PRODUCT DATA SHEET

BFCV50E and BFCV50ES

Banlaw FillSafe™

FillSafe Zero 2" NPT FxM Flow Control Valves (External Pilot Line)

Thank you for purchasing this high quality Banlaw product. Please read through and understand the information in this Product Data Sheet (PDS) BEFORE installation or operation to avoid accidental personal injury or property damage.

Figure 1 - BFCV50E Flow Control Valve

1 PRODUCT DESCRIPTION

The range of patented and patents pending [#] **Banlaw FillSafe™** ***Zero*** overfill protection (OFP) systems is designed for the safe and reliable refuelling/refilling of diesel fuel tanks, commonly used in the mining, rail, port, construction and other off-road industries. The system comprises two (2) major assemblies;

- Banlaw Flow Control Valve (e.g. BFCV50E or BFCV50ES).
- Banlaw Level Sensor (e.g. BLS or BVLS series);
    - Refer applicable documentation (e.g. PSG, PDS) for information on the range of FillSafe Zero Level Sensors.

[#] This product and aspects of the Banlaw FillSafe Zero system are protected by patents and patents pending. Please refer to www.banlaw.com for details.

CAUTION	
	***The content of this document is <u>not</u> meant to override or substitute any applicable Statutory, Regulatory, Customer/Site, etc. Health Safety & Environment (HS&E) requirements.***
	All works should only be performed by trained, qualified and competent personnel who are aware of the hazards associated with the constituent components of this installation in addition to the system as a whole. Failure to comply with these practices may result in death, serious bodily injury, loss of equipment and environmental damage.
	A risk assessment (job hazard analysis - JHA) should be conducted PRIOR to the start of any works or actions within this document. Whilst every effort has been made to ensure the execution of this document represents no HS&E hazard of high risk, Banlaw takes neither responsibility nor liability for the consequences and damages that may occur in the execution of works within this document.
	Persons conducting or otherwise involved with the execution of the works within this document and project have an obligation to ensure that all HS&E requirements are known and understood, and subsequently followed at all times.

The important features of the BFCV50ES Flow Control Valve are illustrated in Figure 2 (Piston shown in closed/forward position).

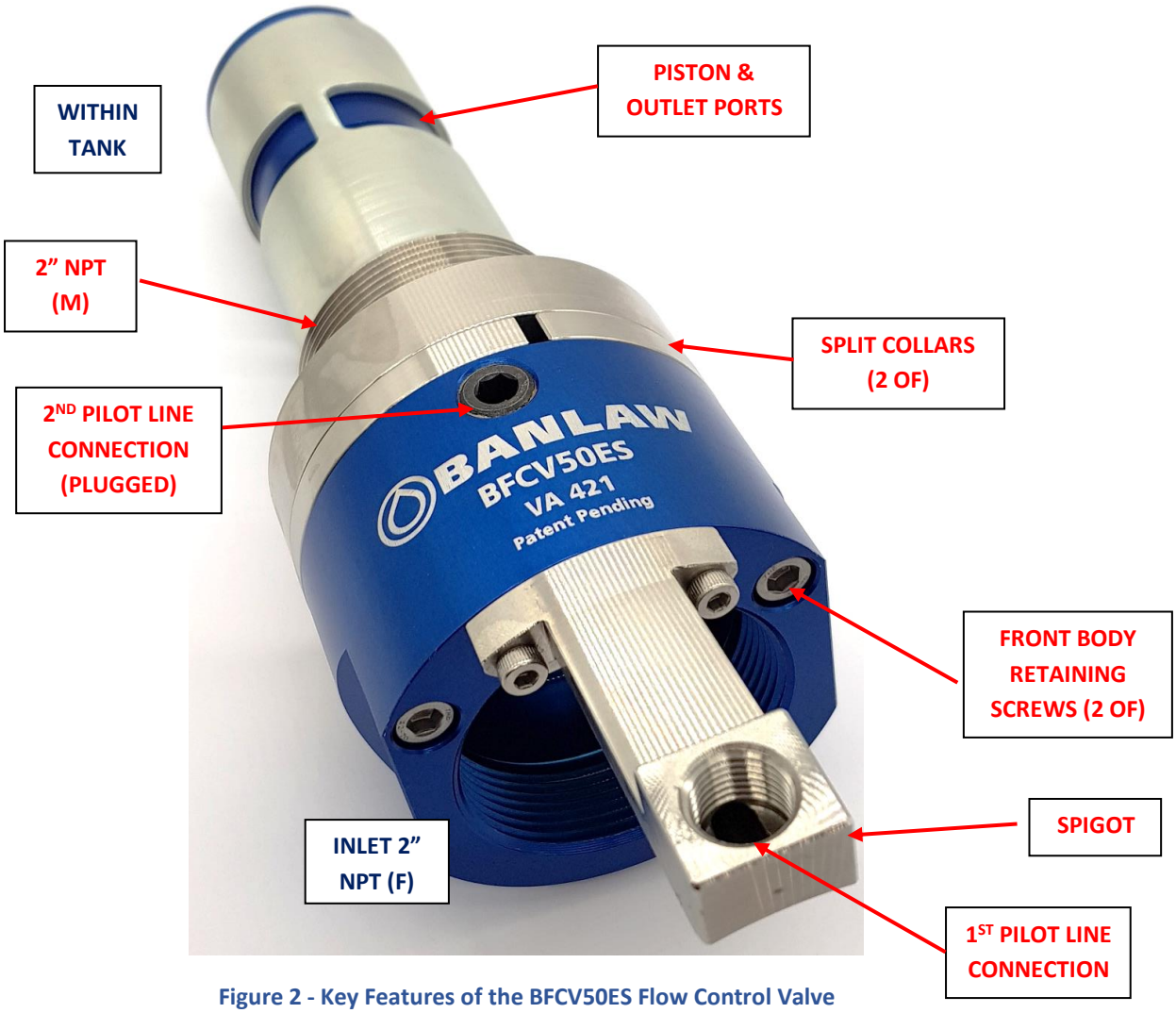

Figure 2 - Key Features of the BFCV50ES Flow Control Valve

The BFCV50E Valve does not incorporate the Spigot, but instead a blanking plate – refer Figure 3.

Figure 3 - BFCV50E Valve

The Part Number and (unique) serial code for each Valve is marked as per Figure 3.

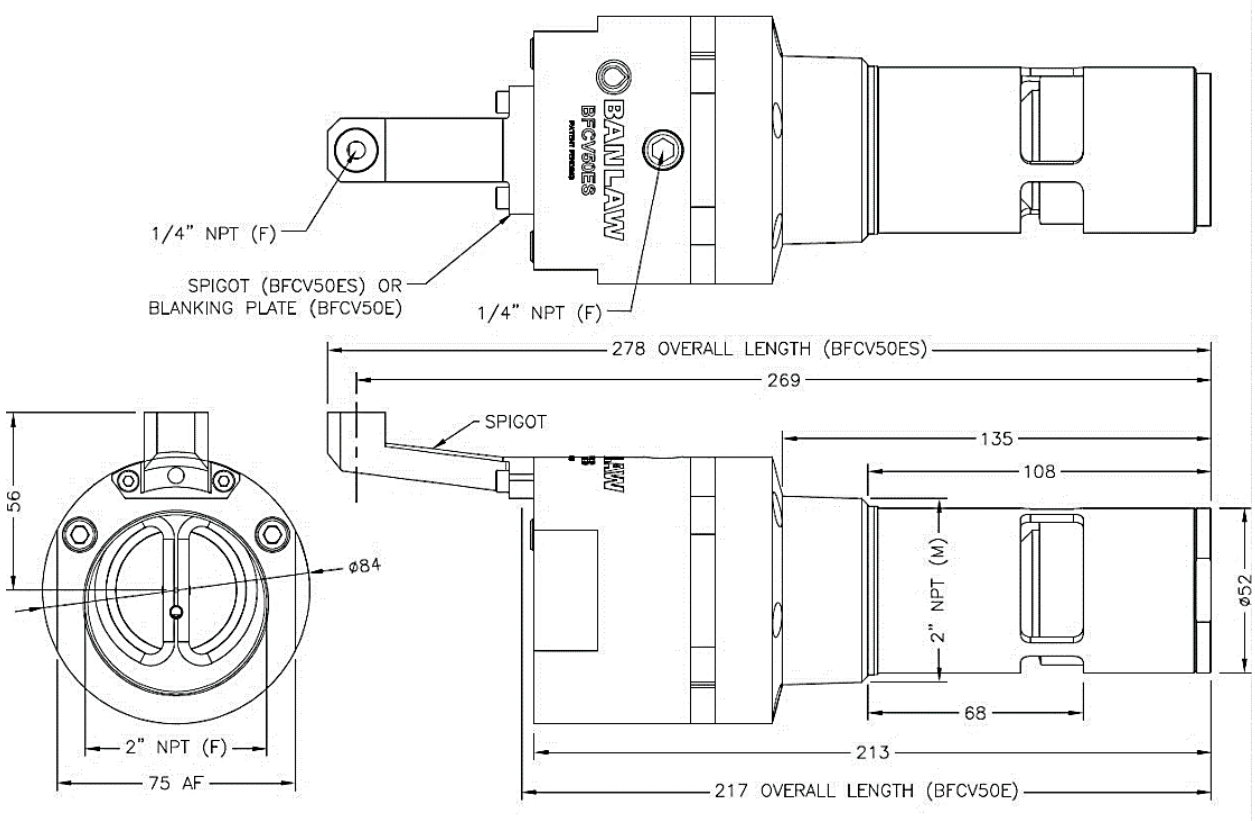

Figure 4 - Overall Dimensions of BFCV50E and BFCV50ES Valves

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The BFCV50E and BFCV50ES Valves incorporate one independent means of diesel flow control;

- Flow Control Valve Piston (rear of Valve assembly);
  - Open and closed status actuated by fuel flow (pressure).
  - Piston forced into the closed position upon actuation of the Level Sensor used in conjunction with the Valve assembly (specifically closure of the fuel trickle flow from the Valve to the Level Sensor via the Pilot Line).
  - The Flow Control Valve is *not* designed nor intended to act as a non-return (check) valve to prevent the discharge of fuel from the tank via the Receiver.

2 KEY FEATURES AND BASIC OPERATION

Key advantages of the Banlaw FillSafe Zero BFCV50E and BFCV50ES Flow Control Valves;

- The internal flow path through the Flow Control Valve assembly has been optimised to provide **lower resistance to fuel flow**, **increased flow efficiency**, and **reduced incidence of premature shut-off** of a pressure sensitive (auto shut-off) dry-break diesel refuelling nozzle.
- Achieves a higher (diesel) flowrate capability when compared with some competitor OFP valves.
- Only a single fuel pilot (signal) line is required to connect the FillSafe Zero Flow Control Valve and Level Sensor assemblies.
- The 2" NPT-F inlet suits either;
  - A Banlaw 23 series 2" NPT (M) Receiver, *or* equivalent industry standard Receiver;
    - Banlaw "standard" (Non-FuelTrack) Receivers e.g. BRM23K series.
    - Banlaw FuelTrack™ (auto ID) Receivers, e.g. BFT23KS series.
  - A 2" NPT (M) threaded fitting connecting the Valve inlet to a remotely mounted Receiver or other diesel tank refuelling/refilling fluid coupler.
  - A Banlaw proprietary 43 series 2" NPT (M) Receiver, *provided* the maximum flowrate capability of the Valve is not exceeded – refer section 4.
- The BFCV50ES Valve is designed to fit within a Banlaw Receiver Shell (e.g. AUS24A007), a Wiggins Receiver Shell (e.g. ZN4-20-025), and other equivalent Shells. The Spigot mounted to the front of the Valve allows connection of an external Pilot Line leading to the Level Sensor.
- The front section of the Valve can be rotated after the Valve is installed to allow the Pilot Line Port to be oriented (positioned) in 1 of 4 locations to better facilitate connection to the External Pilot Line.

Figure 5 illustrates an example of a FillSafe Zero system incorporating a **BFCV50ES** Flow Control Valve installed within a Shell, connected to a Banlaw BVLS model Level Sensor via an External Pilot Line. The tank is being refilled in this illustration;

- **Level Sensor;** Pilot Line passage open, and BVLS venting air from the tank to atmosphere.
- **Flow Control Valve;** open, allowing fuel to enter the tank.
- **Dry-break Diesel Refuelling Nozzle;** securely connected and in the **ON** (open) position.

The Banlaw BVLS series "venting" Level Sensors incorporate features *not* illustrated nor covered within this document. For detailed information on the BVLS series - and other Banlaw products – please refer to Banlaw product specific literature, e.g. BVLS series Product Specification Guides (PSG's) and Product Data Sheets (PDS's).

Figure 6 is similar to Figure 5 with the exception that the Receiver is now installed *remotely* from the Valve inlet.

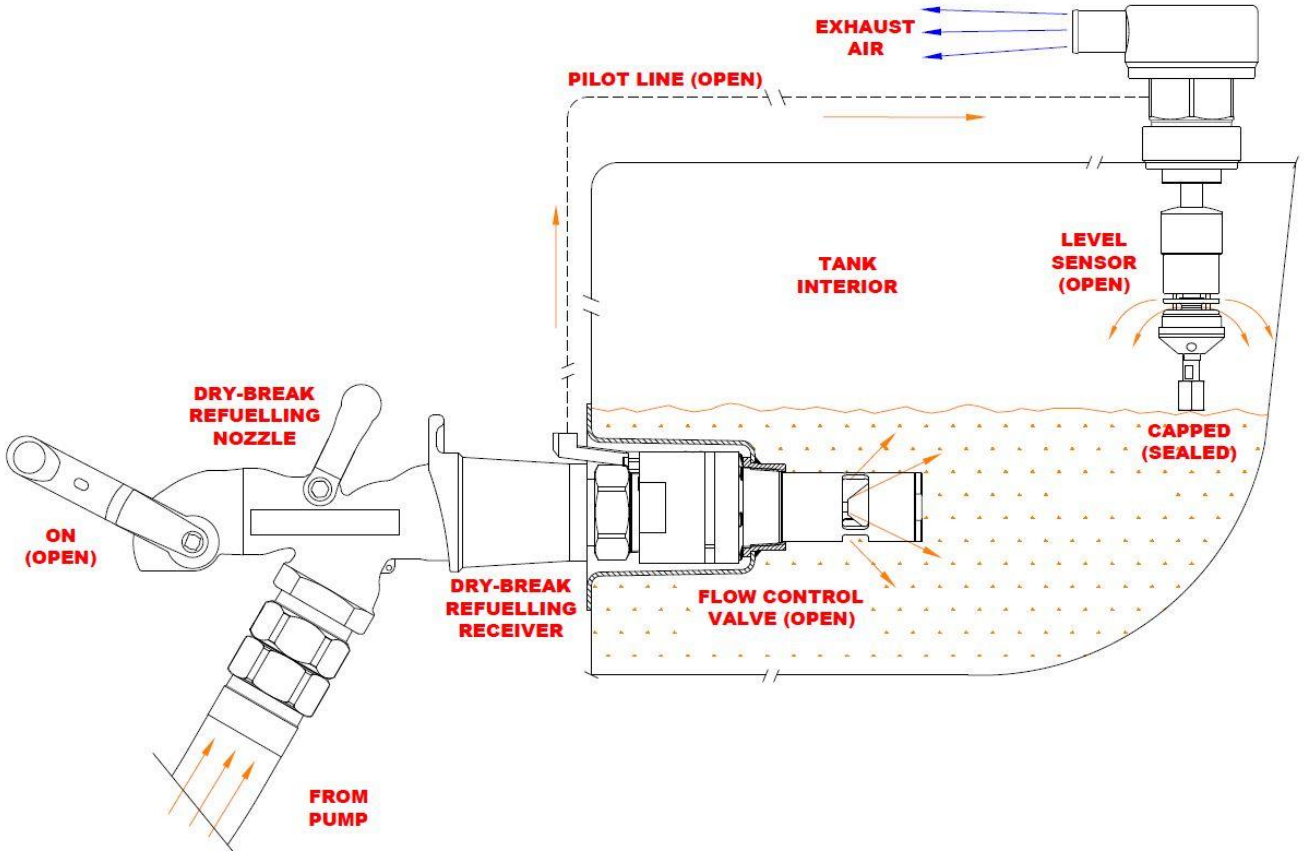

Figure 5 - Example of BFCV50ES Installation within a Shell with Receiver Directly Attached

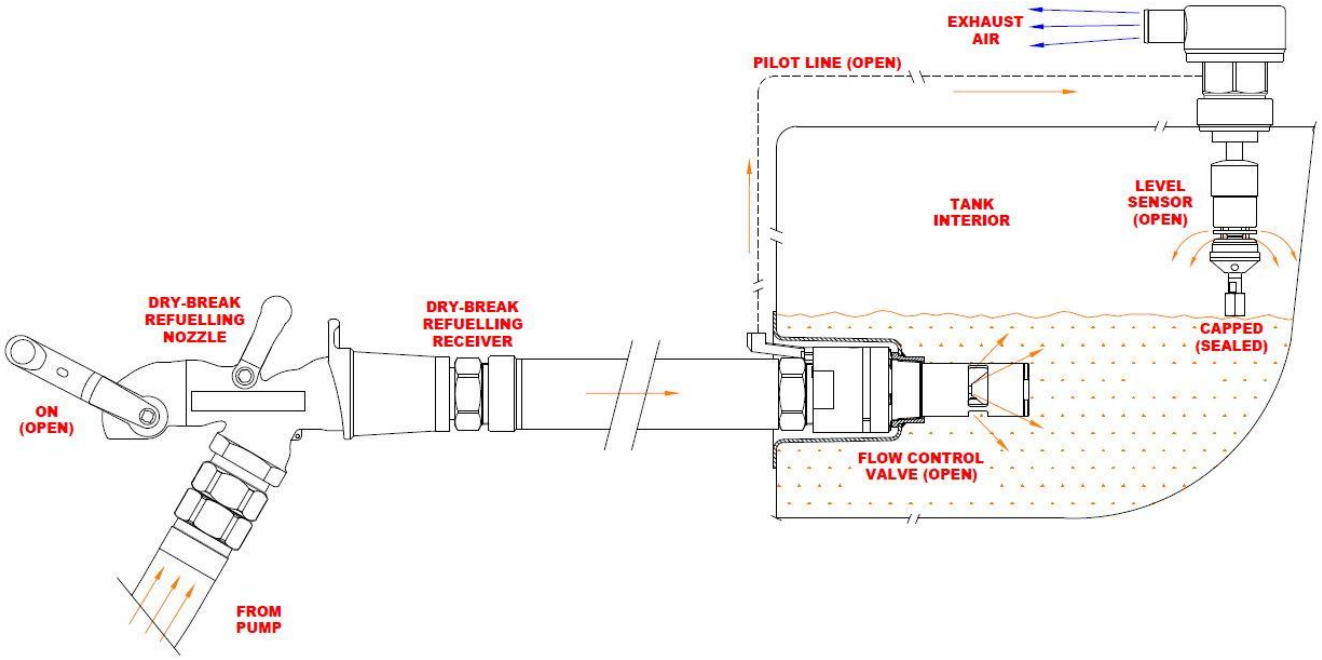

Figure 6 - Example of BFCV50ES Installation within a Shell with Receiver Remotely Located

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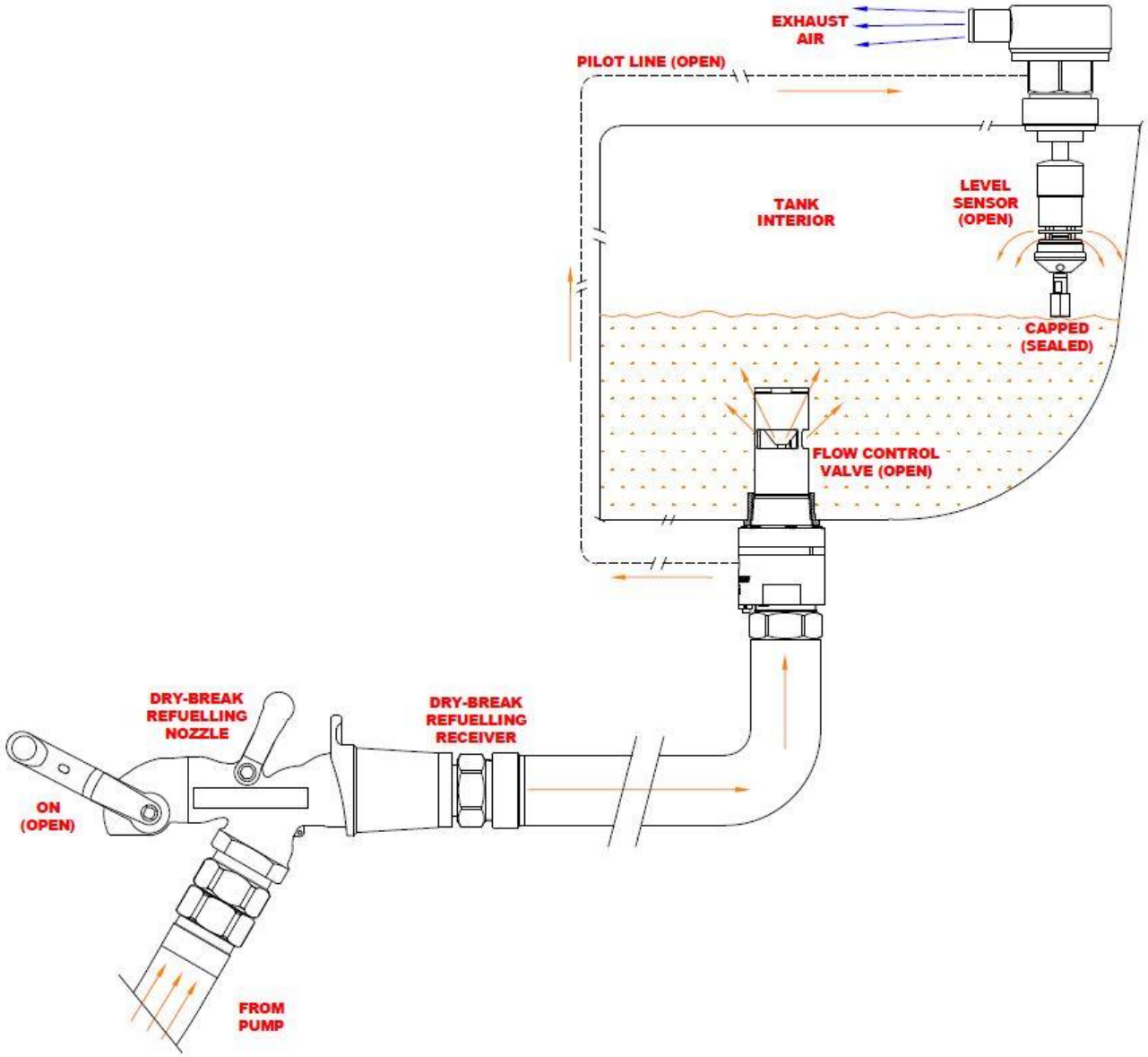

Figure 7 - Example of BFCV50E Installation with Receiver Remotely Located

Figure 7 illustrates an example of a FillSafe Zero system incorporating the **BFCV50E** Valve installed into the bottom entry of a tank – such applications include Dozers. The BFCV50E does not incorporate the front Spigot, so the External Pilot Line connection is now on the main Body of the Valve – refer Figure 2.

Figure 8 now illustrates this same system once the tank has been ***filled*** to the nominated capacity;

- **Level Sensor;** Pilot Line passage closed.
- **Flow Control Valve;** closed, prohibiting fuel entering the tank.
- **Dry-break Diesel Refuelling Nozzle;** in the **OFF** (closed) position, awaiting disconnection.

The degree (height) of tank ***ullage*** can be varied by installing a Level Sensor of a different length, whether a Banlaw BVLS “venting” series or a BLS “non-venting” series Level Sensor. Please refer to separate Banlaw documentation for the details of Level Sensor lengths – and ullages – available.

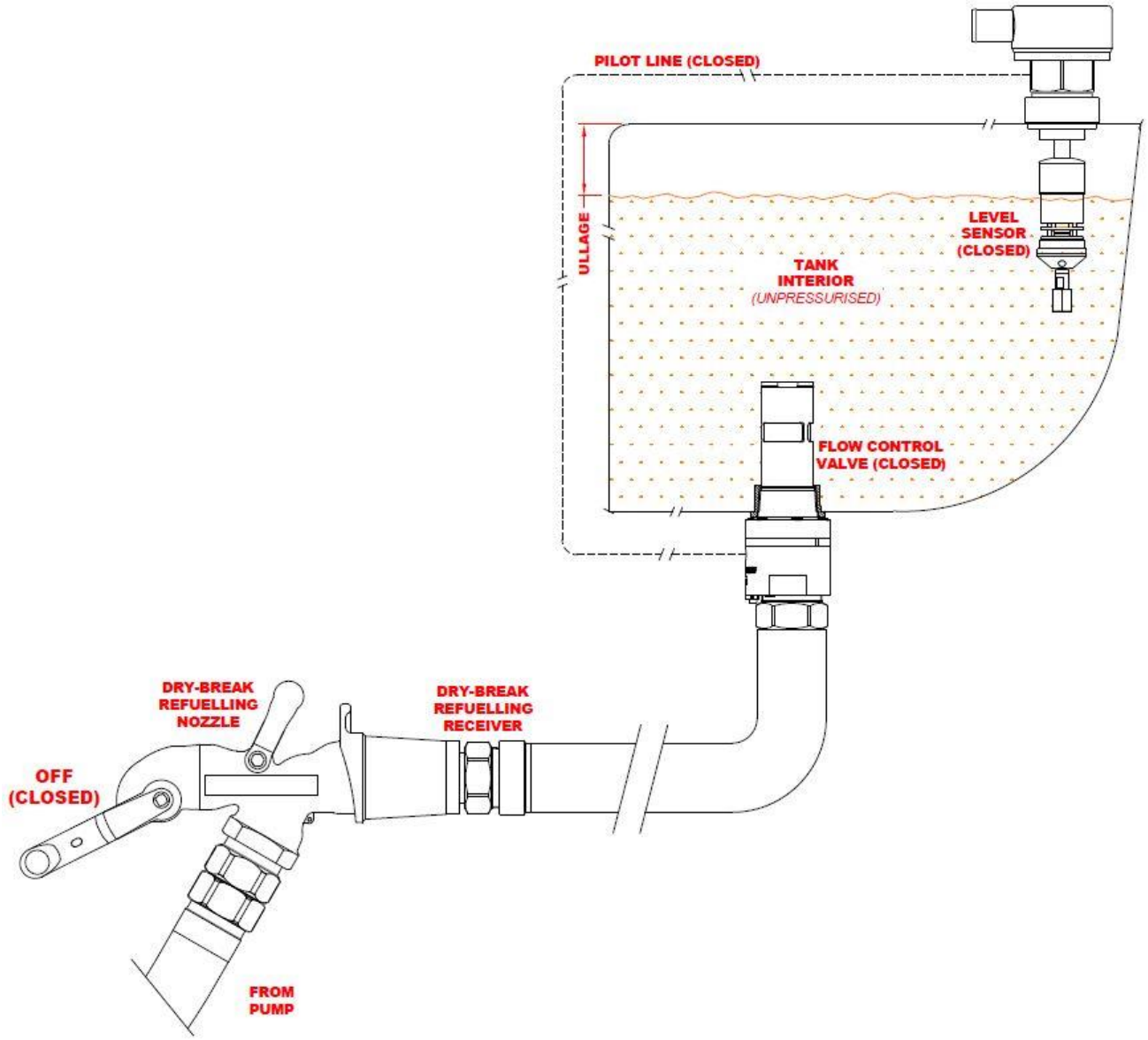

Figure 8 - Example of FillSafe Zero Install - Tank Full

Figure 9 shows a BFCV50ES Valve installed within a Banlaw Receiver Shell (e.g. AUS24A007). This Valve can be installed in all Shells of the same basic design when mounted ***directly*** to a fuel tank.

Figure 9 - BFCV50ES Installed in Receiver Shell (Banlaw Shell shown)

The **BFCV50E** Valve *cannot* be installed within a Shell, as the absence of the front Spigot prohibits access to a Pilot Line port.

Figure 10 illustrates an example of a FillSafe Zero BVLS series ***"Venting"*** Level Sensor compatible with the BFCV50E and BFCV50ES Flow Control Valves. A Flow Control Valve is connected to a BVLS series Level Sensor via the Pilot Line routed ***external*** to the tank.

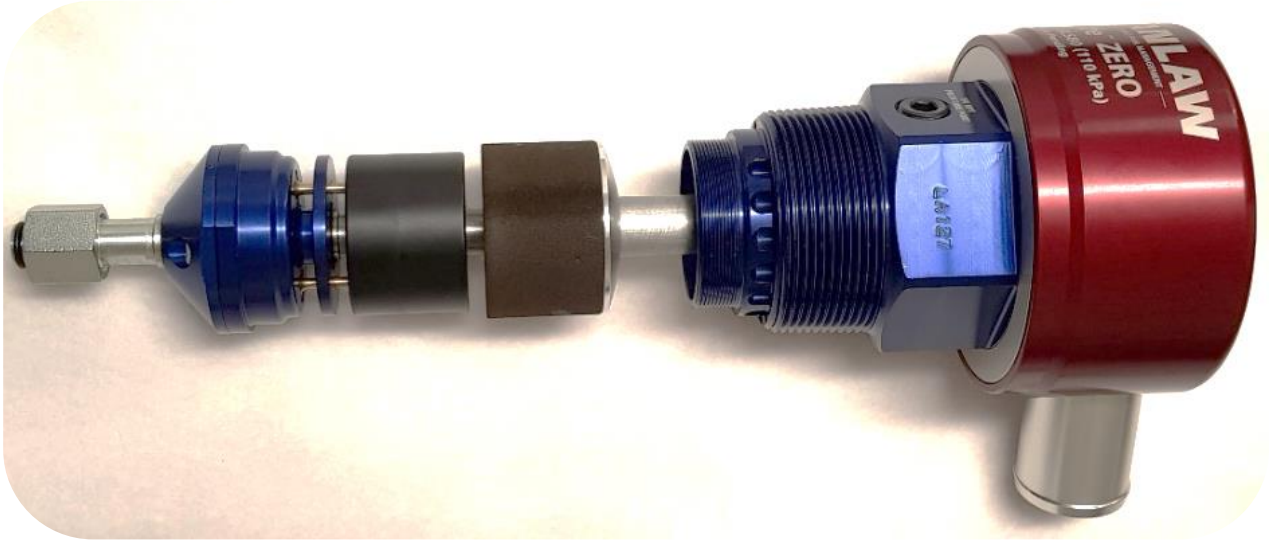

Figure 10 - Example of a "Venting" Style Level Sensor (BVLS80 shown)

Figure 11 illustrates examples of FillSafe Zero BLS series ***"Non-Venting"*** Level Sensors also compatible with the BFCV50E and BFCV50ES Flow Control Valves. A Flow Control Valve is connected to a BLS series Level Sensor via the Pilot Line routed ***external*** to the tank.

Figure 11 - Examples of "Non-Venting" Style Level Sensors (BLS100 and BLS40B shown)

3 IMPORTANT RESTRICTIONS ON THE USE OF THIS PRODUCT

1. The safe installation and subsequent operation of a Banlaw product relies on the completion of all necessary ***"due diligences"*** for the assessment of the Banlaw product(s) being suitable for the intended application(s). Such an assessment is best achieved through the cooperation of the supplier/OEM (Banlaw) and the customer or end-user. Once such an assessment deems the Banlaw product(s) to be suitable, the customer or end-user shall ensure effective ***"change management"*** applies should any prominent or influential aspect of the application (upon which the initial assessment was based) be subject to change and may affect the ongoing suitability (i.e. safety and proper function) of the Banlaw product.
2. The Banlaw FillSafe Zero **BFCV50E** and **BFCV50ES** Flow Control Valves incorporate **internal** components manufactured from **aluminium**. Products containing **external (exposed) aluminium** are typically unsuitable for use within an underground coal mine, or otherwise within an area where the use of external aluminium components (or other materials within the product) are prohibited for use in such areas in accordance with applicable governances.

1. Unless noted otherwise by Banlaw, the Banlaw FillSafe Zero tank overfill protection (OFP) system has *not* been assessed under any Regulatory or Industry Standard, Code, Directive, Guideline or other governance which may apply to the use of this product in applications where a governance applies. Please consult Banlaw prior to installation if in doubt.
2. The Banlaw FillSafe Zero system is designed for use only with ***clean*** (i.e. filtered) automotive grade diesel fuels, including commercial bio-diesel blends. This Banlaw product is ***not*** recommended for use with waste diesel fuel, or with diesel fuel containing contamination levels beyond those stipulated by governances and guidelines such as the current Worldwide Fuel Charter (WWFC) and fuel quality requirements of modern diesel engine manufacturers. *The use of this product with fuel of higher contamination levels will reduce the reliability of the FillSafe system by causing the improper operation (failure) of the product and other detrimental effects.* Banlaw recommends adequate fuel contamination controls (e.g. filtration) for all fuels passing through the Banlaw FillSafe Zero system.
3. This Valve is fitted with fluid seals rated for cold climate temperatures – refer section 4. *When used at lower temperatures*, **the safe, proper and reliable operation of this Valve – and the FillSafe Zero system – will be jeopardised by adverse physical changes to the fuel passing through the Valve**, e.g. agglomeration of constituent content of the fuel (e.g. additives, waxes, etc.), a fuel below its cloud point (temperature), or noticeable changes to the fuel viscosity. It is therefore important that only proper fuels rated for such environmental conditions are used with the FillSafe Zero system, and that adequate controls are maintained to preserve the properties and quality of the fuel.

This product is unsuitable for use with AdBlue (DEF) or with an alternative fluid (or substance) whose properties may affect the safety, function or reliability of the product. Please consult with Banlaw to confirm fluid compatibility if in doubt.

4 PRODUCT SPECIFICATIONS

BANLAW BFCV50E & BFCV50ES FLOW CONTROL VALVES	
Max. Diesel Flow Rate LPM (GPM)	800LPM (211GPM)
Min. Flow Rate LPM (GPM)	100LPM (26GPM)
Operating Temp. Range °C (°F)	-51°C (-60 °F) to 55°C (131°F)
Max. Internal SWP kPa (psi)	2,500kPa (363psi)
Compatible Fluid Types	***Clean*** Diesel Fuels, including Bio-Diesel Blends
Principal Material Composition	Zinc Plated Steel, Aluminium, Fluorosilicone (Seals)
Process Connections	2" NPT (F) Inlet and 2" NPT (M) Outlet
External Pilot Line Port Connections (2 of)	¼" NPT (F)
Nominal Mass of Flow Control Valve	BFCV50ES; 2.86kg (6.3lb), BFCV50E; 2.74kg (6.0lb)

Legend: **"SWP";** Maximum recommended Safe Working Pressure
"LPM"; Litres per minute (volumetric flowrate)
"GPM"; US Gallons per minute (volumetric flowrate)
"Max."; Maximum (upper limit)
"Min."; Minimum (lower limit)

Notes: 1. All pressure data refers to the ***internal*** fluid pressure, where each product is in "as new" condition.

5 INSTALLATION & COMMISSIONING GUIDELINES

This Installation & Commissioning Guide is general and is not meant to replace or override installation guidelines that arise out of a *due diligence* assessment of a Banlaw product for a specific (intended) application.

The scope of this section applies to the Banlaw BFCV50E and BFCV50ES Flow Control Valve assemblies. Whilst other FillSafe Zero products are mentioned – e.g. Level Sensors and Pilot Lines – end-users must refer to ***separate*** Banlaw documentation covering each product *prior* to their installation.

General Installation Notes;

1. Conduct a **Job Hazard Analysis** (JHA) ***prior*** to install to mitigate health, environmental and equipment hazards.
2. Do ***NOT*** install any parts that are damaged or are otherwise faulty.
3. Do ***NOT*** install parts which are not compatible with mating parts or parts which do not satisfy the specifications of the FillSafe Zero system.
4. Conduct all necessary measures to ***prevent the ingress of contamination*** into the Banlaw Flow Control Valve and other parts.
5. Only engage threads of the same thread type. Ensure all threaded connections are clean and in good condition. Avoid over-tightening.
6. An appropriate thread sealant (e.g. Loctite 567) is recommended on the 2" NPT process connections. Use ***sparingly*** and avoid excess use of Loctite and similar products – *residual thread sealants etc. may cause contamination and malfunction of the FillSafe Zero system*.
7. Use only proper ***hand tools*** for the installation of all components. Avoid the use of power or impact tools, and adjustable wrenches (e.g. Stillsons).
8. Use consumables (e.g. Loctite products) strictly in accordance with the OEM Safety Data Sheet (SDS) and operating guidelines. Do not use consumables beyond their expiry date.

5.1 Pre-Installation Guidelines

- A BFCV50E or BFCV50ES Flow Control Valve may be installed in any angular position, i.e. ± 90° from the horizontal.
- The outlet (i.e. back end) portion of a Flow Control Valve cannot be installed within a Pipe or some other "extended" socket or extension (>70mm, 2.7") which may impede (choke) the flow of diesel fuel from the array of circumferential ports on the forward (upstream) side of the Piston. It is recommended the Valve be installed within a 2" NPT ***half*** socket (i.e. ***half*** coupling) – refer Figure 12.

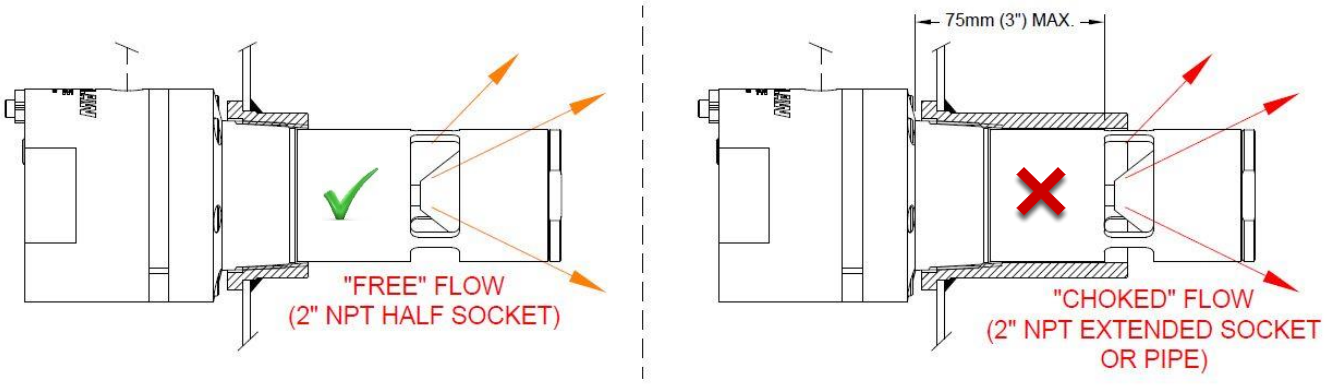

Figure 12 - Do *NOT* Install Valve Back End within Pipe (or Extended Socket)

- The Spigot on the front of the BFCV50ES Valve extends out of a Shell and is thus susceptible to damage by impact. An appropriate mechanical guard should be installed to protect the Spigot in applications where impact is more likely to occur. In the event the Spigot is damaged to the extent fuel leakage can occur, the extent of the spillage will continue until the fuel level within the tank into which the Valve is installed is below the Valve. I.e. there is no means of isolating the reverse flow of fuel from the tank and through the Valve to the Pilot Line port(s). Figure 13 illustrates an example (only) of a guard installed to provide some protection to the Valve, Spigot and Receiver, which also serves to reduce the degree of contamination build-up on the tank fill point.

Figure 13 - Mechanical Guard Around Receiver and BFCV50ES Valve

5.1.1 Fuel Discharge from Valve and Diesel Foaming

Figure 14 provides a basic illustration of the fuel discharge array from the Valve. This "spray-pattern" discharge requires consideration of 2 important issues which may affect the function and reliability of the FillSafe Zero OFP system;

1. **Diesel foaming;**
    a. The spray-like discharge of diesel fuel will increase the aeration (foaming) of the fuel and may also increase the generation of static electricity (charge) within the fuel tank. It is therefore important every available effort is made to install the Valve as close to the base of the tank as possible. This way, the fuel discharge will be below the surface of the liquid diesel for a longer period during refuelling of the tank minimising foaming and static charge. In smaller tanks or where the Valve position cannot be moved lower, the foaming may delay the actuation of the Level Sensor, cause some spillage of fuel from the Level Sensor or Tank Vent(s) until such time as *liquid* fuel actuates the Sensor, allowing the Valve to close.
2. **Location of Valve relative to Level Sensor and Tank Vent(s);**
    a. Figure 15 illustrates the Valve discharge impacting the Level Sensor or Tank Vent(s). This situation should be avoided as it may cause;
        i. Discharge of liquid fuel from the venting passage(s) to atmosphere during tank refuelling.
        ii. Malfunction of the Level Sensor and/or Tank Vent(s).

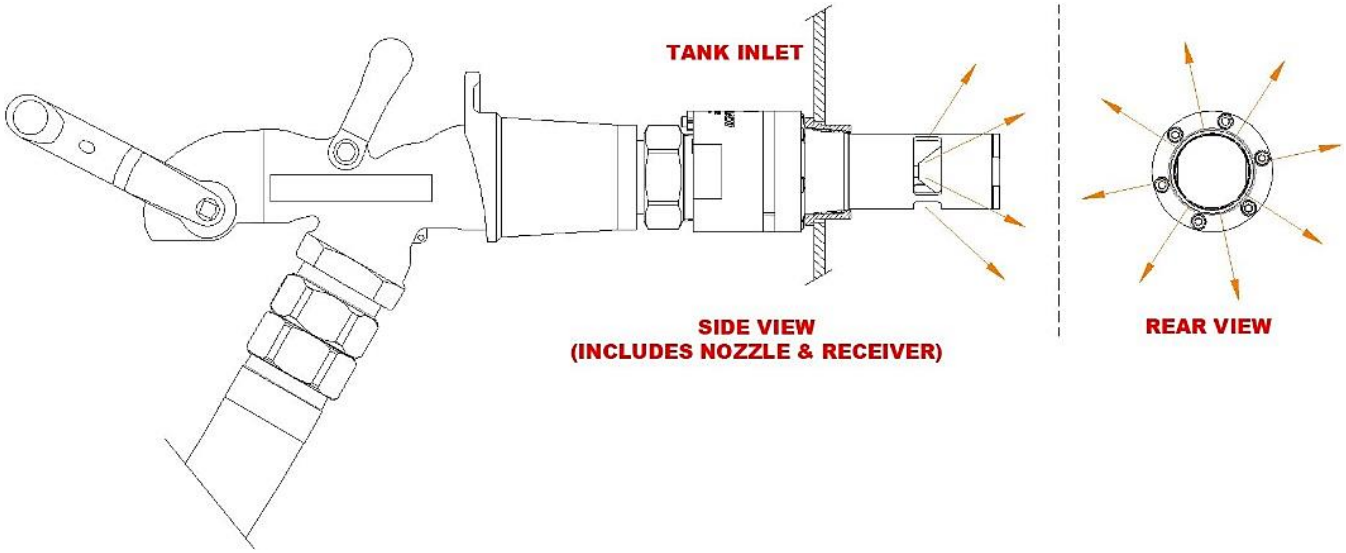

Figure 14 - Fuel Discharge from Valve

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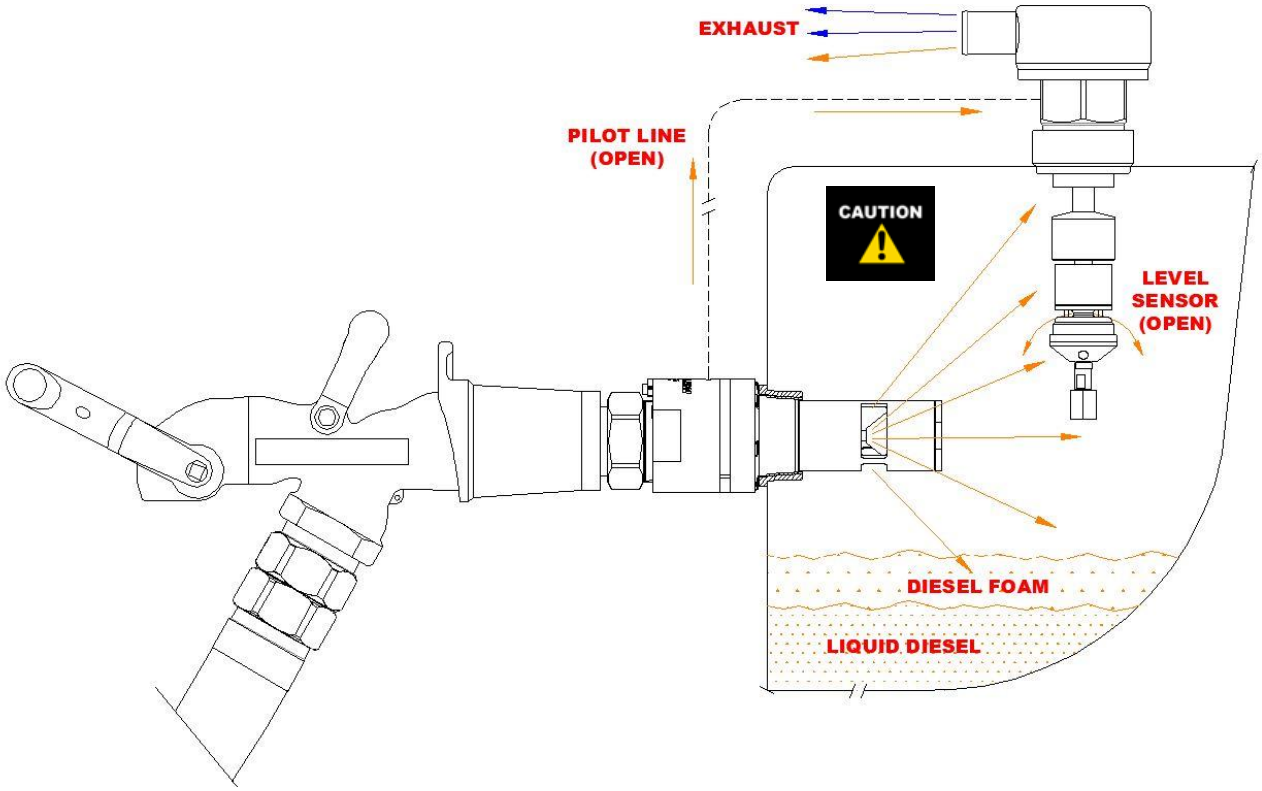

Figure 15 - Fuel Discharge Impacting Level Sensor (BVLS series shown)

Section 5.1 and Figure 12 warn against installing the Valve within an extended socket, pipe or some other area which may "choke" the fuel discharge from the Valve. Whilst this is important, Figure 16 and Figure 17 illustrate examples of a Valve installed within a Drop Pipe (or metal Tube) which is satisfactory **provided the size (bore) is no less than 4" (DN100) and short radius bends are avoided**. The use of a Drop Pipe/Tube will help to minimize diesel foaming, static charge, and avoid the fuel discharge from the Valve impacting the Level Sensor or Tank Vent(s). Adequate structural support for any Drop Pipe shall be provided to avoid undue stress and fatigue, particularly at the point of attachment (i.e. inlet).

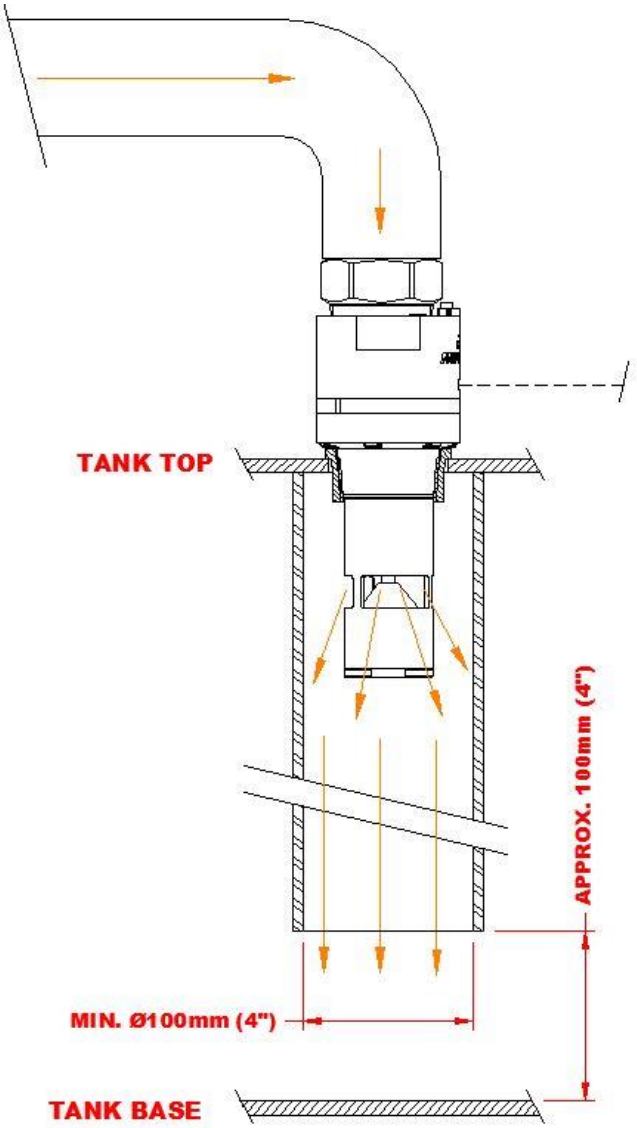

Figure 16 - BFCV50E Installed Within Vertical Drop Pipe

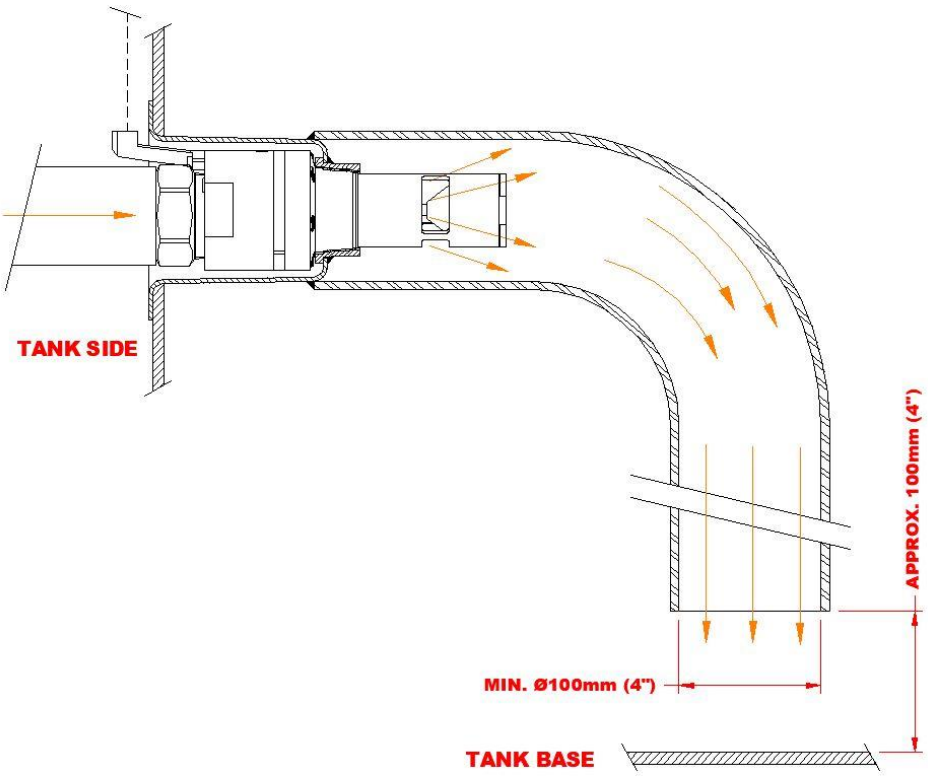

Figure 17 - BFCV50ES Installed Within Swept Drop Pipe

5.1.2 External Pilot Lines

Important limitations apply to the external **Pilot Line** – please also refer to Banlaw document PRH-OFP-30 for further detail. Internal Pilot Lines are incompatible with this Valve. **External Pilot Lines** used with this Valve shall comply with the following key requirements;

1. Supplied by Banlaw, or otherwise manufactured strictly in accordance with Banlaw specifications.
2. Recommended hose specification;
   i. AS/SAE 100 R1AT, or 100 R2AT.
   ii. Rated to environmental and process temperature range.
3. Minimum ID (bore size);
   i. 3/8" (DN10) up to a maximum length of 4m (13').
   ii. ½" (DN12) up to a maximum length of 10m (33').
4. Maximum recommended vertical head; 4m (13') between Flow Control Valve location (lower) and Level Sensor location (top). Contact Banlaw for applications requiring an extended head height.
5. Minimum (internal) safe working pressure (SWP); 2,500kPa (25 bar, 363psi).
6. Hose couplings; ¾" JIC-F (or as per other Banlaw recommendation);
   i. Any hose coupling or other fitting shall be appropriately rated for the application.
   ii. ¼" NPT (M) x ¾" JIC (M) Nipple available from Banlaw separately (Part No. 000510).
7. Installed external to the diesel tank;
   i. To achieve the *minimum* possible Pilot Line length. Excess Pilot Line length should be avoided.
   ii. Adequately supported using hose clamps (or similar) – refer Figure 18.
   iii. Via a routing (pathway) which minimises the probability of damage due to sharp edges, impact, excessive wear & tear, and relative movement (e.g. rubbing) between the hose and another surface. Any potential contact with sharp edges or movement against a surface should be mitigated by improved routing or support of the hose, or by inclusion of a protective sheath (outer cover) over the hose.
   iv. Any twisting or sharp (small) radius bends of the Pilot Line must be avoided.
   v. Other than the weight of the Pilot Line itself, no additional mass or tension (stretch) shall be added to the hose assembly.
   vi. Routing between 2 relative moving surfaces, e.g. through an articulated region of a vehicle (e.g. front-end loader, etc.), should be avoided where possible. If not, routing and support of the hose over this region must be as per the hose OEM guidelines for such applications to avoid accelerated wear and fatigue of the hose.

Figure 18 - Example of External Pilot Line Support

5.2 Installation Procedure

CAUTION

In preparation for the installation of the new Flow Control Valve, *the fuel level within the tank must be **below** the tank fill point.* This will prevent the discharge (spillage) of fuel from the tank once the existing Valve, Receiver or other tank refuelling coupler is removed. If necessary, drain fuel from the tank into a clean reservoir for reuse, or otherwise dispose of in a responsible manner. The flow control valve (piston) within the BFCV50E or BFCV50ES Valves is not designed nor intended to act as a non-return (check) valve.

1. Complete all necessary hazard mitigation, monitoring and control actions as per the JHA.
2. Once the tank is ready to accept the new Flow Control Valve, remove the Valve from its packaging (leave within packaging until just prior to install). Remove any dust caps, plugs etc. from ports.
3. Invert Valve several times to confirm the Valve Piston is freely sliding within the Valve body.
4. Inspect the Pilot Line and Pilot Line connection for visual damage or defects. If condition is unsatisfactory, do ***NOT*** attempt to repair a damaged Pilot Line – instead replace with a Pilot Line assembly in accordance with Banlaw specifications.
5. For a **BFCV50ES** Valve, verify the 2nd ¼" NPT (F) pilot line connection on the Valve Body – refer Figure 2 – is plugged (sealed). A new Valve is supplied with a Threaded Plug sealing this port. For a **BFCV50E** Valve, verify the Blanking Plate is securely fastened to the front of the Valve – refer Figure 3.
6. When installing a **BFCV50ES** within a Shell, first remove the Spigot and O'ring Seal from the front of the Valve – refer Figure 19. Retain the 2 of Screws, Spigot and O'ring within a clean & dry location for reinstallation.

Figure 19 - Spigot Screws and O'Ring Removed from Front of BFCV50ES

7. Inspect the 2" NPT (F) half coupling on the tank inlet for damage and contamination – clean as necessary. Apply the necessary amount of thread sealant (e.g. Loctite 567) to the mid-section of the 2" NPT (M) thread on the Valve, align mating threads concentrically, and hand-tighten the Valve into the tank inlet. Using an appropriate hand tool, tighten by no more than an additional 6.5mm (1/4") thread length;
    a. When installing a BFCV50ES Valve into a Receiver Shell (or other recessed tank inlet port), the use of a specialist Tool is required – refer Figure 20. If such a Tool is unavailable, the Valve may be installed into the tank port ***after*** the installation of the Receiver (or other threaded fitting) into the 2" NPT (F) Valve inlet to provide a means of tightening the Valve.

Figure 20 - Tightening a BFCV50E Valve Using a Specialist Tool

b. Once a BFCV50ES is installed within the Shell, clean mating surfaces and ***reinstall*** the O'ring Seal, Spigot and 2 Screws. Apply a small amount of Loctite 222 (or equivalent) thread-locker to each Screw thread to resist loosening.

Note:

- Avoid overtightening.
- Do ***NOT*** use power tools, i.e. impact wrenches etc.

8. Once the Valve (BFCV50E or BFCV50ES) is installed into the tank inlet, the unique (patent pending) feature whereby the front body of the valve can be rotated can now be used to position either Pilot Line Port in **1 of 4** possible locations (90° apart). To access this function, the 2 screws within the front of the Valve must first be removed – refer Figure 21.

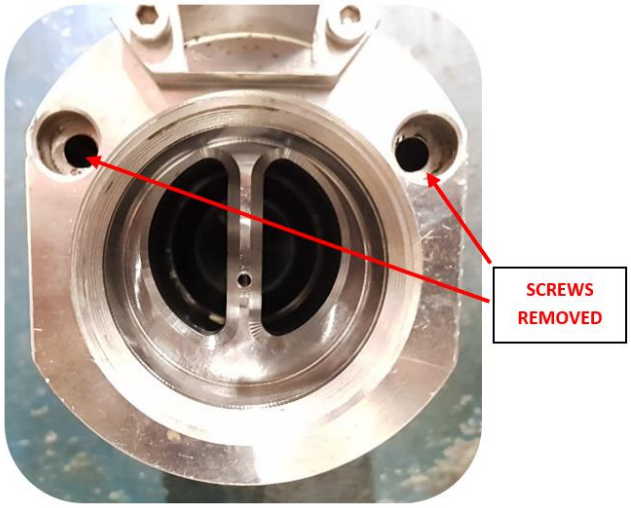

Figure 21 - Both Screws Removed from Front of Valve

9. Once these 2 Screws are removed, the Front Body of the Valve may be rotated ± 90° or 180° to achieve the best possible location of the Pilot Line connection to be used. Aligning the Front Body in each position is achieved by ***aligning the 2 holes with threaded holes within the Split Collars behind the Front Body*** (a torch may be required to view the threaded hole location).

10. Once the Front Body (and Pilot Ports) have been positioned, re-install both Screws and tighten. A small amount of Loctite 222 (or similar low strength thread-locker) may be applied to the Screw threads to resist loosening on tanks more prone to mechanical vibration – e.g. mobile plant equipment, etc.

CAUTION

Both Screws ***must*** be reinstalled to secure the Front Body once the desired Pilot Line Port position is achieved. Failure to install both Screws may cause subsequent rotation of the Front Body, strain on the Pilot Line, and fuel leakage from the Split Collar joint.

11. Apply a ***small*** amount of Loctite 567 thread sealant to the ¼" NPT (M) thread of the NPT to ¾" JIC Nipple, and fasten into the Pilot Line port, i.e.;

    a. BFCV50ES; port on front of Spigot.
    b. BFCV50E; port on Valve Body.

CAUTION

The unused (redundant) Pilot Line port ***must be plugged*** (sealed). Failure to seal this port will cause fuel leakage and the potential improper operation of the Valve (specifically its automatic closure).

12. Attach the mating JIC (F) Pilot Line hose connection/fitting to the Nipple and tighten securely.

13. Install the Receiver or refuelling point line into the 2" NPT (F) threaded inlet of the Valve. ***Avoid*** the use of excess thread sealant, as residual sealant may enter the Valve and Banlaw FillSafe OFP system and cause system malfunction. Do ***NOT*** over-tighten threaded connection.

Note:

- For Banlaw FuelTrack™ "auto ID" Receivers, the unique ID "tag" (code) must be entered into the FuelTrack database and assigned to the asset (plant equipment) onto which it is installed ***prior*** to commissioning of the system. With the security feature of the FuelTrack system enabled, no fuel dispensing will be authorised until the Receiver tag is correctly registered.
- A ***"Light"*** spring setting Receiver is recommended – e.g. Banlaw BRM23KL – when used with a FillSafe Zero OFP system. The use of a Receiver with a higher ("heavier") spring setting will increase the probability of premature nozzle shut-off.

5.3 Commissioning

1. ***Pre-commissioning checks*** for a dry-break diesel refuelling system comprising FillSafe Zero OFP;

    a. Ensure ***all*** dry-break nozzles to be used with the installed system are compatible with the Banlaw Receiver (e.g. BRM23KL) fitted to the refuelling point.

    b. Ensure the process conditions (flowrate, pressure, etc.) will be ***maintained*** within the FillSafe Zero Valve Specifications – refer section 4.

    c. Inspect the tank vent breather for excessive contamination ingress, which may restrict the free flow of exhaust air during tank refuelling. If a breather hose is installed, inspect the hose outlet for contamination build-up and the hose for damage, kinking and distortion which could also affect airflow. If a filtered breather system is used, inspect the serviceable filter element for condition and replace if necessary. Ensure the exhaust breather outlet is routed towards the ground and away from potential ignition sources (e.g. hot surfaces).

CAUTION

Inspect the fuel tank(s) for signs of visible damage, distortion and fuel leakage which may indicate the past over-pressurisation of the tank(s) due to a failure with the overfill protection (OFP) system previously used. *If the root cause of such failure has not been identified and will not be resolved by the installation of this new Flow Control Valve, commissioning of the new Valve shall* ***not*** *commence until all such failures are identified, mitigated, controlled and/or managed.*

2. When the FillSafe Zero Flow Control Valve is completely installed, and all other refuelling "system" components are all properly installed and awaiting commissioning, the initial (maiden) tank refuelling event shall serve as the means of commissioning the FillSafe Zero Valve and OFP system.

3. ***Prior*** to any attempt to refuel the tank, ensure the fuel level is below the SFL and subsequently, the OFP system will permit fuel to enter the tank for a period of no less than approx. 30secs (i.e. adequate time for system commissioning).

4. Remove the Receiver Dust Cap from the Fuel Receiver and securely connect a Banlaw (or other compatible) dry-break refuelling Nozzle to the Receiver. Now disconnect and reconnect the nozzle to confirm ease of engagement with the receiver. In the event of a problem connecting or disconnecting the nozzle, please refer to section 0. Prepare to refuel the tank as per ***normal refuelling procedure.***

5. For ***FuelTrack/ResTrack "auto ID" Receivers***, (only) e.g. BFT23KS and BFT43KS series;

    a. Ensure the unique receiver tag ID (code) is loaded into the onsite FMS database and assigned to the applicable plant equipment (tank) asset number.

b. Once the mating Banlaw FuelTrack "auto ID" dry-break nozzle is connected, verify the local FMS depot (controller) reads (receives) the unique ID tag by referring to the depot screen.

6. Any air entrained within the FillSafe Zero system will need to be bled from the system until the system is fully operable. This is best achieved by throttling (reducing) the maximum achievable refuelling flowrate to approx. 50% and steadily oscillating the flowrate between zero and 50% - this can be readily achieved by manually cycling the operating (open/closed) handle of the refuelling nozzle, or similar means. Continue this for approx. 10-15sec.

7. Once the system is completely bled, the nozzle can be fully opened. If the nozzle automatically closes ***prior*** to the tank reaching capacity and the FillSafe Zero system closing, refer to section 0. Do ***NOT*** manually or otherwise forcibly maintain the nozzle operating handle in the ON (open) position. Automatic shut-off of a Banlaw nozzle ***prior*** to the FillSafe Zero system closing is an issue known as *premature nozzle shut-off* and should be addressed/corrected in accordance with Banlaw guidelines – contact Banlaw for further information.

8. Whilst the tank is being refilled, carefully check the FillSafe Zero system for any signs of fuel leakage. Mark/record any sources of leakage for prompt corrective action after the tank is refilled. If the degree of leakage is unacceptable, manually close the refuelling nozzle, disconnect it from the receiver and rectify the leak. If the fuel leakage occurs from between the nozzle and receiver, please refer to section 0.

9. As the tank level approaches the nominated capacity (or SFL), remain next to the refuelling nozzle. *Closely monitor the fuel level to ascertain whether the FillSafe Zero OFP system automatically terminates the inflow of fuel into the tank at the required level.* In the event of a failure, ***promptly*** close the refuelling nozzle or otherwise stop the fuel supply before the tank(s) is overfilled – refer section section 0. ***Only for this commissioning procedure***, manually reopen the Banlaw nozzle and hold it fully open for approx. 5sec. Confirm negligible (no greater than approx. 10LPM/4GPM) fuel can enter the tank by observing the flow meter measuring fuel dispensed via the nozzle. If additional fuel enters the tank, please refer to section 0.

10. At the completion of refuelling, remove the Nozzle from the Receiver and return the Nozzle to its nominated holster or storage location. Replace the Receiver Dust Cap onto the Receiver.

11. After the above commissioning procedure has been successfully completed, the FillSafe Zero system may be placed into service. *A system that does not perform correctly should **not** be placed into service, but instead quarantined until the problem is identified and rectified.*

In the event the root cause(s) of the OFP system failure cannot be identified and rectified prior to the next refuelling event, ***alternate means shall remain in place to prevent overfilling of the tank*** until such root cause(s) are identified, mitigated, controlled and/or managed.

It is typically the legal responsibility of the person(s) who has identified the potential hazard to isolate the part of the system whose continued use may result in an unacceptable risk to health, safety and environment. Complete the applicable procedure for the safe and positive isolation of the system and inform worksite management immediately.

6 PRINCIPLES OF OPERATION

The FillSafe Zero system itself is fully "automated" and requires no manual operation or manipulation. Whether using a Banlaw FuelTrack system, a "standard" Banlaw dry-break system, or an alternative dry-break system, the installation of the FillSafe Zero system onto a tank requires ***no change to the normal safe operating procedure of the dry-break refuelling system*** (i.e. the procedure by which a tank is *normally* refuelled).

Refuelling couplings, e.g. nozzle and receiver, that are contaminated with dust and other build-up ***must be cleaned prior to use***. This will help prevent;

- Contamination entering the FillSafe Zero system, subsequently increasing the probability of system failure.
- Contamination from entering the fuel stream, increasing the probability of engine fuel system problems.
- Accelerated wear & tear of mating parts.
- Damage to fluid seals, creating fuel leakage.
- Difficulty in properly engaging/connecting the nozzle and receiver.

Listed below is a typical operating sequence for a dry-break system refuelling a tank fitted with FillSafe Zero (OFP system). Equipment that is damaged, leaking or otherwise unfit for operation must not be used, but must instead be replaced or repaired prior to use of a diesel refuelling system.

1	**REMOVE RECEIVER DUST CAP. REMOVE NOZZLE FROM ANCHOR OR HOLSTER**
2	**RETRACT NOZZLE ACTUATOR AND PUSH ONTO RECEIVER. RELEASE ACTUATOR AND ALLOW IT TO RETURN FORWARD. PULL BACK SLIGHTLY ON NOZZLE TO CONFIRM SECURE CONNECTION WITH RECEIVER**
3	**START FUEL DISPENSING PUMP**
4	**MANUALLY OPEN REFUELLING NOZZLE. IF NOZZLE IMMEDIATELY SHUTS OFF, MANUALLY CYCLE NOZZLE BETWEEN OPEN AND CLOSED FOR APPROX. 2-3SECS. IF NOZZLE WILL STILL NOT REMAIN OPEN, CONFIRM TANK IS NOT ALREADY FILLED TO CAPACITY. IF NOT, REFER SECTION 8**
5	**ALLOW TANK TO REFILL. IF REQUIRED BY SITE REFUELLING PROCEDURE, WITNESS ENTIRE REFUELLING EVENT WHILST VISUALLY MONITORING RISING FUEL LEVEL**
6	**ONCE TANK REACHES CAPACITY, THE FILLSAFE ZERO LEVEL SENSOR WILL "CLOSE", PROMPTING THE FILLSAFE FLOW CONTROL VALVE TO CLOSE. THE BANLAW NOZZLE WILL THEN PROMPTLY CLOSE. ENSURE NOZZLE OPERATING T-HANDLE IS LATCHED IN "OFF" (CLOSED) POSITION PRIOR TO DISCONNECTION**
7	**STOP FUEL DISPENSING PUMP. RETRACT NOZZLE ACTUATOR AND DISCONNECT NOZZLE FROM RECEIVER. REPLACE RECEIVER DUST CAP AND RETURN NOZZLE TO STORAGE HOLSTER/ANCHOR**

7 MAINTENANCE & SPARE PARTS

The BFCV50E and BFCV50ES Flow Control Valves are a ***non-serviceable*** Banlaw product. Banlaw warranty is void in the event an attempt is made to repair, modify or otherwise tamper with the Valve assembly. Further, tampering with the Valve may increase the risk of hazards jeopardising the operation of the Valve and OFP system, and subsequent safety of the refuelling system.

As an accessory, Banlaw can supply a ¼" NPT (M) x ¾" JIC (M) Nipple (Part No. 000510) to suit the ¼" NPT (F) Pilot Line Port(s) on the BFCV50E and BFCV50ES Valves and also the range of Banlaw Level Sensors.

7.1 Preventative Maintenance

The integrity (sound working condition) of refuelling couplings and tank overfill protection systems is critical to ensure all equipment can be operated in a safe and proper manner.

The working life of refuelling equipment depends on many factors, including the environment in which it operates, and the care by which such equipment is used and maintained. Dusty and dirty environments more prone to contamination build-up on/in equipment such as refuelling couplings cause accelerated wear & tear, as does excessive contamination within the fuel stream. Due to the many varied operating environments in which Banlaw equipment is used, any preventative maintenance information provided within this document shall be used a guide – unless noted otherwise.

This Valve contains relative moving parts which will wear after a period of use. Such wear will be accelerated by contamination within refuelling couplings and within the fuel stream itself. Excessive contamination within the fuel stream may even cause malfunction of the dry-break refuelling equipment and FillSafe Zero (OFP) system.

The following preventative maintenance guidelines apply to the BFCV50E and BFCV50ES Flow Control Valves;

1. Ensure adequate controls and condition monitoring are in place to ensure the contamination levels (and other specifications) of your fuel supply are maintained – ***PREVENT*** poor quality fuel entering your sites fuel infrastructure and plant equipment.
2. Install inline (bulk) filtration on all diesel dispensing lines – contact Banlaw for advice.
3. Maintain the use of the Receiver Dust Cap and Nozzle Anchors, Holsters, or Dust Caps.
4. Remove any contamination from the dry-break Receiver (front end) ***prior*** to connecting a Nozzle.
5. Visually inspect the Receiver for excessive wear & tear or damage ***prior*** to connecting a Nozzle.
6. Replace the Flow Control Valve assembly no later than every 8 years.
7. Inspect the External Pilot Line every 6 months, and test/service/replace as per hose OEM guidelines.

7.2 Banlaw Site Service and Preventative Maintenance

Clients can benefit from a **Banlaw Service Level Agreement (SLA)** to assist in the preventative and corrective maintenance of a FillSafe Zero system onsite, in addition to other diesel, fuels, oils and coolant infrastructure. Clients with an SLA can *focus on their core business activities* and allow experienced Banlaw technicians and engineers to help keep such infrastructure operating at optimum ***safety, performance and reliability.***

8 TROUBLESHOOTING

This section provides troubleshooting recommendations for the BFCV50NPTF Valve and FillSafe Zero system when installed, operated and maintained in accordance with Banlaw guidelines.

PROBLEM	PROBABLE CAUSE AND SOLUTION
Premature nozzle shut-off at the *start* of or *during* refuelling.	• Zero system requires bleeding (to remove air). With the supply pump running, cycle nozzle T-handle between ON and OFF several times to resolve this issue (also refer section 5.3). • Residual pressure in Pilot line. Cycle nozzle T-handle between ON and OFF several times to resolve this issue. • Pilot line blocked/obstructed, kinked or undersized. Check Pilot line size and connections for blockages or obstructions. Avoid the use of restricted bore style fittings, sharp elbows etc. within the Pilot Line routing between the Flow Control Valve and Level Sensor. • Level Sensor installed too high (over 4m (13')) above the Flow Control Valve). • The BVLS model "venting" Level Sensor is not installed correctly onto the tank, e.g. installed within an "extended" socket or riser pipe etc. Refer to BVLS requirements (i.e. PDS document) and rectify. • Float Valve at base of Level Sensor is "stuck" in the closed (up) position. Remove Level Sensor, investigate, identify root cause and rectify. • Faulty Level Sensor. Replace Level Sensor. • Fuel flow out of the Flow Control Valve outlet ports is "choked" – i.e. the Valve is installed within a pipe, extended socket, etc. or installed too close to the side of the tank or internal tank baffle (plate). Refer section 5.1. • Piston mechanism within Flow Control Valve is "stuck" in the closed (forward) or otherwise restricted in its "free" reciprocating action. Remove Valve, investigate, identify root cause and rectify. • Faulty Flow Control Valve. Replace Flow Control Valve. • Flow rate below recommended minimum. Increase delivery flow rate. • Flow rate above recommended maximum. Reduce delivery flow rate. • The shut-off setting of the nozzle & receiver *combination* is too "low" (i.e. too light) for this application. Contact Banlaw or your nearest Banlaw agent for advice. • Faulty nozzle. Replace nozzle. • Excessive restriction to the "free" discharge of air from the tank's venting (breather). Check vent(s), vent exhaust, breather hose, and filtered breather system (if fitted) for the source of the restriction. Also confirm the venting system is rated for the tank refuelling flowrate. • Excessive restriction in the refuelling line connecting the Receiver to the Flow Control Valve. Upsize line size (bore) and remove short radius bends and unnecessary chokes to fuel flow. • Accidental/premature activation (closure) of the Level Sensor by fuel movement (sloshing) in the tank. Pause for 1 min and restart refuelling.

PROBLEM	PROBABLE CAUSE AND SOLUTION
Nozzle shut-off and/or Flow Control Valve closure as tank approaches SFL (capacity).	• Accidental/premature activation (closure) of the Level Sensor by fuel movement (sloshing) in the tank. Pause for 1 min and restart refuelling. • Incorrect Level Sensor (length) for the required tank ullage. Contact Banlaw or your nearest Banlaw agent for advice.
Fuel discharged from vent outlet during refuelling	• Fuel discharge from Flow Control Valve is impacting the tank venting passage – refer section 5.1.1 for guidance. • Pilot Line fuel flow discharged from Level Sensor into tank is impacting the tank venting passage. Refer to the Level Sensor PDS for guidance.
Tank overfilling	• Incorrect Level Sensor (length) for the required ullage. Contact Banlaw or your nearest Banlaw agent for advice. • Leakage from Pilot Line and/or connections. Check Pilot line and connections. • Float Valve within Level Sensor has failed to close. Remove Level Sensor, investigate, identify root cause and rectify. • Faulty Level Sensor. Replace Level Sensor. • Piston mechanism within Flow Control Valve is “stuck” in the open (rearward) or otherwise restricted in its “free” reciprocating action. Remove Valve, investigate, identify root cause and rectify. • Faulty Flow Control Valve. Replace Flow Control Valve. • Flow rate below the recommended minimum. Maintain flowrate within the recommended minimum and maximum range. • Excessive foaming of the diesel fuel during refuelling – refer section 5.1.1 for guidance.
Fluid Leakage between Nozzle and Receiver during Refuelling	• Worn Receiver and/or Nozzle preventing effective locking of Nozzle to Receiver. Install new Receiver and/or replace Nozzle. • Dirt and debris interfering with locking action and/or fluid seals. Clean both Nozzle and Receiver and ensure that the Receiver Dust Cap and Nozzle Holster (or Plug) are always used. • Front face of Receiver is damaged. Install new Receiver. • Seals worn out on Nozzle. Replace Nozzle and return to Banlaw repair agent for servicing.
Fluid Leakage from Flow Control Valve	• Loose process connection. Investigate and rectify. • Damaged seal within Flow Control Valve – replace Valve assembly.
Fluid Leakage From front of Receiver	• Worn Poppet Seal in Receiver or debris on Seal. Remove Receiver and inspect seal. If damaged, install new Receiver.

PROBLEM	PROBABLE CAUSE AND SOLUTION
No fuel issued via Nozzle (or fuel dispensing system)	• Banlaw FuelTrack receiver ID tag (code) has not been entered into the onsite FMS database and/or properly configured within the database. Local FMS Controller is preventing fuel issue. • Banlaw FMS is installed at fuel dispensing location, but a non-Banlaw "Auto ID" Receiver is installed on the tank refuelling point. Contact Site Management. • FuelTrack receiver ID tag has not been received by local FMS depot; a. Existing fault with auto ID dry-break system – investigate and rectify. b. Faulty auto ID chip in receiver – install new Banlaw "Auto ID" Receiver. c. Turn nozzle on (open) and verify code is read. d. Contact your onsite FMS "champion" or Banlaw Helpdesk.
Nozzle Accidently Uncouples from Receiver During Refuelling	• Incorrect combination of Nozzle and Receiver. Confirm compatibility. **Only use the correct combination of Nozzle and Receiver.** • Worn ball lock mechanism on Nozzle and/or Receiver. Inspect both equipment and replace if necessary. • Contamination within ball lock groove on receiver body. Clean thoroughly and reconnect nozzle. • Nozzle improperly coupled to Receiver. Try again.

9 PRODUCT RECYCLING & DISPOSAL

Banlaw values and supports the sustainable use of resources, and the safe, responsible and proper disposal or recycling of all materials within its products. For a description of the principal materials within the Banlaw FillSafe Zero system, please refer to section 4.

10 PRODUCT WARRANTY

Banlaw is committed to providing quality products and services. To provide further assurance, our products and services are backed by generous warranties.

A copy of the Banlaw product warranty terms and conditions is available from Banlaw, the Banlaw website, or your nearest authorised Banlaw agent.

END OF DOCUMENT

BANLAW – UNIFIED FUEL MANAGEMENT

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