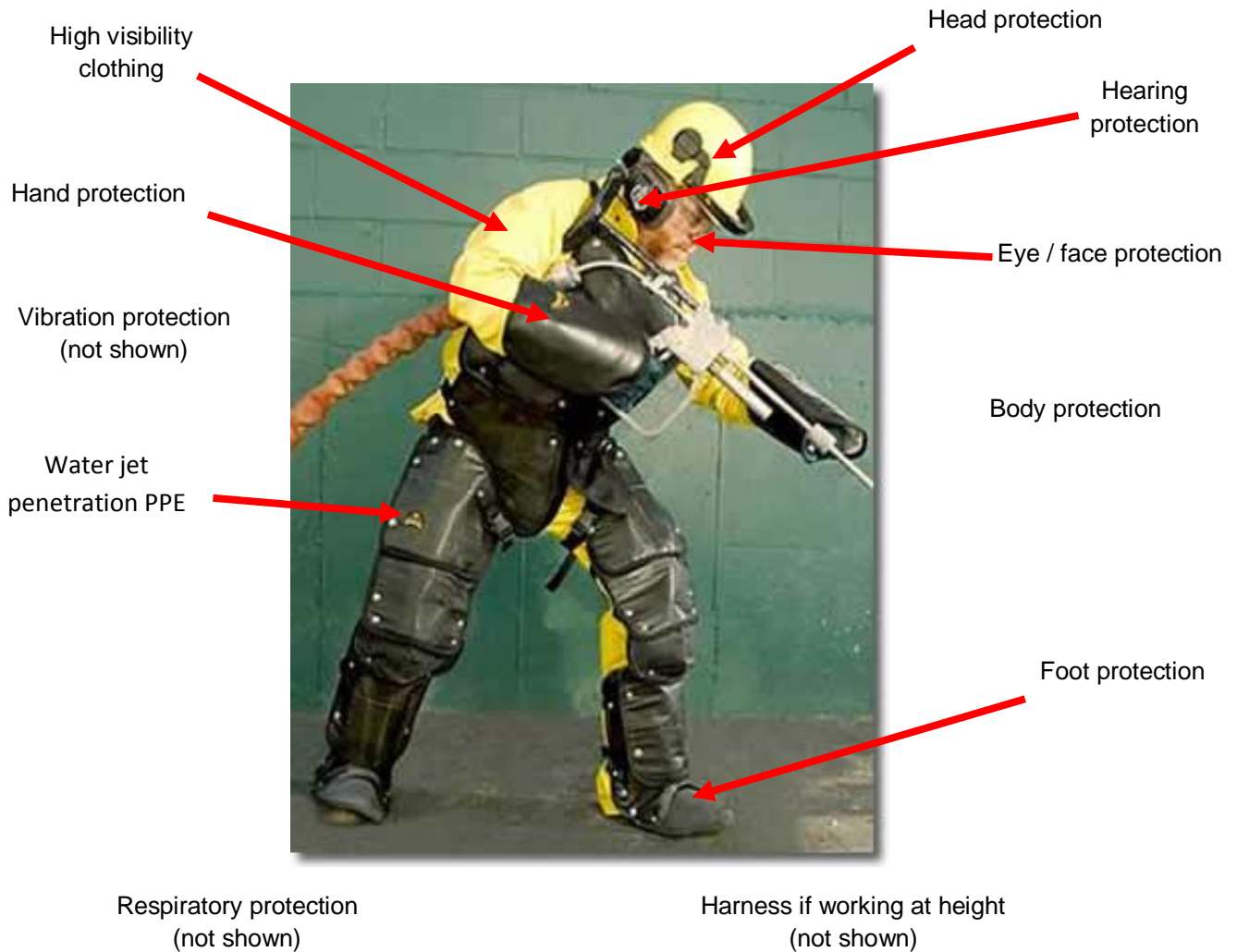
## 4. Personal Protective Equipment

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 1/3<sup>rd</sup> 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.