

Operation & Maintenance Manual

Original Instructions

320 Y-SERIES VANPACK

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Operation & Maintenance Manual for:

UNIT: Unit 320 Y-Series Radio Control

ISSUE DATE: 09/05/2022

AMENDMENTS

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1. Contents & Introduction

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1.2. Introduction

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.

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 Vanpack

The 320 Series 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 Pump

Details of the pump and gearbox assembly.

Section 8 Engine

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

Section 9 Ancillaries

Section 10 Parts list / Spares

How to identify and order spares

Section 11 Service Documents

Service logbook and checklist.

Section 12 Warranty & Certification

2. Scope of Supply

2.1. Scope of Supply

Unit:	UNIT 320 Y-SERIES RADIO CONTROL
Machine Build Code:	003309, 003311

The Scope of Supply in compliance with the above order comprises the following items:

1. UNIT RADIO VANPACK 320 SERIES (200 BAR 45 LPM)

2.2. Vanpack Assembly

The General Arrangement drawing: 003-295, defines the components of the 320 Series 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, (Pump is specified at 200microns)

The **Speck** high-pressure plunger pump is driven by a **Yanmar 3TNV76 18.5kW Stage 5** industrial diesel engine through a Speck NP25 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 Hawk safety relief Valve. The system pressure can be adjusted by means of a Speck UL221 Unloader Valve.

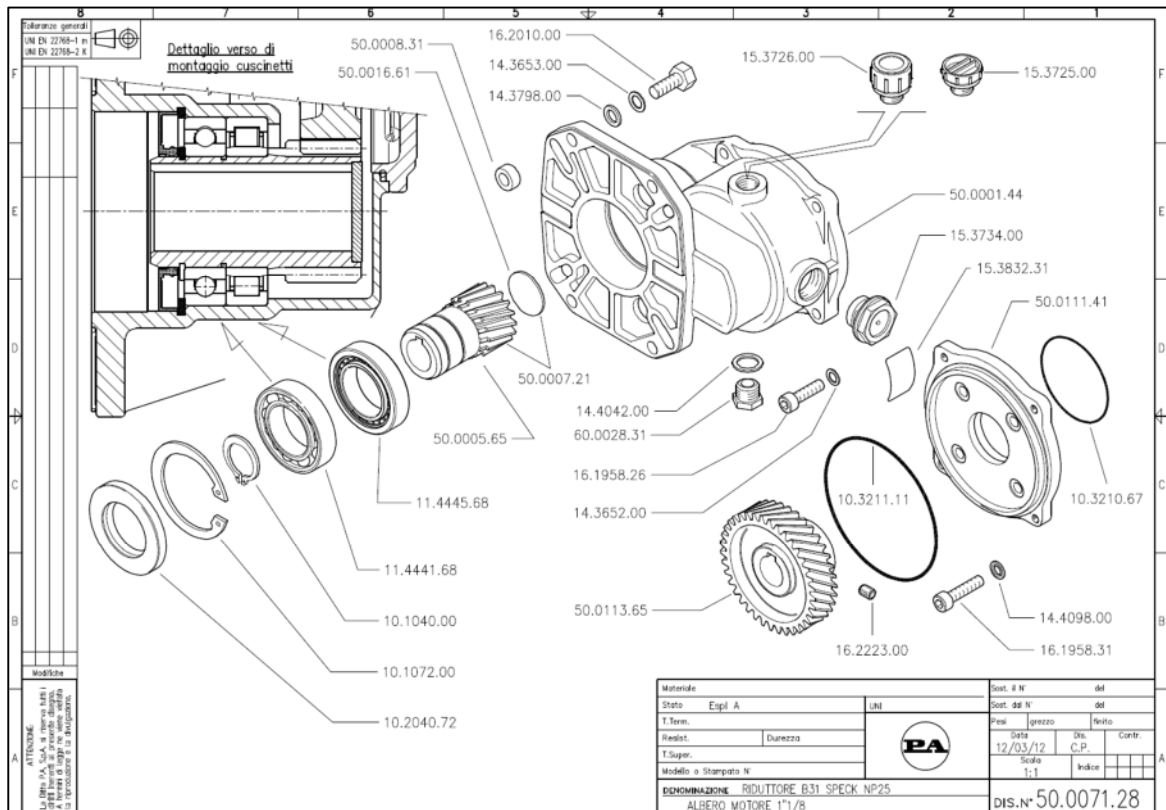
The engine and system pressure can be monitored at the control panel situated at the rear of the van.

2.3. Detailed Drawings

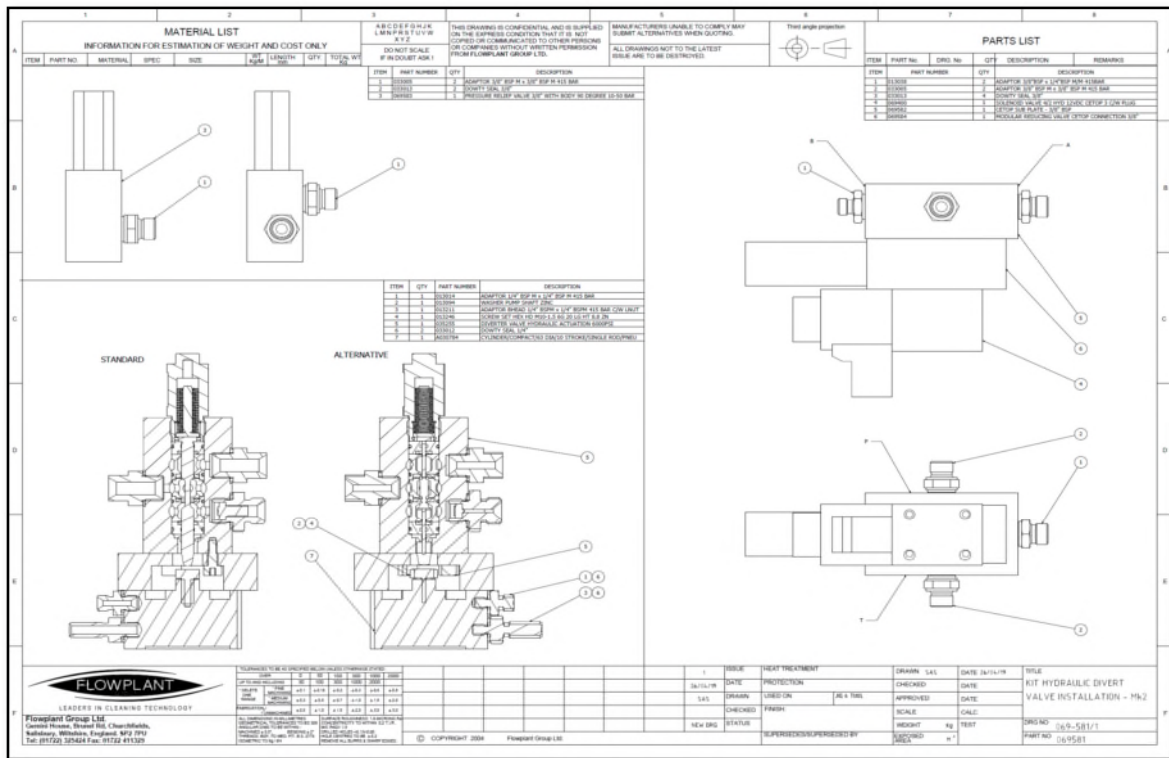
Detailed drawings and parts lists for the above components are provided as follows:

The Speck Pump is detailed in Section 7.

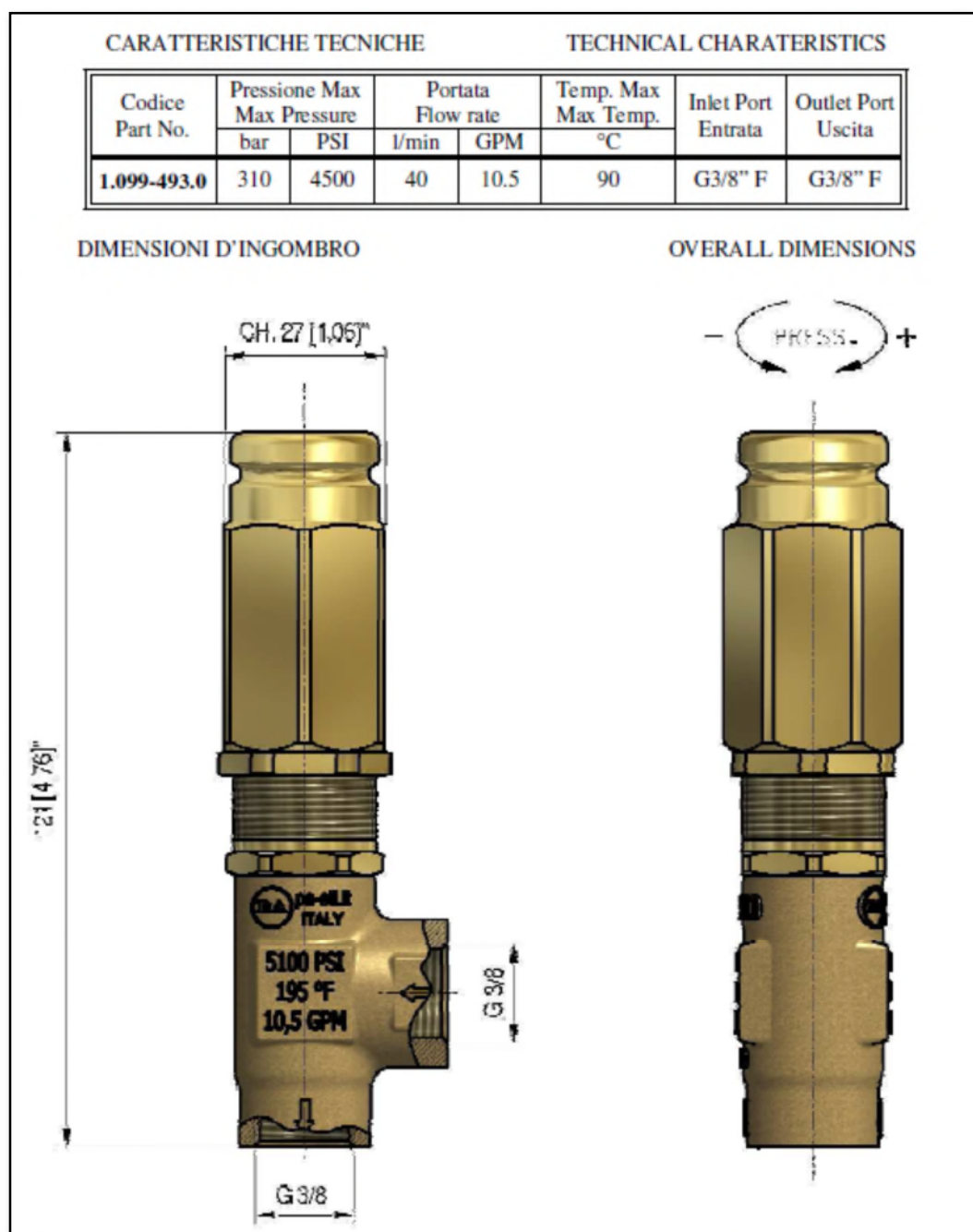
NP25 Gearbox Detail



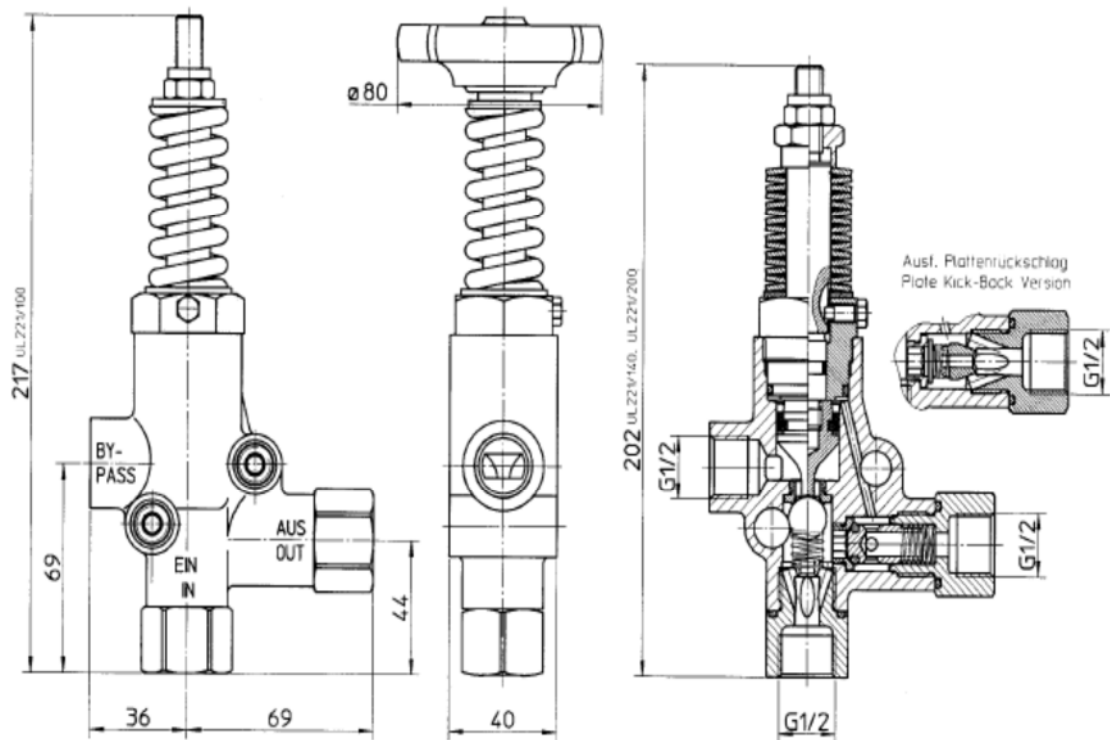
Hydraulic Diverter Valve 069-581



Hawk Safety Relief Valve 035-401



Speck Unloader Valve UL221 035-185



320 Series 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)
- Optional Service / Location Tracking



Model	320 Series Van Pack
Pressure & Flow	200 Bar @ 54L/pm
Pump	Speck Triplex Plunger
Engine	Yanmar 3 Cylinder Liquid Cooled
Water Tank	White / Transparent 400l Breathable plastic tank
Frame	Lightweight Fibreglass canopy / lightweight steel frame, shot blasted and powder coated
Hose Reel	Variable speed Hydraulic driven reel with a 100m Capacity
Dimensions	TBC
Weight	Dry Weight from 475kg
Build Options	<ul style="list-style-type: none"> • Remote Service Monitoring & Location Tracking (UK Only) • Lightweight Tough Skin Hose

3. Technical Data

3.1. Technical data

3.1.1. Pump data

PUMP TYPE	Speck NP25/54-200 [positive displacement]
Number of cylinders	3
Power rating (nominal)	16.8 kW
Plunger diameter	25mm
Crankshaft speed	1450rpm
Maximum pressure	200
Normal operating pressure	200 bar [2900psi]
Flow rate	Up to 54 L/min
Crankcase lubrication	Splash / Gravity
Crankcase oil capacity	0.9 litres
Recommended crankcase oil	ISO VG 220 or SAE 90 Gear oil.
Valves	Identical suction & discharge.
NPSH	Input 10 bar max. Suction head -0.3 bar.

Prime Mover	Yanmar 3TNV76 18.5kW Stage 5
Drive	Gearbox Speck NP25 Reduction box (2.176:1)
Water Tank	Capacity 88 gals. (400 litres)
Supply Water Filter	N05105 Hypro line strainer / 177 micro mesh
Pressure Gauge	Digitally Displayed
Safety Relief	Hawk (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 Vanpack are as follows:

1. A prime mover in the form of a Yanmar 3-cylinder water-cooled diesel engine which drives a Speck NP25 type high-pressure pump.
 2. The pump is capable of raising the water pressure up to 2900psi (200 bar).
 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 085-271, 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: 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.

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)

Note: 050-324 Hydraulic gear pump detail: -

(Ratio 0.844/1.00, Output 4.35 cc/rev, direct mounting, theoretical discharge volume @ 3000rpm = 11l/pm, max speed 3200rpm, max pressure 1707psi)


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 just below and right of the high pressure hose reel.

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

Carry out all daily checks. Full maintenance checks are detailed in Section 5 - Routine Maintenance.

They are:


- Pump oil level
- Gearbox oil level
- Water filter cleanliness
- Engine oil level
- Engine coolant level
- Tank water level & Cleanliness
- Diesel level
- Anti-freeze level
- Radio Remote fully charged

If the unit has previously been in operation for more than 100 hours, other routine maintenance checks may need to be carried out. Refer to section 7 and 8.




SAFETY RELIEF VALVES MUST BE RECALIBRATED EVERY 6 MONTHS

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 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.

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

4.4. 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. The

NOTE: Do Not allow unfiltered water into the pump

machine WILL NOT RUN if the water tank is empty, this will be indicated by an on-screen warning on the control panel, clearly marked as 'low water' as well as an audible warning. It is preferable to have a full tank of water and provide the pump with a good positive head.

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.

Emergency Shutdown



Fig. 4.1 Estop on control panel. Twist to release

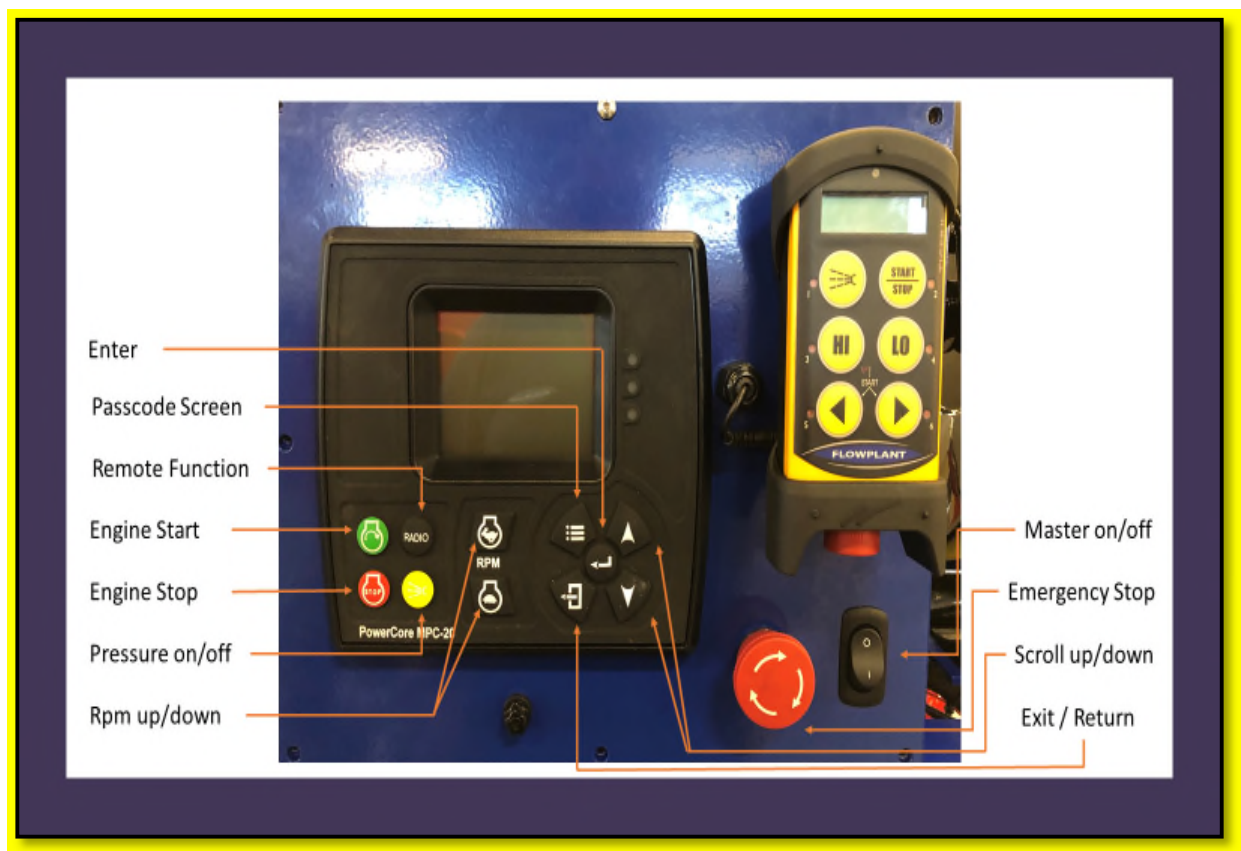
4.5. Pre-start Checks & Procedures

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 prestart When cold. 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.

If the engine is already warm the same process will be followed. The system shutdowns are automatically overridden in the initial sequence to allow to engine oil pressure to stabilise.

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. ** or in emergency situations press the stop button on the radio control panel or the emergency 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

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.

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 mechanically governed to 3150 rpm.

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  button until engine tick over speed is reached, then press the 'water off' button and return the unit to the idle position

When using the RCU the operator is required to remove the key from the Local/Remote selection whenever the trailer/van pack is unattended

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

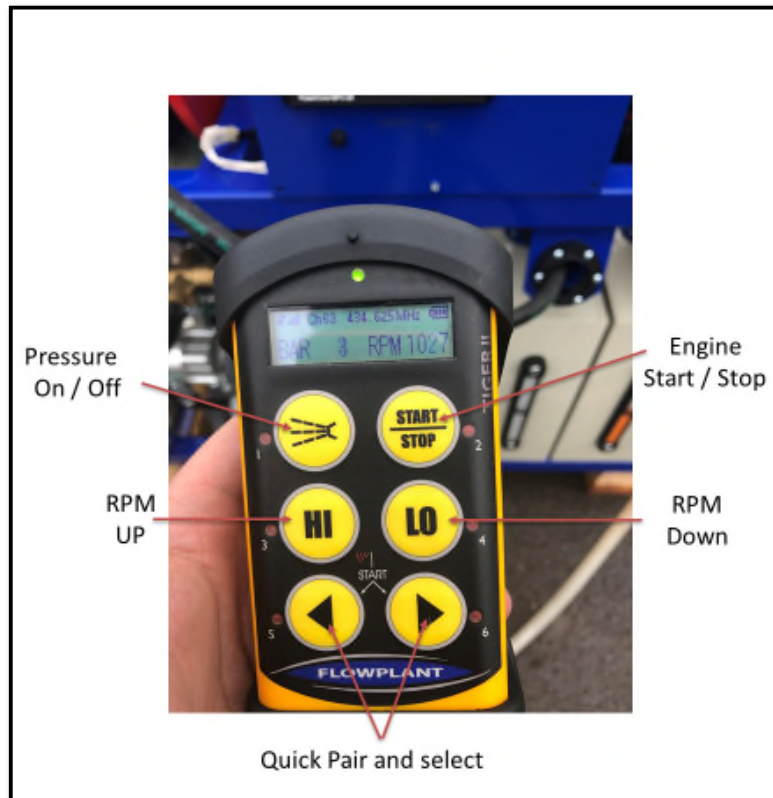






Fig 4. Operating with the Radio Remote

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, 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.




Fig. 5 Handheld RADIO Control Unit (RCU)


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

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. Possible reasons for an automatic shutdown are detailed in Section 6 - Fault Finding.


4.9. 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 motor is fitted to the hub of the hose reel. The motor speed and direction is controlled via a manually actuated spool valve. (018-005 "Hydraulic Directional Control Valve" CV1185 c/w 90- 100psi relief and 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 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.

4.10. 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. Quickly fully unwind the unloader to protect these lines.
10. As soon as it is fully unwound. Shut down the engine.
11. Select freewheel on the hydraulic lever Manually rewind the hose reel.
12. Secure the hose end in the correct place on the frame.
13. Ensure the hydraulic valve is taken out of the freewheel position.
14. Replace the antifreeze tank lid.
15. 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"> • Check inlet water filter element (Clean if necessary) • Check engine oil level on dip stick • Check engine coolant level • Visual check for hose damage/water leaks & for any cracks in frame/chassis etc. • Check Power and remote control • Check emergency stop button operation (Ref para 4.4)
Weekly / 24 hours	<ul style="list-style-type: none"> • Visually inspect van pack for security checking for any loose, damaged or missing parts. • Check for any leakage • Check air filter cleanliness • Check engine fuel water trap for contamination
Three monthly / 50 hours	<ul style="list-style-type: none"> • First service contact Flowplant Service
Six Monthly / 100 hours	<ul style="list-style-type: none"> • Inspect tanks and fittings for leaks, thoroughly clean & flush through • Tighten any loose joints • Grease the hydraulic hose reel bearing blocks • Check condition of 12volt start battery • Grease battery terminals for protection • Check alternator belt
Yearly / 300 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 (Specifically welded joints) • Check hydraulic filter gauge. If it reads in the red replace the filter and oil (Shell Tellus 22) • Carry out detailed inspection of pipes, hoses and fittings. (Specifically looking for perished rubber and damage)
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.
Two Yearly / 600 hours	<ul style="list-style-type: none"> • Major service of engine, gearbox and pump required (Contact Flowplant) • Replace pump inlet/delivery valves • Check wiring terminals/connections and continuity of electrical earth.

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. Gearbox Lubricating Chart – Speck NP25

Always use the sight glass in the side of the gearbox as the level indicator

Manufacturer	Type	Oil Capacity (litres)	
		Output shaft Above Input	Input shaft Above Output
ESSO	Nuto H15	0.65	0.50
GULF			
MOBIL	DTE 11		
ROC			
TEXACO			
BP	Energol SHF LT15		
AGIP			
SHELL	Tellus T15		
CENTURY OIL	Nevis No5		
PETROFINA			
CASTROL	Hyspin AWH 15		

5.3. 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.

5.4. Daily Maintenance

The following must be completed daily with the unit 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.

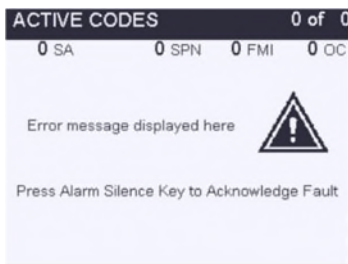
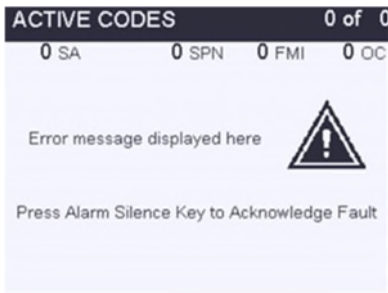

6. Fault Finding

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>Low oil pressure shutdown.</p>	<p>Check oil level & top up if necessary.</p> <p>Check and replace switch if faulty.</p> <p>Check the oil pressure, if the pressure is low</p> <p>Refer to the handbook for further advice.</p>
	<p>Water/coolant temperature shutdown.</p>	<p>Check Coolant level & content top up if necessary</p> <p>Check and replace switch if faulty.</p> <p>Check the water temp in the radiator, if the temp is abnormally hot, Refer to the engine handbook for further advice.</p>
	<p>Emergency stop button in</p>	<p>Twist to release the button.</p> <p>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!</p>

	<p>Charge warning indication</p>	<p>Check the alternator 'V' belt tension, tighten the belt if it is slack and slipping.</p> <p>Check the connecting terminals to the alternator.</p> <p>Check the engine idle speed, reset if necessary.</p> <p>Refer to engine handbook for further advice.</p>
--	---	--

6.1. Equipment Fault Finding

Problem	Possible Cause	Recommended Action
Low system pressure	Worn or incorrectly sized nozzle. Blocked water filter. Blocked suction hose. Damaged suction hose. Leaks in delivery hoses/couplings. Unloader valve leaking. Worn pressure packings. Worn suction or delivery valves.	Replace nozzle. Clean filter element. Remove obstruction. Repair or replace. Check all joints for tightness. Replace any worn hoses. Repair or replace. Replace worn parts. Replace seals or renew valves.
Low pressure and pump pulsing	Broken valve spring. Leaking O-ring on valve cartridge. Worn pressure packings.	Replace spring. Renew O-rings. Renew packings.
Excessive water leakage from pump	Worn pressure packings. Scored plungers.	Renew packings. Replace plungers.
Water in crankcase	Filler/breather cap missing. High humidity.	Replace cap. Replace oil and reduce oil change interval.
Noisy operation	Worn bearings.	Overhaul or replace pump.
Oil Leaks	Worn pressure packings. Worn oil seals.	Renew packings. Replace oil seals.

6.2. Selector Fault Finding

Selector problem	Cause	Action
Loss of pressure and flow is down.	Water leaking through the worn seat back to tank.	Replace the seats and the plug if also damaged.
If water leaks along spindle and past lever.	O-ring and back up ring failure along shaft.	Replace O-ring and back up ring 013-021 & 023-001.
Water leaking along the gland nut thread.	Leaking selector seal.	Replace seal 012-095.

7. Pump

Flowplant offer a detailed manual with the Speck NP25/54-200 Pump and this will be accompanied by this manual.



8. Engine

Yanmar offer a detailed manual with the **Yanmar 3TNV76 18.5kW Stage 5** 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
051-1102	ENGINE OIL FILTER
051-1103	ENGINE FUEL FILTER
051-1104	ENGINE AIR FILTER
054-020	ENGINE OIL
054-047	GEARBOX OIL
054-047	PUMP OIL

9. Circuit and Wiring Diagrams

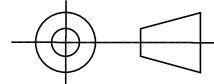
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THIRD ANGLE PROJECTION!



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

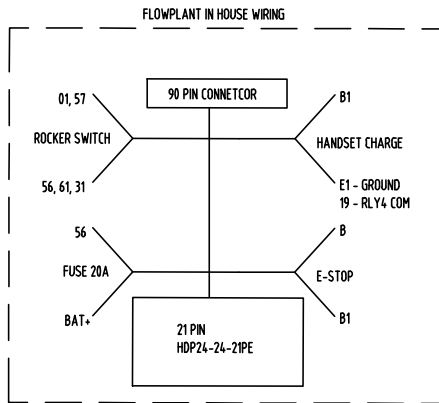
CONNECTORS

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

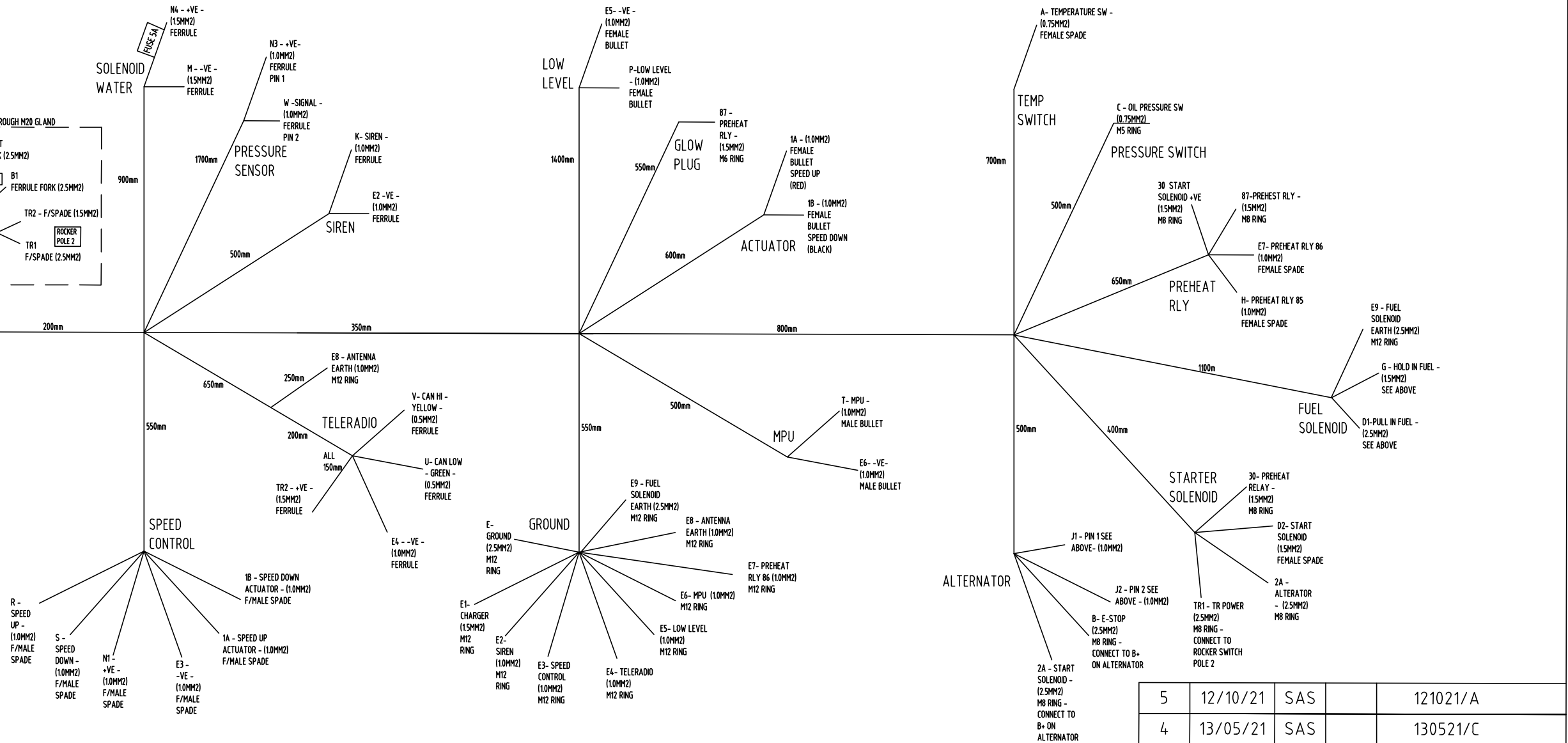
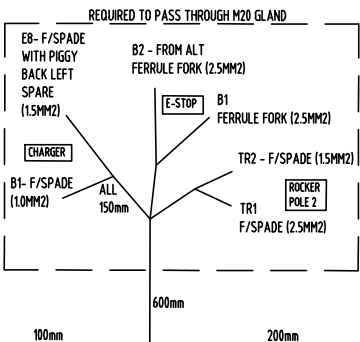
FUEL SOLENOID
YAZAKI 7123-2237-00

LOOM
G D1
E9

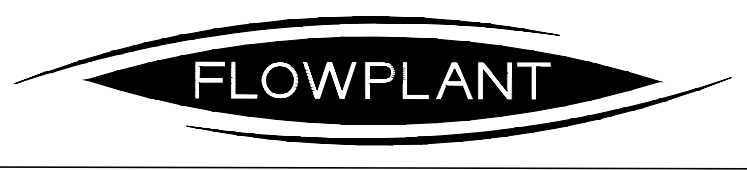
SOLENOID
W R
B



- 21 PIN
HDP26-24-21SN
A - TEMPERATURE SW - (0.75MM2)
B1 - E-STOP - (2.5MM2)
C - OIL PRESSURE - (0.75MM2)
D1 - FUEL SOLENOID - (2.5MM2)
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)
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)



5	12/10/21	SAS		121021/A
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
	* 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

SPEC / PART NO.	APPROVED	DATE
SIZE.	CHECKED	DATE
FINISH.	SCALE	CALC
HEAT TREATMENT.	WEIGHT Kg	TEST
SUPERSEDES/ SUPERSEDED BY	PROTECTION	

DRAWN SAS	DATE 01/08/20
APPROVED	DATE
CHECKED	DATE
SCALE	CALC
WEIGHT Kg	TEST
PROTECTION	

TITLE
D1105 WIRING LOOM
RADIO (320)
SHT 1 OF 2
DRG NO. 071-1395/3-5
PART NO. 0711395

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© COPYRIGHT 2004 FLOWPLANT GROUP LTD.												ITEM	PART NO.	DRG. NO.	QTY	DESCRIPTION	REMARKS				
SOLENOID WATER		PRESSURE SENSOR		SOLENOID WATER		TELERADIO		PREHEAT RELAY		87 - RING TERMINAL STUD - GLOW PLUG		YAZAKI 7123-2237-00									
SPEED CONTROL		LOW LEVEL		EARTH POINT		TEMP SWITCH		E-STOP		E, E1, E2, E2, E3, E4, E5, E6, E7		CHARGER									
ACTUATOR		MPU		STARTER MOTOR		D2		SPADE		STUD											
PRESSURE SWITCH		PREHEAT RELAY		STARTER MOTOR		J1, J2		PRE WIRED CONNECTOR		STUD											
		OVER		0	30	100	300	1000	2000	MATL.		DRAWN		SAS	DATE		01/08/20	TITLE D1105 WIRING LOOM RADIO (320) SHT 2 OF 2 DRG NO. 071-1395/3 - 5 PART NO. 0711395			
		UP TO AND INCLUDING		30	100	300	1000	2000		SPEC / PART NO.		APPROVED		DATE							
		* DELETE ONE RANGE	* FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8	SIZE.		CHECKED		DATE							
			* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0	FINISH.		SCALE		CALC							
		FABRICATION UNMACHINED		± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0	HEAT TREATMENT.		WEIGHT		Kg	TEST						
Flowplant Group Ltd. Gemini House, Brunel Road, Churchfields, Salisbury, Wiltshire. SP2 7PU England. Tel: +44 (0) 1722 325424 Fax: +44 (0) 1722 411329		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 Gg / 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											

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.

FCI-90W CONN COVER
FWM EW0618052

FCI-90W CONN LOCK
FWM EW0623356

WIRES OUT

FCI-90W CONNECTOR
FWM EW0618049
FWM EW0870353
FWM EW0886046
FWM EW0618053

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

1	31	61
15	45	75
16	46	76
30	60	90

WIRE INSERTION VIEW

HARBEN/FLOWPLANT
P/N

KEY SWITCH
FWM 00035218

21 PIN CONNECTOR
DEUTSCH HDP24-24-21PE
FWM 00007681

A	[USER DEFINED] (AI4)
B	BATT (+)
C	[USER DEFINED] (DI6)
D	START SOL. (B+ 5A,RL1)
E	BATT (-)
F	(RL6 NO)[B-,1A USER DEFINED]
G	ECU/FUEL (B+ 5A,RL2)
H	(RL3 NO)[B+,2A USER DEFINED]
J	ALT. EXCITE (B+ 1A,RL2)
K	[USER DEFINED] (DO3,B+,2A)
L	(RL5 NO)[B-,1A USER DEFINED]
M	(RL4 NO)[B-,1A USER DEFINED]
N	4-20mA RTN
P	[USER DEFINED] (DI4)
R	THROTTLE DEC (DO5,B-,1A)
S	THROTTLE INC (DO6,B-,1A)
T	FREQ (HI)
U	CAN LOW
V	CAN HIGH
W	(AI3) [USER DEFINED]
X	(AI1) [USER DEFINED]

ITEMS TO BE SHIPPED LOOSE AND INSTALLED BY CUSTOMER:

1. KEY SWITCH 00035218 WITH 2 KEYS
2. O-RING 00000311
3. FUSE HOLDER 00000933
4. FUSE 00003959
5. NUT 00009128
6. WASHER 00009127

PACKAGING NOTES:

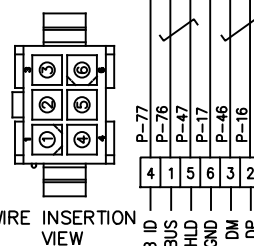
1. PACKAGE SHIP LOOSE ITEMS 1, 2, 3, 4, 5, 6 IN BAG 00000009.
2. PACKAGE HARNESS AND SHIP LOOSE KIT IN LARGE BAG 00002982.



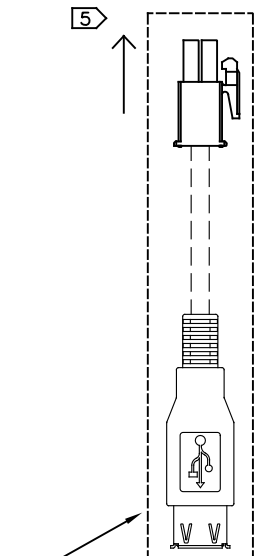
PLACE O-RING ON
BEFORE INSTALLING KEY
SWITCH ON PANEL

E	UPDATED KEY SWITCH. (5/28/2020) WW (IPD)	AU
D	CHANGED WIRE P-19 FROM S2 TO BAT+.	
REV.	(5/21/19) MR (IPD)	AU
CHANGES MADE		
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. E

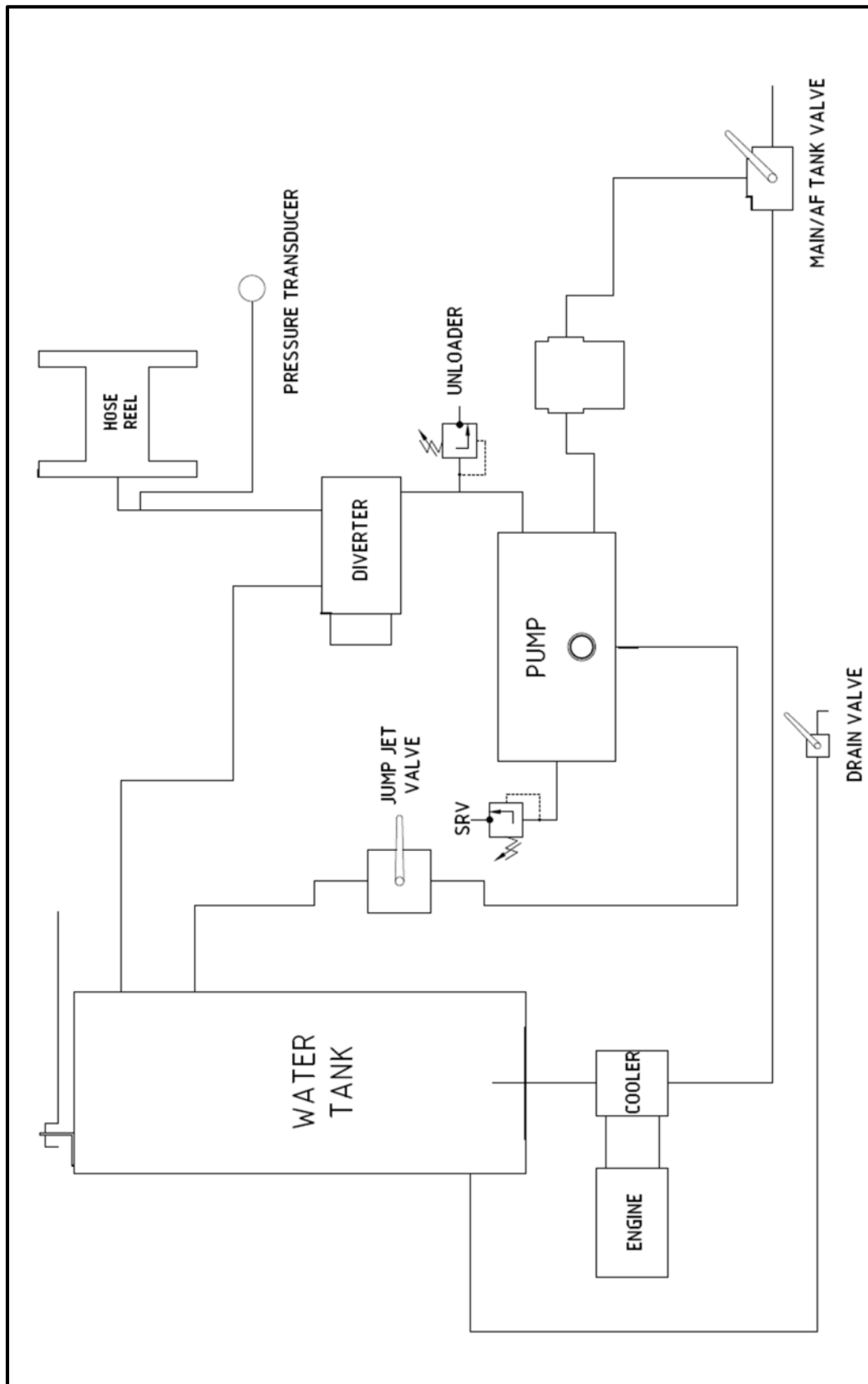
SEE 40351453CL FOR CUTLIST

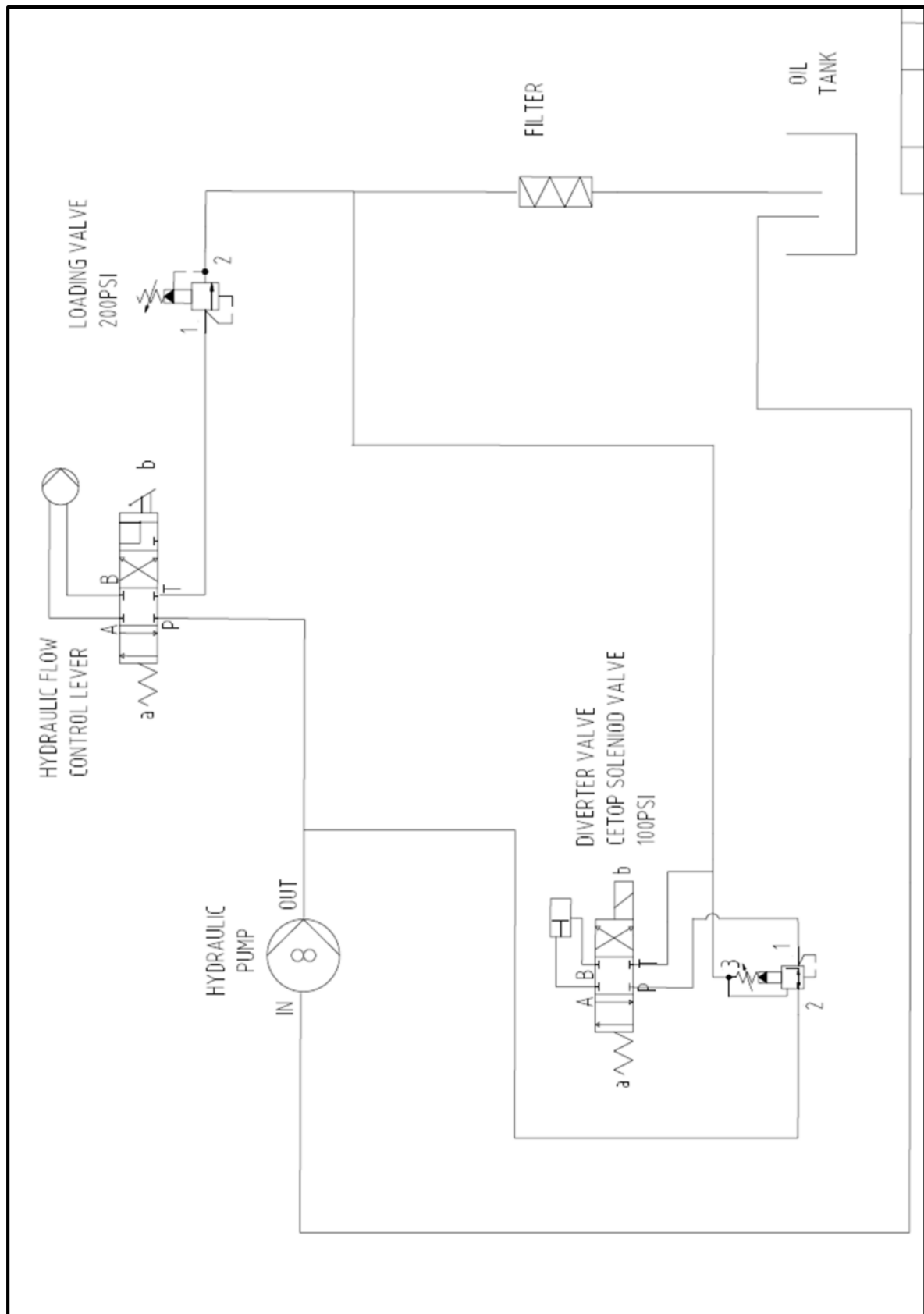


USB
CONNECTOR
AMP 172160-1
FWM 00030195



PROGRAMMING HARNESS 40000566





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

www.flowplant.com

10.3. Accessories & Consumables

10.3.1. Routine Maintenance

For routine maintenance the following will be required.

10.3.2. Consumables

N0621	MESH FOR LINE STRAINER N015108 177 MICRON
011-046	PRESSURE DISC WHITE 4000psi

10.3.3. 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

ITEM	FLOWPLANT PART NO	DESCRIPTION	QTY	CODE
1	051-1107	Engine Oil Filter	1	SSP
2	051-1102	Engine Fuel Filter	1	SSP
3	051-1103	Engine Air Filter	1	SSP
4	051-1104	Engine Water Temp Switch	1	SSP
5	051-1105	Fuel Filter Water Separator	1	SSP
6	051-1106	Alternator Belt	1	SSP
7	054-020	Engine Oil	3.4 L	SSP
8	054-047	Gearbox Oil	0.35 L	SSP
9	054-047	Pump Oil	0.9 L	SSP
10	054-111	Antifreeze Solution	2.0 L	SSP
11	023-011	Angle Swivel Joint 90 deg	1	RSP
12	035-235	3/8" Ball Valve	1	RSP
13	035-185	Unloader Valve UL221/200H	1	RSP
14	035-401	Safety Relief Valve	1	RSP
15	042-3315	320 Murphy Control Panel	1	RSP
16	067-853	Gearbox 2.176:1 Speck NP25	1	RSP
17	071-1240	Teleradio Control System	1	RSP
18	TBC	Transmitter	1	RSP
19	TBC	Receiver	1	RSP
20	071-1242	Pressure Transmitter (Transducer)	1	RSP
21	071-1392	Magnetic Pick-up	1	RSP
22	071-1408	Rocker Switch On/Off Switch	1	RSP
23	071-272	Heavy Duty Battery	1	RSP
24	071-367	E-Stop Twist to Release	1	RSP
25	071-786	Relay 12v 120amp	1	RSP
26	071-886	Float Switch Horizontal 1/2" NPT	1	RSP
27	071-901	Electrical Piston	1	RSP
28	071-902	Electrical Control Unit	1	RSP
29	078-393	Cable Grip Holder	1	RSP
30	N05-105	Line Strainer 1 1/4"	1	RSP
31	N06-021	Line Strainer Element	1	RSP
32	N05-108	Line Strainer O'ring/Seal	1	RSP
33	069-581	Diverter Valve Installation	1	RSP
34	A030784	Hydraulic Cylinder	1	RSP
35	069-581	Diverter Valve Assembly	1	RSP
36	024-048	Diverter Valve Overhaul Kit	1	RSP
37	024-047	Diverter Valve Seal Kit	1	RSP
38	078-1010	Modification to Fluid Head	1	RSP
39	TBC	Fluid Head Valve Assembly	6	RSP
40	TBC	Fluid Head Packing Seals	3	RSP

41	TBC	Plungers	3	RSP
42	TBC	Engine Alternator	1	RSP
43	TBC	Engine Starter Motor	1	RSP
44	TBC	Fuel Stop Solenoid	1	RSP
45		5 Amp Fuse Solenoid	1	RSP
46		20 Amp Fuse Murphy	1	RSP

10.4. Parts List

Component	Description	Qty .
012061	PLUG BRASS FLANGED 1/2" BSP	1
013014	ADAPTOR 1/4" BSP M x 1/4" BSP M 415 BAR	2
013038	ADAPTOR 3/8" BSP x 1/4" BSP M/M 415BAR	1
013039	ADAPTOR 1/2" BSP M x 1/2" BSP M 415 BAR C-TXT	10
013046	ADAPTOR 3/4" BSP M x 1/2" BSP M 345 BAR	2
013053	HOSE CLIP DIA 25-35 JCS HI-GRIP S/S	10
013064	HOSE CLIP DIA 17-25 (OX) JCS HI-GRIP S/S	6
013107	BOLT HEX HD M12-1.75 6G 120MM LG HT 8.8 ZN	4
013203	ADAPTOR BHEAD 3/8" BSPM x 3/8" BSPM 415 BAR C/W LNUT	2
013224	ADAPTOR BHEAD 1/2" BSPM x 1/2" BSPM 415BAR C/W LNUT	4
013266	SEAL DOWTY 1 1/4" BSP SELF CENTERING	13
013349	CLIP "R"	1
013813	SCREW THREAD CUTTING PAN HEAD TORX DRIVE 6.0 mm x 16 mm ZINC PLATED	5
013916	WASHER NEOPRENE RUBBER 14mm O/D 6.35mm I/D 3mm THK	2
013938	SCREW HEX HEAD M10x1.25 x 30MM LG ZN	22
013943	FEMALE BOBBIN MOUNT TYPE 2 / B AV 3015MF20-60	4
014013	HOSE CLIP DIA 20-30 JCS HI-GRIP S/S	4
014201	P CLIP 25mm ZINC PLATED	1
014277	HANDLE 8535-202	2
014284	HOOD LATCH RUBBER 339-9151	5
014288	HOSE CLIP DIA 8-10 JCS HI-TORQUE RS727-5914	4
014304	316 STAINLESS STEEL CABLE TIE, 520MM x 4.6MM	10
015143	O RING BS 033 NBR 70 SHORE	1
015173	SEAL BONDED 1" BSP 400-830-4490-41 780 BAR SELF CENTRALISING	1
015315	GASKET CONTROL PANEL 315 SERIES MK3 (2018)	1
016245	KEY 1/4" X 1/4" X 60MM LONG	1
016267	AV MOUNT CAPTIVE TRANSIT CTM633512/6 REAR (FLYWHEEL END)	2
016416	AV MOUNT CAPTIVE TRANSIT CTM633512/5 REAR (FLYWHEEL)	2
016420	AV MOUNT CAPTIVE M10 CTM833510-40CT	1
018005	VALVE SPOOL HYD FLOW CONTROL	1
021090	ADAPTOR 3/4" BSPM x 3/8" BSPM 415 BAR	2
023008	ADAPTOR 3/8" BSP M x 1/2" BSP F SWIVEL 415BAR	2

023011	ANGLE SWIVEL JOINT 90 DEG 1/2" BSP M/M 415BAR	1
023016	PLUG BLANKING 1/2"BSP 415 BAR	1
023023	INSERT FOR HOSE SWAGED 3/8"BSP FEM	1
023025	INSERT FOR HOSE SWAGED 1/2"BSP FEM	5
023028	TEE 3/8"BSP M 415BAR	1
023030	INSERT FOR HOSE SWAGED 3/4"BSP FEM	1
023041	O CLIP 3/4"	12
023047	HOSE CLIP DIA 30-40 JCS HI-GRIP S/S	8
0231060	1/2"BSP X 1 1/4BSP MALE/MALE PARALLEL 215 BAR	1
0231248	INSERT HOSE STRAIGHT 1" BSPM x 25mm DIA HOSETAIL 316 STAINLESS STEEL	2
0231414	INSERT HOSE 1/8" BSP 90 DEG FEMALE	1
023147	ADAPTOR 1" BSP M x 3/4" BSP M 210 BAR	1
0231674	ADAPTOR HOSETAIL INSERT 90 DEG 3/8" BSP SWIV STAIN. S	1
0231734	ADAPTOR CROSS 1/2" BSP M/M/M/M ZN 415 BAR	1
0231872	ADAPTOR 9/16" SAE O RING MALE TO 3/8" BSP MALE MS ZN PL 415 BAR WP	1
0231873	ADAPTOR 3/4" SAE O RING MALE TO 1/2" BSP MALE MS ZN PL 415 BAR WP	1
023203	INSERT FOR HOSE 1"BSP FEM SWAGED TYPE	2
023261	ADAPTOR 1/2"BSPM x 1/2"BSPF SWIVEL 415 BAR ZINC	2
023262	ADAPTOR 1/2"BSP FEMALE FIXED TEE 415 BAR	2
023273	ADAPTOR BULKHEAD 3/4"BSP X 3/4"BSP MALE C/W LOCKNUT 210 BAR	1
023347	INSERT FOR HOSE SWAGED 3/4"BSP 90DEG FEM	2
023362	ADAPTOR 1/2"BSP M x 7/8"-14 JIC M 415BAR	2
023379	ADAPTOR BHEAD 1 1/4" BSPM x 1 1/4" BSPM 210 BAR C/W NUT	1
023391	PLUG BLANKING 1/2" BSP ST/ST 550 BAR	1
023569	PIN CANOPY RETAINER	1
023609	ADAPTOR 1 1/4"BSPM X 3/4 BSPM ZN 210 BAR	1
023712	ADAPTOR M16 X 1.5 - 3/8"BSP M/M MS ZN 1MB/16-6	1
023847	ADAPTOR 1.1/4" BSP M/F SWIV 2B/20 210 BAR	1
023932	ELBOW 3/8"BSPT-3/8"BSP M/M FORGED 420BAR W.P	1
023978	INSERT FOR HOSE 1 1/4"BSP FEM 90 DEG SWIV MS A50051-20-20	1
023999	ADAPTOR M16 x 1.5 - 1/2" BSP M/M 1MB/16-8	2
031340	TEE 3/8"BSP MALE/FEMALE RUN MALE BRANCH ZINC	1
032459	SPACER SHAFT HYDRAULIC H/REEL MINI VANPACK	1
033005	ADAPTOR 3/8" BSP M x 3/8" BSP M 415 BAR	3
033006	ADAPTOR 1/2" BSP M x 3/8" BSP M 415 BAR ZN	5
033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448 BAR SELF CENTRALISING	27
033012	SEAL BONDED 1/4" BSP 400-821-4490-41 616 BAR SELF CENTRALISING	3
033013	SEAL BONDED 3/8" BSP 400-823-4490-41 492 BAR SELF CENTRALISING	10
033014	SEAL BONDED 3/4" BSP 400-827-4490-41 420 BAR SELF CENTRALISING REPLACES A041271	7
033015	SEAL BONDED 1.0" BSP 400-830-4490-41 312 BAR SELF CENTRALISING	3
033068	ADAPTOR BHEAD 1" BSPM x 1" BSPM 210 BAR C/W LOCNUT	1
033103	ADAPTOR 1"BSPM X 1"BSPM 210BAR (SAME AS N01-570)	1
035072	VALVE 1 1/4"BSP T PORT 375 PSI FIG 2000 S/R TYPE 98 ALBION	1

035185	UNLOADER VALVE UL221/200H G1/2" 50LPM 210BAR WITH HANDLE WHEEL	1
035235	VALVE BALL 3/8" BSP complete with STRAIGHT HANDLE 6000PSI min WP HANDLE PART NUMBER 035095	1
035401	VALVE SAFETY RELIEF (SRV) VS 310 HAWK 310 BAR @ 40LPM	1
037010	NIPPLE GREASE 1/8"BSP	1
038108	SPRING GUARD 24mm I/D	0.2
041034	STUDDING M10 ZINC PLATED [PER 1.5 METRE] c-txt	0.75
0422319	SUPPORT TANK FILL POINT VANPACKS (POWDER COAT)	1
0423179	CONTROL PANEL BOX 315 SERIES MK3 MURPHY	1
0423181	BRACKET UNLOADER VALVE 315 SERIES MK3	1
0423315	CONTROL PANEL 320 SERIES MURPHY (supersedes 042-3180)	1
0423316	CANOPY SUPPORT 320 SERIES (supersedes 042-2869)	1
0423336	HYDRAULIC MOUNTING PLATE 320 UNIT	1
0423337	320 COOLER PLATE	1
0423348	SWING ARM HOSE REEL TRACE 320 UNIT	1
0423413	320 UNIT FRAME EXHAUST STUB	1
0423436	D1105 FUEL FILTER BRACKET	1
0423513	ANTIFREEZE VALVE, REMOTE OIL AND FUEL BRACKET 320 DESILTER	1
0423563	ENGINE FOOT YANMAR 3TNV76	4
0423564	GUARD ENGINE PULLEYS YANMAR 3TNV76	1
0423566	PUMP SUPPORT 320 FOR YANMAR	1
0423567	BATTERY CRADLE - 320 SERIES YANMAR	1
042431	SUMP ADAPTOR M22 X 1.5 X 1/2"BSP M/M 415 BAR	1
043018	CAP HYD/FUEL TANK	3
043061	HOSE CLIP DIA 9.5-12 JCS HI-GRIP S/S	10
043074	VALVE 1"BSP SHUT OFF 200PSI TYPE 750 R751T	1
043186	ADAPTOR 1"BSPT-30MM UPVC HOSETAIL	1
043196	ELBOW 90 DEG. THREADED 1 1/4" BSPF UPVC	2
043203	PLUG BLANKING 1"BSPT GALVANISED IRON (do not use - now use 044029)	1
043222	INSERT HOSE 1 1/4"BSPM X 32 MM DIA HOSETAIL UPVC	5
043235	ADAPTOR FLANGED 1 1/4"BSPM X 1 1/4" BSPM UPVC	1
044563	320 SERIES FRAME YANMAR	1
047004	STEM OUTLET (INLET HOSE REEL)	2
048011	SPACER 10MM LG HOSE FEED GUIDE HYD REEL P TYPE	4
048016A	MOTOR HYDRAULIC DANFOSS OMR 315 (POWDER CAT) Black	1
048103	TUBE WATER OUTLET FOR HYDRAULIC HOSE REEL N15-142 AND 048-110	1
048106	INLET HOSEREEL PERPENDICULAR WALL MOUNT - RAPID REEL	1
048146	HOSE FEED GUIDE STOP 50mm	2
050065	EXHAUST FLEXIBLE TUBING 1MTR ST.ST 40MM O/D	1
050232	CABLE ADJUSTER 6MM 9180.191 SIMILAR TO A030205 LOMBARDINI FOCS	1
050295	OUTER CASING PER METRE CABLE-TEC	1.3
050296	WIRE 1.9MM PER METRE CABLE-TEC	1.52
050317	HEAT EXCHANGE - ENGINE COOLING VAN PACK - HIGH FLOW, CAST ENDS	1
050341	1105 STRAIGHT C51 MUFFLER KIT BLACK - 320 UNIT	1

050346	320 THERMOSTAT STUDDING M8	1
050350	THERMOSTAT OUTLET 1105D COOLER MODIFIED FOR ENGINE YANMAR 3TNV76, MADE FROM 050325	1
050353	BRACKET ELECTRICAL PISTON TYPE PE40-35GV12 071-901 FOR YANMAR 3TNV76	1
050354	SPACER O/D 19 X I/D 9 X 12 LONG FOR 050353	2
0511009	CABLE HOLDER END CHOKE HONDA GX690, C/W SREW & CIRCLIP	1
0511066	KUBOTA D1105 EXHAUST GASKET	1
052382	ENGINE YANMAR 3TNV76 -XCYI2D POWER PACK	1
054123	DIESEL 10W30 MOTOR OIL CF - SUPPLIED IN 20 LITRES DRUM	5
055024	HOSE 1/2" P.V.C. CLEAR BRAIDED [PER METRE] HDPVC12	5
055029	HOSE 1" HELIFLEX [PER METRE]	2.5
055058	HOSE ASSY 3/8" 02.46M STR/ELB 3/8" BSPF EN 853 2SN	1
055063	HOSE 1 1/4" HELIFLEX [PER METRE]	5.5
055070	HOSE ASSY 1/2" 01.37M STR/ELB 1/2" BSPF EN 853 2SN	1
0551023	HOSE ASSY DN10 3/8" PW2-06 0.395M CUT LG STR/ELB	1
0551068	HOSE ASSY 3/4" TRICOFLEX 25 METRES LONG	1
0551088	HOSE ASSY 1/2" BSP ELB/ELB @ 270 DEG 1.300m LG EN 853 2SN	1
0551093	HOSE ASSY 1/4" BSP COMP ELB/COMP ELB DIN 20022 2SN 0.700m LG	1
0551192	3/8" FUEL HOSE (PER METRE)	3
0551257	HOSE ASSY 1/2" BSP STR/ELB 2WB MILD STEEL 0.5M LG 415 BAR WP	1
0551283	HOSE ASSY 1/4" STR/COM ELB 670 LG 415 BAR WP	1
0551583	HOSE ASSY 1/2" BSPF ELB/STR 1.15M LG 415 BAR WP.	1
0551592	HOSE ASSY 1/4" BSPF ELB/STR 550MM LONG 415 BAR	1
0551597	HOSE ASSY 3/8" BSPF ELB/ELB	2
0551602	HOSE ASSY 3/8" BSPF ELB/STR	1
0551604	HOSE ASSY 3/8" BSPF STR/STR	1
0551618	FUEL HOSE 1/8" – TBSE 300	1
0551621	HOSE ASSY 1/2" BSPF ELB/ELB 210 BAR WP 470mm LG 270 DEG	1
0551622	HOSE ASSY 3/8" BSPF 2WB ELB/ELB 0.86M LONG (Spool Valve to Hyd Motor)	1
0551650	HOSE ASSY 1/2" BSP ELB/ELB 1.50M LONG 90DEG 415 BAR WP (SELECTOR TO H/REEL)	1
0551651	HOSE ASSY 1/2" BSP ELB/ELB 1.50M LONG 270DEG 415 BAR WP (PUMP TO SELECTOR)	1
0551679	HOSE ASSY 3/8" BSP ELB/STR 0.95m LONG 140 BAR WP. SPOOL TO RAM	2
0551801	1" RED HOSE Autosiliconehoses.com	1
0551802	1" BLUE HOSE Autosiliconehoses.com	1
0551817	1" BLUE U BEND 180DEG HOSE	1
055985	HOSE ASSY DN10 3/8" 1.05M STR/ELB EN 853 2SN	1
058298	PIPEWORK HOSE JOINER 1" x 1" x 3/8" STEEL PLATED	1
058307	1" O/D 90° 304 1.5D LONG BEND 1.6 THK HYGIENIC TO BS4825-2	2
059115	FRONT PANEL GRP MOULDED 320 SERIES (supersedes 058-287)	1
061030	SPACER D.T & D.T.T. FUEL TANK	3
0611000	LABEL 10mm x 30mm SERIAL NUMBER	2
061434	LABEL "E-STOP" SELF ADHESIVE	1

061829	STATUTORY LABEL PLATE TRAILER	1
061851	LABEL 'BRITISH INDUSTRY'	1
061864	LABEL WARNING DO NOT RUN PUMP DRY, SEE SECTION 5 OF MANUAL	1
061871	KEY RING FLOWPLANT	1
061880	PEEL AWAY SAFETY STICKER	1
061886	USB MANUALS	1
061899	DTB DESILTER SERVICE INTERVALS/FROST WARNING	1
061951	LABEL SET 320 SERIES	1
067853	GEARBOX 2.176:1 SPECK NP25	1
069581	KIT HYDRAULIC DIVERT VALVE INSTALLATION - Mk2	1
069596	HYDRAULIC PUMP 3.5CC/REV GROUP 1 - TO SUIT YANMAR 3TNV	1
071026	LEAD BATTERY 1070mm POSITIVE 12v	1
0711023	4.8MM SADDLE TYPE CABLE TIE MOUNT RS PT NO. 666-717	1
0711024	8MM SADDLE TYPE CABLE TIE MOUNT RS PT NO. 666-739	22
0711040	PVC CABLE GROMMET 9MM MAX. CABLE, 15MM HOLE DIAM.	1
0711135	CABLE GLAND M16 5-10mm IP68 BLACK	1
0711240	TELERADIO RADIO CONTROL SYSTEM CANOPEN - TRANSMITTER AND RECIEVER	1
0711242	PRESSURE TRANSMITTER 0-300 BAR 4-20mA	1
0711340	12V CIGARETTE LIGHTER OUTLET PIXNOR UNIVERSAL WATERPROOF WITH CAP PANEL MOUNT	1
0711345	HEAT SHRINK 1.5M LONG 32MM/8MM SHRUNK	1
0711355	BATTERY 063 V SILVER - C30	1
0711382	CONTROL PANEL MURPHY MPC-20 CUSTOM FRONT	1
0711383	WIRING LOOM CONTROL PANEL MPC-20 SINGLE 21 PIN CONNECTOR	1
0711387	SIREN / SOUNDER 8-35V DC	1
0711390	GASKET FOR MPC-20 CONTROLLER	1
0711392	MAGNETIC PICK UP 68MP0060 M16x1.5	1
0711395	WIRING HARNESS 320 TELERADIO	1
0711408	ROCKER SWITCH ON/OFF BLACK 21A @ 14V SPST IP56 LATCHING	1
0711452	LEAD BATTERY 1050mm NEGATIVE 12V	1
0711513	TEMPORARY RELAY KIT TELERADIO POWER 320 SERIES	1
071261	SHRINK SLEEVING BORE 19.0 TO 9.5 SHRINK	1.15
071367	E STOP TWIST TO RELEASE including NC ACTUATOR 78-3724 78-3732	1
071653	BATTERY CABLE BLACK 16MM SQ TYPE BK RS 516-8016	1.3
071786	RELAY 12V 120AMP RP/120-12	1
071886	FLOAT SWITCH HORIZONTAL POLYPROPYLENE 1/2" NPT 397-0564 (HOTSHOT 200 FUEL TANK)	1
071901	ELECTRICAL PISTON TYPE PE40-35GV12	1
071902	ELECTRICAL UNIT CONTROL TYPE S.FCESY7V12	1
073069	HEAT SHRINKABLE SLEEVING 9.5MM BORE (RS398-177)	0.2
0781075	CABLE END - MODIFIED FROM 0511009 - TO SUIT YANMAR	1
0781188	STUB DRIVE SHAFT 1 1/8" KEYED LOW PROFILE	1
0781189	HOLDER FOR MAGNETIC PICK UP 68MP0060 M16x1.5 (0711392) YANMAR 3TNV76	1
0781190	DRIVE PLATE FOR SAE 7.1/2" FLYWHEEL LOW PROFILE	1

0781191	ADAPTOR PLATE SAE5 TO GEARBOX 067580 MAKE FROM 078-621	1
0781194	MODIFICATION TO FLUID HEAD NP25 50-210 SPECK FOR JUMP JET	1
078393	CABLE GRIP HOLDER TO CLEVIS/THROTTLE, USE WITH A030206	1
078417	EXTENDED HEX NUT M8	1
079261	EXHAUST FLANGE STUB KUBOTA D1105	1
079284	EXHAUST OUTLET FLANGED 90 DEGREE - YANMAR 3TNV76	1
085344	TANK HYDRAULIC PLASTIC 315 SERIES MK2 (BEHIND H/REEL MOUNT)	1
085389	TANK FUEL PLASTIC 320 SERIES MK1	1
085396	EXPANSION TANK 320 COOLING SYSTEM	1
085397	400L WATER TANK 320	1
085406	320 SERIES ANTIFREEZE TANK	1
094103	Elbow 45 deg Male Female 1" BSPT x malleable iron galvanised	1
118131	DRIP TRAY 320 UNIT	1
A0101371	FITTING ADAPTOR 1" BSP 1" BSP MPC/FPC SWIVEL	1
A010143	ADAPTOR 3/8" BSP SWIVEL TO 3/8" BSP SWIVEL 415 BAR WP	1
A0300321	FASTENER EXHAUST CLAMP 1.5/8	2
A030206	CABLE GRIP & SCREW, USE WITH 078393	1
A160500	PLUG 2" BSPT GALV REF 147	2
A180430	ROD STRAP RETAINER WATER TANK	4
A190821	STRAP ASSEMBLY RATCHET TYPE. 25MM WIDE NYLON	2
N00862	SCREW GRUB M6 x 10 LG	2
N00864	M10x10 GRUB SCREW	2
N01280	ELBOW 1" BSP MXF MALLEABLE GALV	2
N01282	ELBOW 1 1/4 BSP MXF MALLEABLE GALV	2
N01456	3/8"BSPF SWIVEL X 3/8"BSPM 90DEG COMPACT ELBOW 415 BAR	2
N01472	ELBOW 90DEG COMPACT 3/8 BSPF x 3/8 BSPF ZN	1
N01492	ADAPTOR 1/2" BSPM x 1/2" BSPTM 415 BAR WP	2
N01496	ELBOW 1/2-1/2 BSP Mx F 90 COMPACT FORGED 415BAR	2
N01518	INSERT 1/2"BSP F 90 DEG COMPACT (PUSH IN) ZINC 415 BAR	6
N01794	BEARING PLUMMER BLOCK HOUSING 1" C/W GREASE NIPPLE (POWDER COAT)	1
N01799	BEARING NEEDLE BUSH	1
N01965	1/4 BSPF S/STEEL CHECK VALVE C25P/9K	1
N02230	ADAPTOR 1/2" BSPM X 1/8" BSPM ZN	1
N05085	HANDLE GRIP PLASTIC	1
N05105	LINE STRAINER 1 1/4" (HYPRO)	1
N05114	SIGHT GLASS 10"	2
N05116	SIGHT LEVEL GAUGE 5116/7	1
N05270	BATTERY CABLE RED 16MM SQ TYPE BK RS516-8038	1.9
N05798	HYDRAULIC FILTER (U.C.C. MX1518.102) RETURN FILTER	1
N10001	BATTERY RETAINING BRACKET	1
N15142	HYD HOSEREEL (POWDER COAT)	1
N15190	ADJUSTING SPACER CONVEX (POWDER COAT)	2
N20836A	BEARING HOUSING HYD HOSE REEL (POWDER COAT)	1

N20838	HOSE REEL SHAFT (FLUID END)	1
N20839	HOSE REEL SHAFT ZINC PLATED	1
N20843	TRACE ROLLER	5

10.5. Hydraulic Divertor Valve Assembly

10.5.1. Recommended Tools

054041	GREASE ESA 100
069186	LUBRICATING METAL PASTE
054003	OIL SHELL TELLUS 150
033275	DRIFT VALVE SPINDLE

10.5.2. Service Kits

024047	KIT SEAL CENTURY TRIGGER ASSY	
013345	O RING BS019/90	4
015062	GLYD RING SEAL	2
015063	STEPSEAL	2
033279	OVERHAUL KIT CENTURY TRIGGER ASSY	
013345	O RING BS019/90	4
015062	GLYD RING SEAL	2
015063	STEPSEAL	2
033293	CENTRE COLLAR	1
033264	SCRAPER	1
033294	END COLLAR	2
033295	GLAND	2
033296	SPINDLE	1
033275	DRIFT VALVE SPINDLE	1

Before attempting to overhaul the diverter valve, the machine must be switched off and all hoses and adaptors to the selector disconnected.

10.5.3. To Dismantle

1. Unscrew the four M8 bolts (4) and remove cylinder (3) (DRG 026-111).
2. Unscrew the three M8 cap head screws (17) (DRG 035-255) and remove the adaptor (2) (DRG 026-111) from the water valve body (18) (DRG 035-255)
3. Remove the spring cap (8) from water valve body (18) (DRG 035-255)
4. TO DISMANTLE THE SPRING PACK: Using a vice fitted with soft jaws and small dia bar, approx 5mm, compress the spring mount (6) and disc springs (1) into the cap (8) and remove circlip (2) (DRG 035-255)
5. Place drift 033275 over spindle (12), tap end of drift gently and remove internal water valve parts. Keeping all parts in order, separate out the spindle stack and remove seals (4), (3) & (15) and scraper (7) (DRG 035-255).

10.5.4. To Assemble

1. Check all parts for burrs, swarf, and damage, then clean thoroughly and lay components out on a clean area.
2. Gently ease both step seals (4) into glands (11) making sure step of inner seal faces pressure (DRG 035-255)
3. Gently ease both Glyd rings (3) into end collars (10) making sure stepped side of inner seal is visible when fitted (DRG 035-255)
4. Fit centre collar (9) between the two end collars (10). This may be a slide, or a light press fit into the collars (DRG 035-255)
5. Holding glands (11) against end collars (10) with step seals facing end collar, gently push lightly oil spindle (12) right the way through internal bore of stack until spindle (12) stops up against face of gland (11) (DRG 035-255)
6. Fit four O-rings (15) to items (10) and (11) (DRG 035-255)
7. Slide scraper (7) over end of spindle (12) (DRG 035-255)
8. Lightly grease O-rings (15), and gently push the complete spindle stack into the water valve body (18). It may be necessary using a Delrin rod to gently tap, evenly and squarely, the spindle stack into the body (18) (DRG 035-255)
9. Stack disc springs (1) onto the spring mount (6) as shown on the (dwg 035-255) and grease the complete stack.
10. Fit the greased spring stack into cap (8) and using a vice fitted with soft jaws and a small diameter bar, approx. 5mm, compress the spring mount (6) and disc springs (1) into the cap (8) bore enough to enable the circlip (2) to be fitted in groove on the wall

- of cap (8). Then pressure can be gently released and spring mount (6) will stop against circlip (2)(DRG 035-255)
11. Apply metal paste to threads of cap (8) and screw into body (18) and torque to 41Nm (DRG 035-255)
 12. Locate the adaptor cylinder (2) (DRG 026-111) onto the water valve body (18) DRG 035-255/3 and secure with the three M8 socket button headset screws (17) (DRG 035-255)
 13. Replace screw set & washer (5&6) (DRG 026-111)
 14. Replace cylinder (3) and the four M8 cap screws (4) (DRG 026-111)

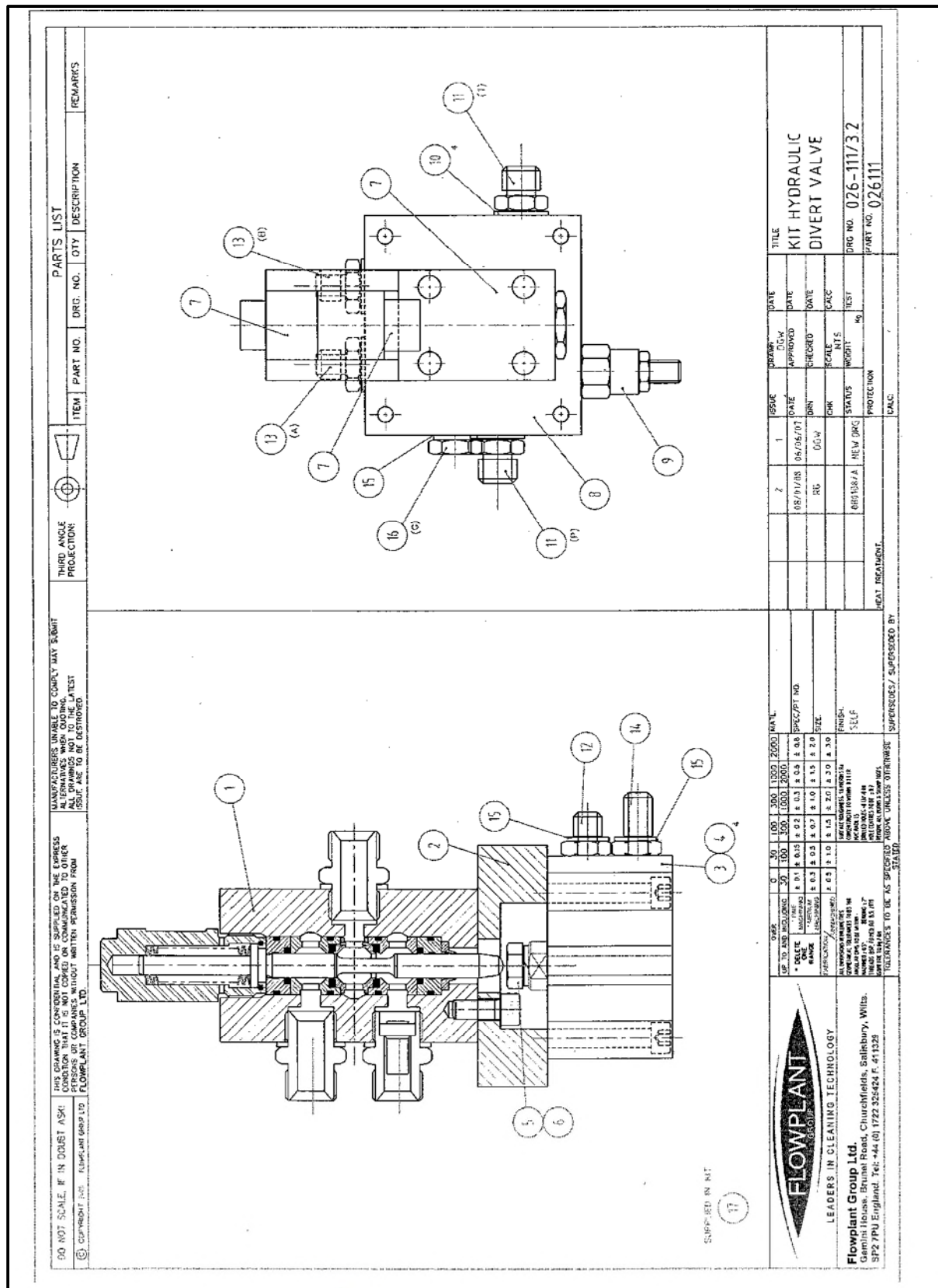
Diverter Valve Hydraulic Actuation – 035255

Component	Description	Qty
014076	DISC SPRING S168206 Stainless Steel	45
014106	CIRCLIP 1700 METRIC X 18 ANDERTON	1
015062	GLYD RING SEAL SHAMBAN S-50992-5907-010	2
015063	STEPSEAL (SHAMBAN) (S-55015-0100-80)	2
032472	CHOKE MKII SOLINOID VALVE	1
033263	SPRING MOUNT BODY ASSY CENTURY GUN	1
033264	SCRAPER BODY ASSY CENTURY GUN	1
033268	CAP BODY CENTURY GUN	1
033293	CENTRE COLLAR BODY ASSY CENTURY GUN MODIFIED	1
033294	END COLLAR BODY ASSY CENTURY GUN MODIFIED	2
033295	GLAND BODY ASSY CENTURY GUN MODIFIED	2
033296	SPINDLE CENTURY GUN MODIFIED	1
033306	HOLDER FOR CHOKE	1
013039	ADAPTOR 1/2" BSP M x 1/2" BSP M 415 BAR	2
013345	O RING BS019/90	4
033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448 BAR	3
A040814	SCREW CAPSCREW M8 X 20MM LONG SOCKET HD	3
078200	BODY WATER DIVERTER VALVE AIR OPERATED	1

Flowplant Limited, Gemini House, Brunel Road, Churchfields Industrial Estate, Salisbury, Wiltshire SP2 7PU
Tel: +44 (0)1722 325 424, Fax: +44 (0)1722 411 329, sales@flowplant.co.uk, www.flowplant.co.uk


Kit Hydraulic Divert Valve Installation – 069581

Component	Description	Qty
013014	ADAPTOR 1/4" BSP M x 1/4" BSP M 415 BAR	1
013038	ADAPTOR 3/8" BSP x 1/4" BSP M/M 415BAR	2
013094	WASHER S/COIL SQR.SECTION M10 SPRING STEEL ZN	1
013211	ADAPTOR BHEAD 1/4" BSPM x 1/4" BSPM 415 BAR C/W LNUT	1
013246	SCREW SET HEX HD M10-1.5 6G 20 LG HT 8.8 ZN	1
013500	BOLT SOCKET CAP HD M8-1.25 6G 60mm LG 8.8 Zn	4
033005	ADAPTOR 3/8" BSP M x 3/8" BSP M 415 BAR	5
033012	SEAL BONDED 1/4" BSP 400-821-4490-41 616 BAR SELF CENTRALISING	2
033013	SEAL BONDED 3/8" BSP 400-823-4490-41 492 BAR SELF CENTRALISING	5
035255	DIVERTER VALVE HYDRAULIC ACTUATION 6000PSI	1
0423300	MOUNTING BRACKET DIVERTER CETOP ASSEMBLY	1
069400	SOLENOID VALVE 4/2 HYD 12VDC CETOP 3 C/W PLUG	1
069582	CETOP SUB PLATE - 3/8" BSP	1
069583	PRESSURE RELIEF VALVE 3/8" WITH BODY 90 DEGREE 10-50 BAR	1
069584	MODULAR REDUCING VALVE CETOP CONNECTION 3/8" - 3-35BAR (P LINE)	1
A014038	FITTING BLANKING CAP 3/8" BSP FEM SWIVEL	1
A030784	CYLINDER/COMPACT/63 DIA/10 STROKE/SINGLE ROD/PNEU	1



11. Service Documents

11.1. Service Checklist


SERVICE CHECK LIST											
Serial Number -										<i>Sht 1 of 2</i>	
Unit Number -											
Date -											
Hours Run -											
										Engine -	
										ESR -	
I - Intermediate service				Y - Yearly service				R - Customer request			
Engine				Hydraulics				Water tank			
	I	Y	R		I	Y	R		I	Y	R
1				34				63			
2				35				64			
3				36				65			
4				37				66			
5				38				67			
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NA - Not applicable, A - Adjusted, ✓ - Satisfactory, R - Repair required, O - Observation

Note - If 'Adjusted' or 'Repair required' please describe issue on sht 2

FLOW 0321 Iss 3

11.2. Service Logbook

Flowplant Unit Log Book		
Serial Number -		
Unit Number -		
Date of Manufacture -		
		<i>Sht 1 of 2</i>
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>
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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		<i>FLOW 0322 Iss 1</i>

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>
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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
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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

13. Health and Safety Manual – 061956

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.

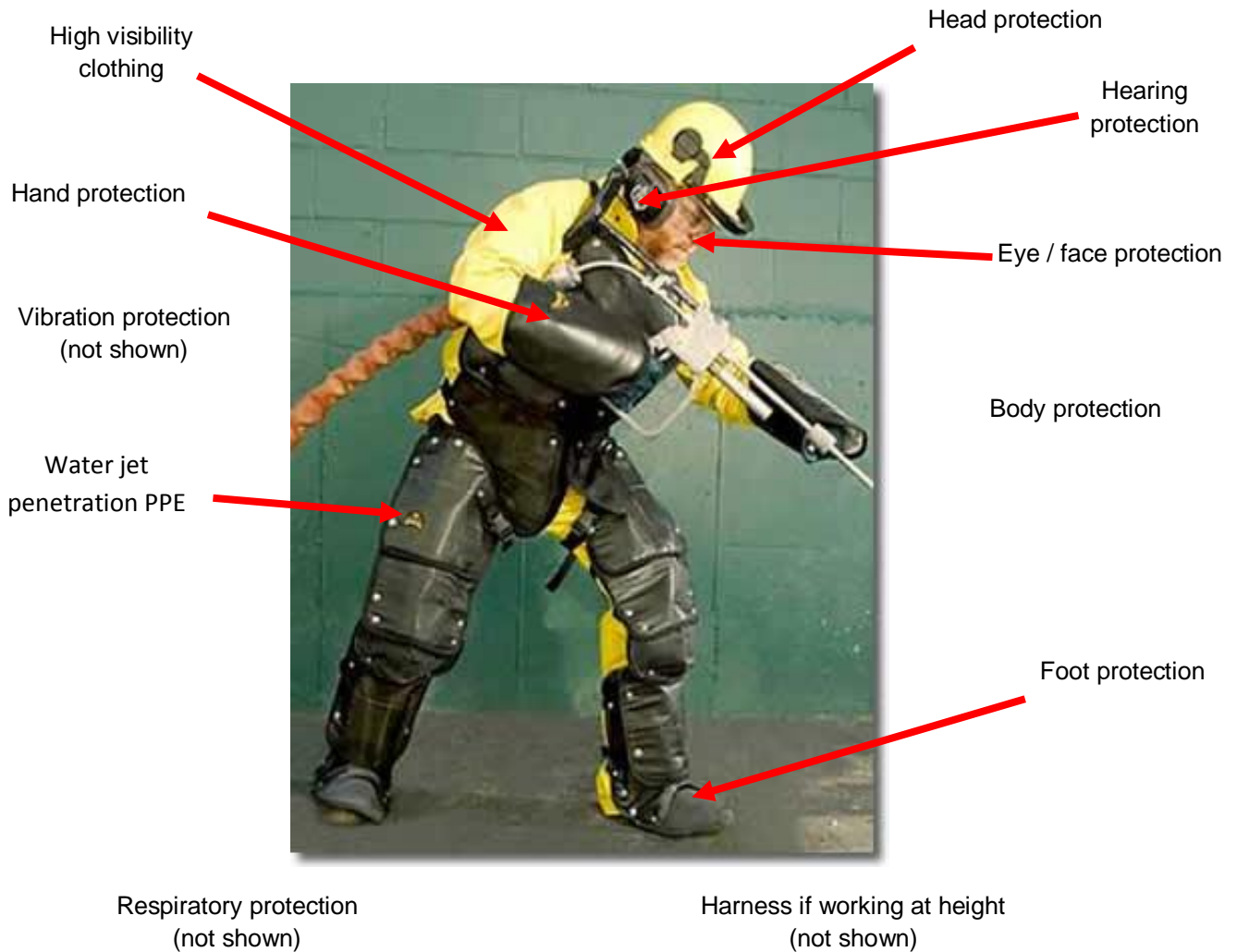
4. Personal Protective Equipment

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 1/3rd 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.