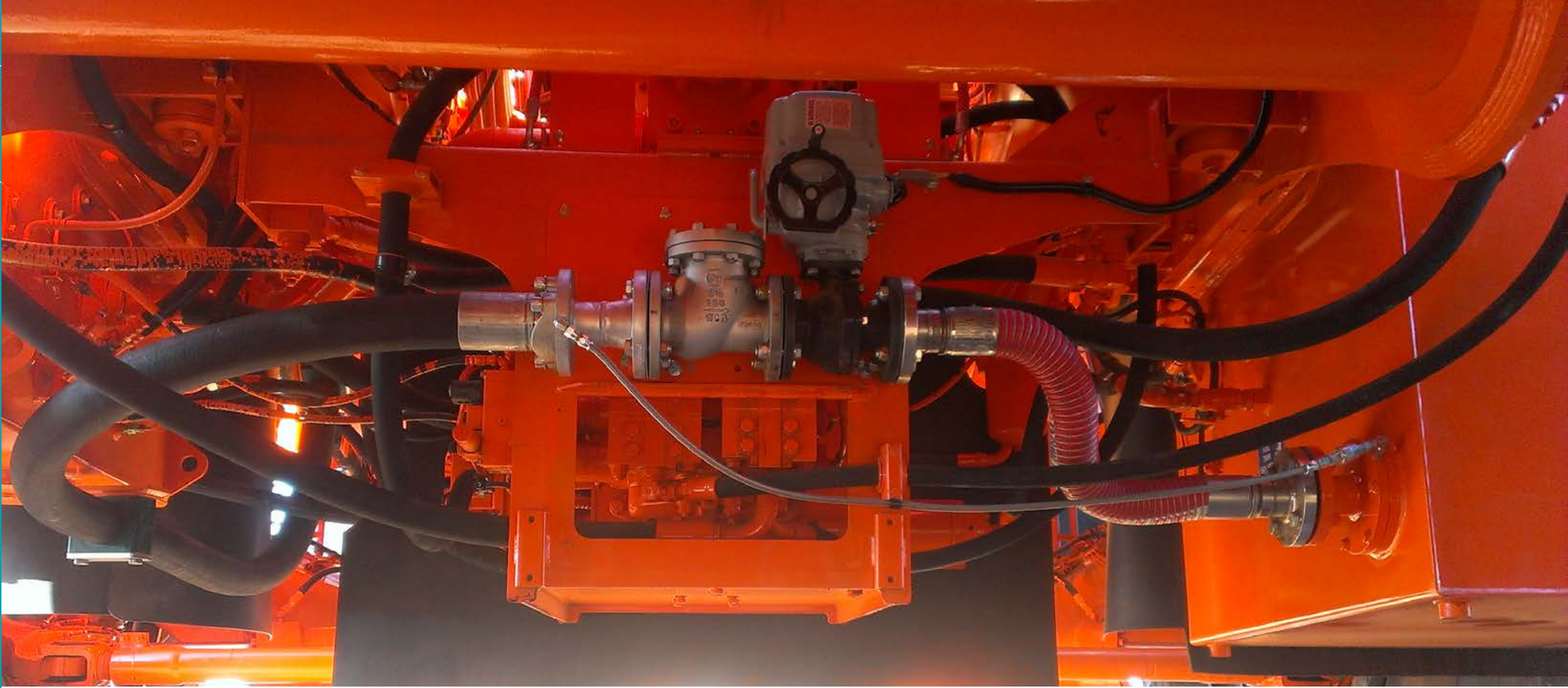




# Banlaw FillSafe™

Pressureless Overfill Protection Refuelling Solutions

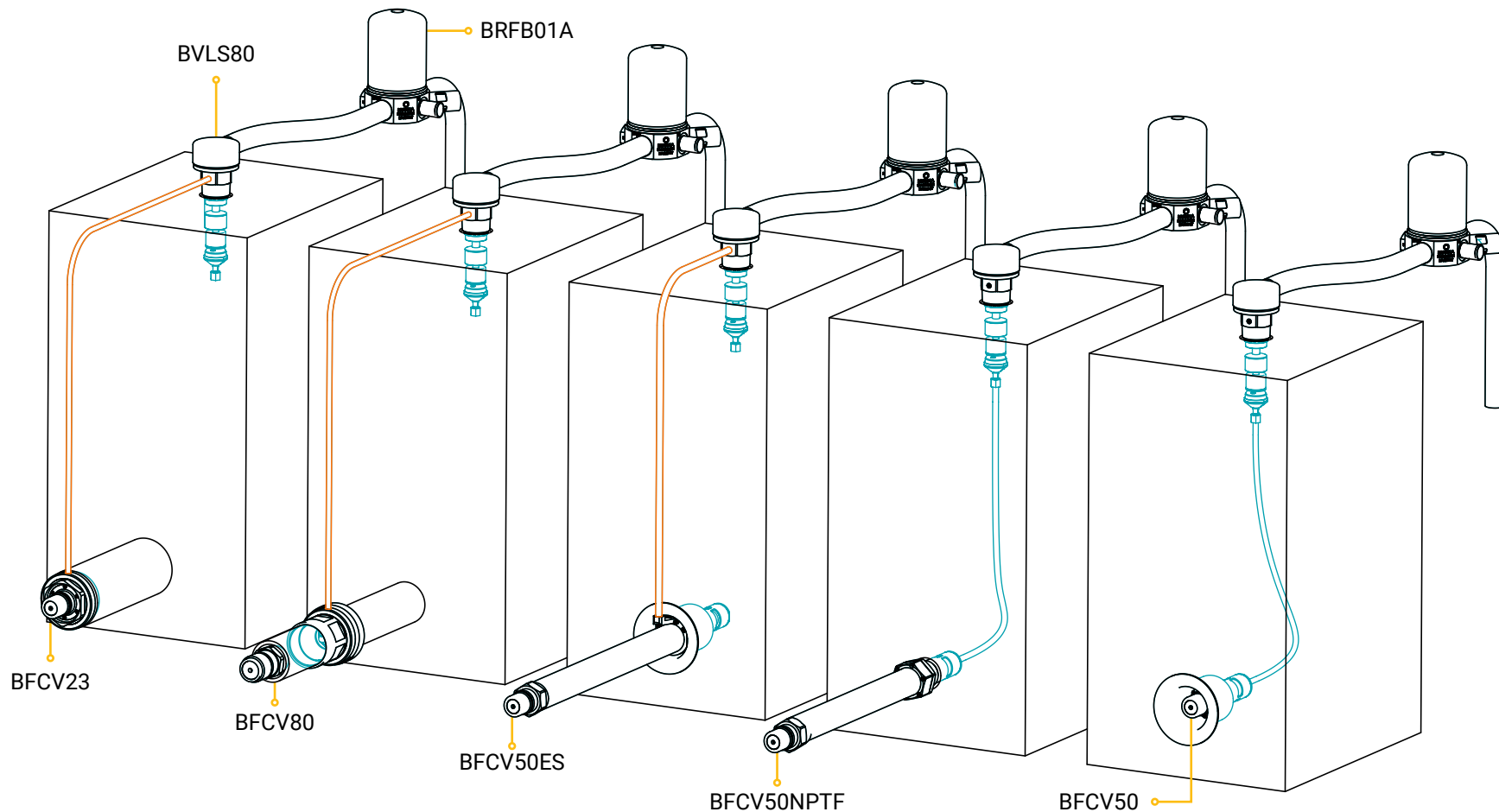




## Introduction to Banlaw FillSafe™

Banlaw ReFuelling™ products have been the benchmark for high quality refuelling hardware in mining, rail and other heavy industries for over 35 years. Excellence in product performance and long service life has kept Banlaw products the favoured choice for clients who want the highest productivity-achieving hardware for their operations.

Banlaw FillSafe™ products are designed to protect valuable machine assets by giving our clients the widest choice of **zero tank pressure** overfill protection systems available on the market. Banlaw clients can choose between FillSafe Zero, our purely mechanical pressureless overfill protection system, or FillSafe Power, the premium solution for the most demanding or critical applications.



## Why go Pressureless?

'Pressureless' refers to a tank overfill protection system that requires zero tank pressure, for it to automatically terminate refuelling once the tank is filled. Any manual override of the FillSafe Zero or FillSafe Power overfill protection systems will result in a dead head of pump pressure being applied to a closed valve, and not the tank itself. This avoids a primary cause of tank overfill and potential tank rupture. It is simply a safer, more efficient way to refuel.

## Basic Principle of Operation

A traditional dry-break refuelling system operates by momentarily pressurizing the tank at the point of maximum fill. The dry break nozzle senses this momentary pressure increase and automatically closes, ceasing the flow of fuel into the tank. For over 30 years this has been the most common way to safely refuel at a high flow rate.

A Banlaw FillSafe™ system basically operates by sensing fuel level, to signal a tank inlet valve to close at the point of maximum fill. This has the same shutoff effect on the dry break nozzle, but without pressurising the tank. Furthermore, as the valve to the tank is closed, any attempt to override the nozzle and add more fuel will be prevented.

## Integrated Auto-ID Technology

Our products are the only dry break high-flow refuelling systems available in the world, which can be fully integrated into a Fuel Management System. Banlaw FillSafe™ overfill protection systems can combine the safest and most reliable overfill protection equipment with automatic fuel reconciliation. This powerful combination of technologies boosts efficiency from the pit to the corporate boardroom with easy, automatic instant access to all refuelling transactions and reporting.



\* Differential Pressure is a difference of fluid pressure in a system. This difference is useful to control the open or closed state of the valve.

Differential pressure under high flow conditions can be problematic if the difference is too great, as it will prematurely shut off the refuelling dry break nozzle. For maximum flow rate, low pressure drop across a valve is desirable.

## Banlaw FillSafe™ Zero

Patent Pending, incl. PCT/AU2015/050802, PCT/AU2017/051039, AU2018903182

Banlaw mechanical overfill protection systems use the principle of differential pressure\* to close a Flow Control Valve. Clever design produces minimum pressure drop, whilst the 'spring-less' piston further reduces the resistance to fuel flow. Banlaw Flow Control Valves achieve the highest flow rates for size in the market. Lower pressure drop reduces the instances of premature nozzle shutoff, an issue which often leads to underfilling of tanks.

A Banlaw FillSafe™ Zero system consists of a Flow Control Valve, a Level Sensor, and a Pilot Line to form a system. The Flow Control Valve closes when a Level Sensor detects that the tank is full, stopping the flow of fuel from entering the tank. This initiates a dead head event at the Flow Control Valve, which automatically closes off the pressure sensitive dry-break nozzle. The tank is not subject to over pressurisation or the risk of overfill.

## Flow Control Valves

### 2" Flow Control Valves

#### In Shell Flow Control Valve 2" NPT (M) – Internal Pilot Line

- ▶ Designed to mount in any standard industry receiver shell.
- ▶ Diesel flow range of 200-800lpm.
- ▶ Mining Series connects to Banlaw 800 Series Mining Nozzles and all standard industry dry break nozzles.
- ▶ Rail Series connects to Banlaw 800 Series Rail Nozzles only.
- ▶ Internal Pilot line only.
- ▶ Cold temperature and Auto-ID configurations available.
- ▶ Replaceable front end kits available.
- ▶ Adaptors available to suit Cat, Komatsu, and other tank inlet port styles.



Model BFCV50

Part Number	Description	Replacement Front End
	<b>Mining Series – 200-800lpm (Suits BNM800 &amp; BNMF800 Series Nozzles)</b>	
BFCV50	Standard Mining Series Flow Control Valve	BFCV50-KIT
BFCV50-CT	Mining Series Flow Control Valve – Cold Temp	BFCV50-CT-KIT
BFTFCV50	Mining Series Flow Control Valve – Auto-ID	BFTFCV50-KIT
BFTFCV50-CT	Mining Series Flow Control Valve - Auto-ID / Cold Temp	BFTFCV50-CT-KIT
	<b>Rail Series – 200- 800lpm – (Suits BNR800 &amp; BNR800 Series Nozzles)</b>	
BFCV50R	Standard Rail Series Flow Control Valve	BFCV50R-KIT
BFCV50R-CT	Rail Series Flow Control Valve - Cold Temp	BFCV50R-CT-KIT
BFTFCV50R	Rail Series Flow Control Valve - Auto-ID	BFTFCV50R-KIT
BFTFCV50R-CT	Rail Series Flow Control Valve - Auto-ID / Cold Temp	BFTFCV50R-CT-KIT

# Flow Control Valves

## 2" Flow Control Valves



### 2" Remote Flow Control Valve 2" NPT (M) – Internal Pilot Line

- ▶ Ideal for applications where the receiver is mounted a distance from the fuel tank.
- ▶ 2" NPT Female inlet port.
- ▶ Diesel flow range of 100-800lpm.
- ▶ Internal Pilot line only.
- ▶ Suitable for all climate extremes.
- ▶ Adaptors available to suit Cat, Komatsu, and other tank inlet port styles.

Part Number	Description
BFCV50NPTF	2" Remote Fill Flow Control Valve – Internal Pilot Line



Model BFCV50ES

### 2" Flow Control Valve 2" NPT (M) – External Pilot Line Only

- ▶ Designed to mount in any standard industry receiver shell, or directly into a 2" NPT (F) tank inlet port;
  - BFCV50ES supplied with the Pilot Line Spigot for installation within a Shell.
  - BFCV50E not supplied with the Spigot.
- ▶ 2" NPT Female inlet port.
- ▶ Diesel flow range of 200-800lpm.
- ▶ Applicable for direct or remote filling applications.
- ▶ External Pilot Line only (choice of 2 ports).
- ▶ Rotating Pilot Line inlet collar for ease of Pilot Line routing during installation.
- ▶ Suitable for all climate extremes.

Part Number	Description
BFCV50E	2" Flow Control Valve – External Pilot Line
BFCV50ES	2" Flow Control Valve – External Pilot Line – In Shell w/Spigot

## 3" Flow Control Valve



### 3" Remote Flow Control Valve 3" NPS (M) – External Pilot Line Only

- ▶ Applicable for direct or remote filling applications.
- ▶ 3" NPS (o-ring seal) Male outlet.
- ▶ 3" NPT Female inlet port.
- ▶ Diesel flow range of 200-950lpm.
- ▶ External Pilot Line only.
- ▶ Rotating Pilot Line inlet collar for ease of Pilot Line routing.
- ▶ Suitable for all climate extremes.
- ▶ Adaptors available.

Part Number	Description
BFCV80	3" Remote Flow Control Valve – External Pilot Line

## Flow Control Valves

### 4" Flow Control Valve

#### 4" NPT (F) – External Pilot Line Only

- ▶ Designed to replace existing railway diesel fuel tank fuel receivers with a 4" NPT Female port (e.g. Aeroquip style refuelling system).
- ▶ Diesel flow range of 200-1000lpm (depending on model).
- ▶ Mining Series connects to Banlaw 800 Series Mining Nozzles and all standard industry dry break nozzles.
- ▶ Rail Series connects to Banlaw 800 Series Rail Nozzles only.
- ▶ 43 Series connects to Banlaw 1000 Series nozzles only.
- ▶ Applicable for direct or remote filling applications.
- ▶ External Pilot Line only.
- ▶ Rotating Pilot Line inlet collar for ease of Pilot Line routing.
- ▶ Cold temperature and Auto-ID configurations available.
- ▶ Replaceable front-end kits available.
- ▶ Adaptors for outlet available.



Model BFCV23R

Part Number	Description	Replacement Front End
	<b>Mining Series – 200-800lpm – BNM800 &amp; BNMF800 Series Nozzles</b>	
BFCV23	Mining Series Flow Control Valve	BFCV23-KIT
BFCV23-CT	Mining Series Flow Control Valve - Cold Temp	BFCV23-CT-KIT
BFTFCV23	Mining Series Flow Control Valve - Auto-ID	BFTFCV23-KIT
BFTFCV23-CT	Mining Series Flow Control Valve - Auto-ID / Cold Temp	BFTFCV23-CT-KIT
	<b>Rail Series – 200- 800lpm – BNR800 &amp; BNR800 Series Nozzles</b>	
BFCV23R	Rail Series Flow Control Valve	BFCV23R-KIT
BFCV23R-CT	Rail Series Flow Control Valve - Cold Temp	BFCV23R-CT-KIT
BFTFCV23R	Rail Series Flow Control Valve - Auto-ID	BFTFCV23R-KIT
BFTFCV23R-CT	Rail Series Flow Control Valve - Auto-ID / Cold Temp	BFTFCV23R-CT-KIT
	<b>1000 Series – 400-1000lpm – BN1000 &amp; BNF1000 Series Nozzles</b>	
BFCV43	43 Series Flow Control Valve	BFCV43-KIT
BFCV43-CT	43 Series Flow Control Valve - Cold Temp	BFCV43-CT-KIT
BFTFCV43	43 Series Flow Control Valve - Auto-ID	BFTFCV43-KIT
BFTFCV43-CT	43 Series Flow Control Valve - Auto-ID / Cold Temp	BFTFCV43-CT-KIT

## Level Sensors



Model BLS100B



Model BLS40

### Non-Vented – Single Pilot Line Port

- ▶ Single external Pilot Line port only.
- ▶ Designed for tanks with a separate means of tank venting.
- ▶ Robust vertical actuated valve, not prone to fuel sloshing.
- ▶ Available in cold temperature configuration.

Part Number	Description
BLS40B	Non-Vented Level Sensor, Single Pilot Line Port External, 40mm (1.6") Ullage
BLS100B	Non-Vented Level Sensor, Single Pilot Line Port External, 100mm (3.9") Ullage
BLS200B	Non-Vented Level Sensor, Single Pilot Line Port External, 200mm (7.9") Ullage
BLS300B	Non-Vented Level Sensor, Single Pilot Line Port External, 300mm (11.8") Ullage
BLS40B-CT	Non-Vented Level Sensor, Single Pilot Line Port External, 40mm (1.6") Ullage, Cold Temp
BLS100B-CT	Non-Vented Level Sensor, Single Pilot Line Port External, 100mm (3.9") Ullage, Cold Temp
BLS200B-CT	Non-Vented Level Sensor, Single Pilot Line Port External, 200mm (7.9") Ullage, Cold Temp
BLS300B-CT	Non-Vented Level Sensor, Single Pilot Line Port External, 300mm (11.8) Ullage, Cold Temp

### Non-Vented – Dual Pilot Line Port

- ▶ Dual external Pilot Line ports allow connection with two Flow Control Valves.
- ▶ Suitable for locomotives and other machines that need to be filled from either side.
- ▶ Designed for tanks with a separate means of tank venting.
- ▶ Robust vertical actuated valve, not prone to fuel sloshing.

Part Number	Description
BLS40	Non-Vented Level Sensor, Dual Pilot Line Ports External, 40mm (1.6") Ullage
BLS100	Non-Vented Level Sensor, Dual Pilot Line Ports External, 100mm (3.9") Ullage



## Level Sensors

### Vented Level Sensor

- ▶ Suits internal or external Pilot Line connections (unused port is sealed).
- ▶ Will work with any Flow Control Valve in the FillSafe Zero range.
- ▶ 2" NPT Male mounting thread.
- ▶ 'Anti-spill' roll over protection.
- ▶ 1,000 litres per minute (264gpm, 2,118 SCFH) air venting capability (exhaust and intake).
- ▶ Tank pressure gauge port.
- ▶ 80mm (3.1") or 180mm (7.1") ullage options.
- ▶ 110kPa (16psi) or 49kPa (7psi) pressure relief valve setting options.
- ▶ Secondary (top) float for dry-break refuelling system 'shut-off' redundancy.



Model BVLS80

Part Number	Description
BVLS80	Vented Level Sensor, Internal or External Pilot Line Ports, 80mm (3.1") Ullage, 110kPa (16psi) Relief
BVLS80-L	Vented Level Sensor, Internal or External Pilot Line Ports, 80mm (3.1") Ullage, 49kPa (7psi) Relief
BVLS180	Vented Level Sensor, Internal or External Pilot Line Ports, 180mm (7.1") Ullage, 110kPa (16psi) Relief
BVLS180-L	Vented Level Sensor, Internal or External Pilot Line Ports, 180mm (7.1") Ullage, 49kPa (7psi) Relief
BVLS80-CT	Vented Level Sensor, Internal or External Pilot Line Ports, 80mm (3.1") Ullage, 110kPa (16psi) Relief, Cold Temperature
BVLS80-L-CT	Vented Level Sensor, Internal or External Pilot Line Ports, 80mm (3.1") Ullage, 49kPa (7psi) Relief, Cold Temperature
BVLS180-CT	Vented Level Sensor, Internal or External Pilot Line Ports, 180mm (7.1") Ullage, 110kPa (16psi) Relief, Cold Temperature
BVLS180-L-CT	Vented Level Sensor, Internal or External Pilot Line Ports, 180mm (7.1") Ullage, 49kPa (7psi) Relief, Cold Temperature

## Vent Assembly



Model BV50

- ▶ Designed specifically for plant equipment with multiple fuel tanks that are filled via a common refuelling point (Cat 992 Wheel Loader etc.).
- ▶ Installed within the 'primary' fuel tank and connected via an internal Pilot Line to the Flow Control Valve in that primary tank. The FillSafe Vent Assembly is also connected to the Level Sensor within an 'auxiliary' tank.
- ▶ 2" NPT Male mounting thread.
- ▶ 'Anti-spill' roll over protection.
- ▶ 50mm ullage (air space).
- ▶ Integrated pressure relief valve.
- ▶ 1,000 litres per minute (264gpm, 2,118 SCFH) air venting capability (exhaust and intake).
- ▶ Does not incorporate a Level Sensor, but instead a float valve to close the venting passage from the primary fuel tank. The FillSafe Zero system terminates the inflow of fuel into the primary tank once the Level Sensor in an auxiliary tank is activated.
- ▶ Contact Banlaw for advice on the safe and proper means of incorporating a FillSafe Vent Assembly into your specific diesel refuelling application.

Part Number	Description
BV50	Vent Assembly, 50mm (2") Ullage, 110kPa (16psi) Relief
BV50-L	Vent Assembly, 50mm (2") Ullage, 49kPa (7psi) Relief
BV50-CT	Vent Assembly, 50mm (2") Ullage, 110kPa (16psi) Relief, Cold Temp
BV50-L-CT	Vent Assembly, 50mm (2") Ullage, 49kPa (7psi) Relief, Cold Temp

## Remote Filtered Tank Breather



- ▶ Filters inwards air to 3µm (abs.) to stop airborne contaminants from entering the fuel tank.
- ▶ Air filter element intake is not directly exposed to the surrounds, but instead protected/sealed from washdown water and excessive contamination ingress.
- ▶ 2,000 nominal engine hours of filter capacity.
- ▶ Internal check valves ensure tank exhaust air/vapour bypasses the filter element to minimise the likelihood of premature nozzle shutoff. This feature also prolongs filter life and avoids the risk of tank pressurisation.
- ▶ 1,000 litres per minute (264gpm, 2,118 SCFH) air venting capability (exhaust and intake).
- ▶ Filter condition indicator.
- ▶ 1/8" NPT F port for optional pressure gauge/transmitter fitment.
- ▶ Sold with 1-1/4" Hose barbs as standard.
- ▶ All ports have 1" BSP threads for client configuration.
- ▶ Banlaw Mounting Kits are available as accessories.

Part Number	Description	Spare Filter Kit
BRFB01A	Remote Filtered Breather, 3µm (abs.) Air Filter	BFV225-KIT

## Pilot Lines

Pilot Lines are the vital link between the Flow Control Valve and the Level Sensor. They carry a small 'trickle' flow of diesel from the Flow Control Valve to the Level Sensor. The Level Sensor closes when the tank fuel level reaches the nominated maximum fill point. When this occurs the fuel flow through the Pilot Line is terminated and it pressurises. The pressurised Pilot Line prompts the Flow Control Valve into the closed position, ending the flow of fuel into the tank(s) and triggering the pressure sensitive nozzle to shutoff. It is imperative Pilot Lines are selected, installed, and maintained as per Banlaw specifications.

### Internal

Internal Pilot Lines are subjected to strain and fatigue, as they are essentially 'unsupported' within the tank between the Flow Control Valve and Level Sensor process connections. Third party (non-Banlaw) OFP systems using internal pilot lines often experience poor reliability when this line is damaged, or where a process connection of the pilot line has 'fallen off'. Banlaw has engineered our internal Pilot Lines and the 'swivel' process connections on the Flow Control Valve and Level Sensor to overcome such problems and maintain the reliability of the FillSafe Zero system.

### External

External Pilot Lines can be supplied by Banlaw, or sourced from any reputable hose supplier in accordance with Banlaw specifications. Typically, a hose rated for use with diesel fuels and complying with SAE 100R1AT would be a minimum requirement.



Part Number	Description
	<b>Internal</b>
BFCV50H-0.5M	Pilot Line – Steel Braided 0.5m (1.6') long, strain relief, 9/16" JICF ends
BFCV50H-1.0M	Pilot Line – Steel Braided 1.0m (3.2') long, strain relief, 9/16" JICF ends
BFCV50H-1.5M	Pilot Line – Steel Braided 1.5m (4.9') long, strain relief, 9/16" JICF ends
BFCV50H-2.0M	Pilot Line – Steel Braided 2.0m (6.5') long, strain relief, 9/16" JICF ends
BFCV50H-2.5M	Pilot Line – Steel Braided 2.5m (8.1') long, strain relief, 9/16" JICF ends
BFCV50H-3.0M	Pilot Line – Steel Braided 3.0m (9.8') long, strain relief, 9/16" JICF ends
BFCV50H-3.5M	Pilot Line – Steel Braided 3.5m (11.4') long, strain relief, 9/16" JICF ends
	<b>External</b>
BFCVH-3.0M	Pilot Line – Steel Braided 3.0m (9.8') long, 3/4" JICF ends
	External Pilot Lines are produced in many lengths – please contact Banlaw for options
	Adaptor - External Pilot Line to Valve or Level Sensor
000510	Nipple – 1/4" NPTM – 3/4"JICM



## Banlaw FillSafe™ Power

Banlaw's FillSafe Power electronic overfill protection system is the premium choice in overfill protection systems, and is by far the most versatile overfill protection available on the market. It can accommodate any system flow rate depending on system design. There is no upper or lower flow rate limitation.

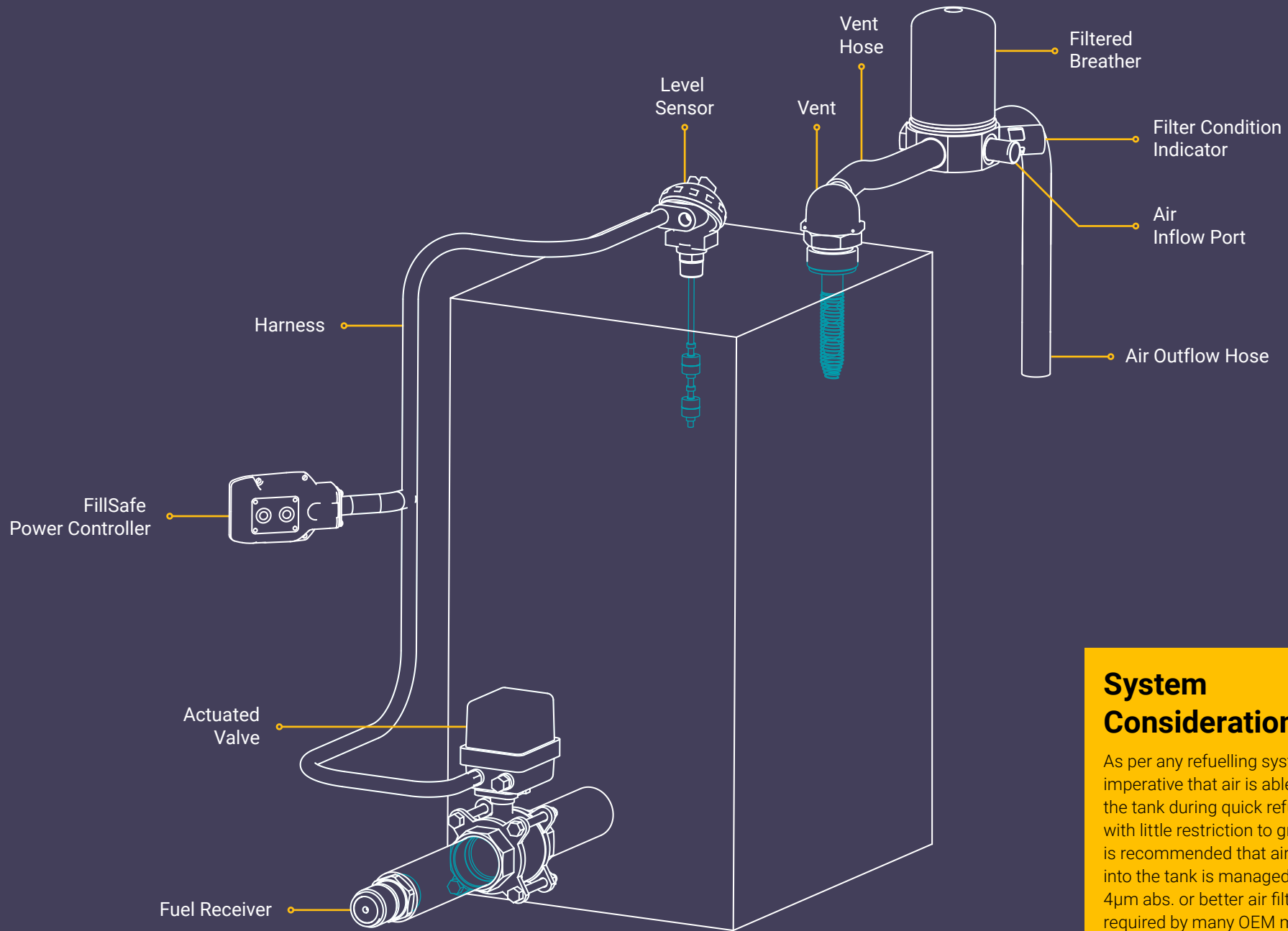
The FillSafe Power system requires 4 basic components, a Controller, an Actuated Valve, a Level Switch and a Harness to connect them all together.

FillSafe Power can be configured to suit any machine and is the only overfill protection system that indicates exactly when the tank is full via controller feedback. The Level Switch used in the FillSafe Power system

can incorporate multiple float switches. These floats can trigger 'high-high' or 'low fuel level' alarms, or allow selection of different maximum fill levels. Locomotives operating on differing axle load limit rail networks often require a selection of fill levels.

FillSafe Power controls any type of electric, pneumatic or fire-safe actuated 'open bore' ball valve to achieve the least pressure drop possible. Other actuated style valves (e.g. solenoid valves) may be used to suit a wide variety of applications and fluid types – not just diesel fuels.

As an alternative to FillSafe Power, Banlaw can also engineer a SIL-rated safety system on request.



**System Considerations**

As per any refuelling system it is imperative that air is able to escape the tank during quick refuelling with little restriction to ground. It is recommended that air passage into the tank is managed with a 4µm abs. or better air filter, a valve required by many OEM manufacturers of modern diesel engines.

## FillSafe Power Controller

The FillSafe Power Controller is the heart of the overfill protection control system. It has 2 vandal proof piezo electric switches with LED illumination to operate the system. One is a red Stop switch which indicates that the system has power and can be used by the operator to manually close the Actuated Valve. The green Fill switch is used to open the Actuated Valve to allow fluid to enter the tank. If the Fill button is illuminated this indicates that the tank is not full. If it is flashing it means the Actuated Valve is in the open position. If the light is off it indicates that the tank is full. The Controller lights can also indicate fault conditions should they occur. The lights are bright, allowing the system and fluid level status to be determined at a distance.

The Controller takes an input from a Level Switch to indicate when the tank has reached the required fill level. Once the Level Switch is triggered, the Controller will automatically close the actuated valve.

The Controller may be optioned to automatically close the Actuated Valve after 15, 30, 45 or 60 minutes. This feature – known as a ‘watchdog timer’ provides additional safety to the system.

Controllers are available in MIL-Spec, Deutsch or M20x1.5 threaded conduit entry (left or right conduit entry is available). The Controller may be simply plugged in, or hard wired to the Harness as per a client specification.

## Level Sensor

The Level Sensor is a simple robust switching mechanism that can be made to fit the top (i.e. vertical mount) or side (i.e. horizontal mount) of a tank. A Level Sensor can have multiple float switches, allowing complete control of ullages and alarm signals.



‘Right Hand’ MIL-Spec Controller BFSP2RKMAR



2 float ‘vertical’ Level Sensor

## FillSafe Power

### Actuated Valve

The Controller is able to affect a wide range of actuators that use an electrical input to initiate opening and closing of the valve. This makes it suitable for Actuated Valves including:

- ▶ Electrically Actuated.
- ▶ Spring Return Electric Actuated.
- ▶ Pneumatic Single Acting/Spring Return (Air Electric Solenoid control).
- ▶ Pneumatic Double Acting (Air Electric Solenoid control).
- ▶ Direct/Indirect Acting Solenoid Valve.

These actuators can be fitted to any sized valve to suit the application – e.g. multiple fluid types and flowrates. When used in conjunction with a ball valve, the pressure drop through the system is reduced in comparison to mechanical overfill protection systems, delivering superior flow. This makes FillSafe Power the best choice for high flow systems on larger plant equipment (such as excavators).

Fire-safe valves may also be used in a FillSafe Power system for added security of the fuel reserves in the event of a fire.

### Harness

The Harness connects the supply power source to the Controller, Level Switch, and Valve Actuator. FillSafe Power wiring is simple, and can be manufactured and routed by any competent electrician.

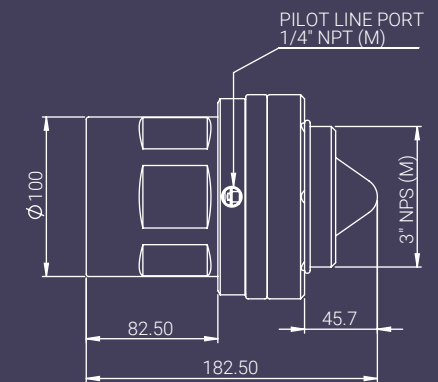
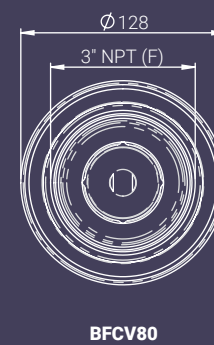
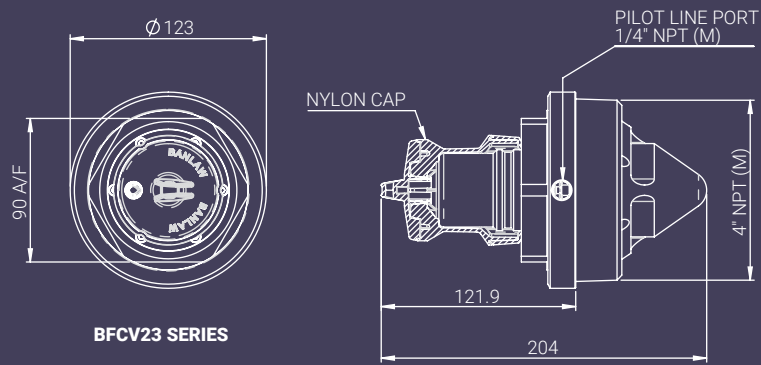
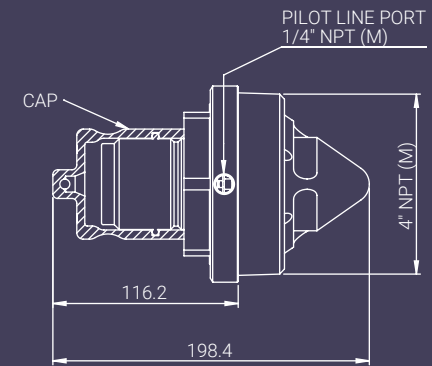
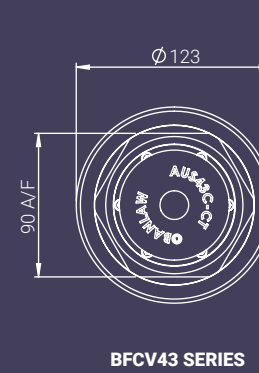
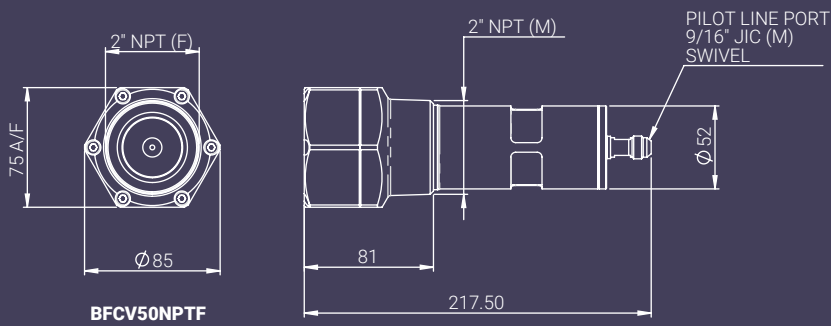
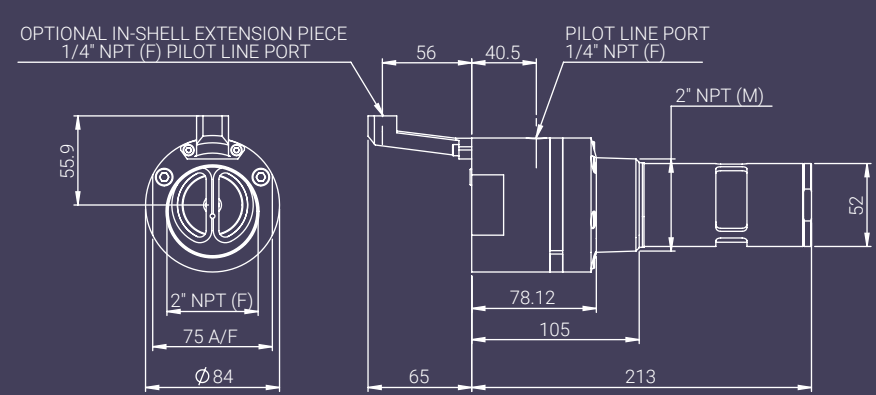
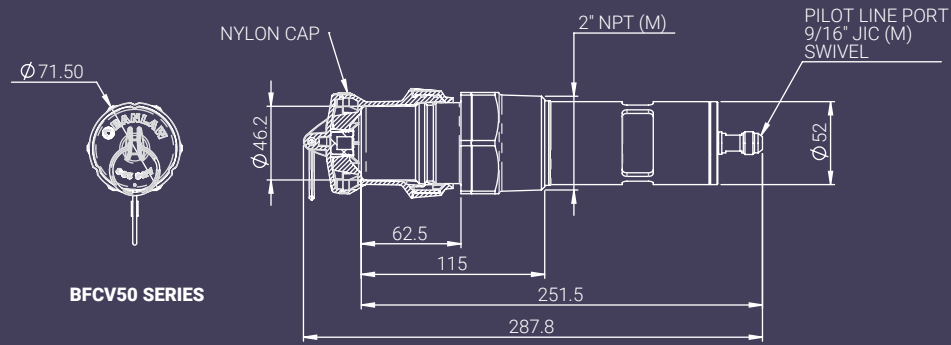


### Refuelling Hardware

A FillSafe Power system is independent of the mechanical hardware – e.g. dry-break refuelling system – used to refill the tank(s). There is no limitation on the type or number of fluid couplings (e.g. fuel receivers) that a system can accommodate. Banlaw can engineer, supply, install and maintain/service a FillSafe Power system to suit your specific requirements.

# FillSafe Zero Flow Control Valves Overall Dimensions

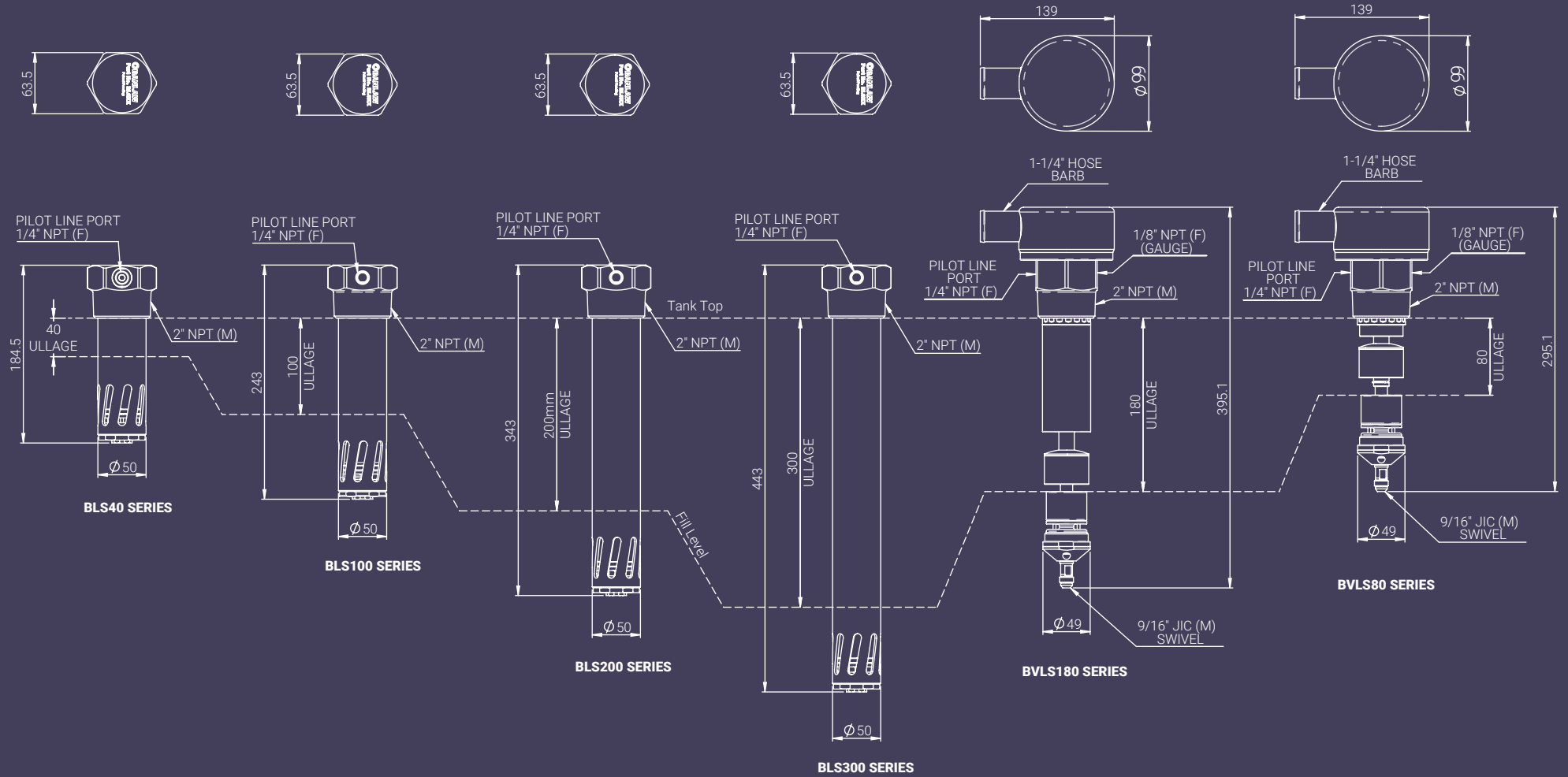
(All dimensions in mm unless noted otherwise)





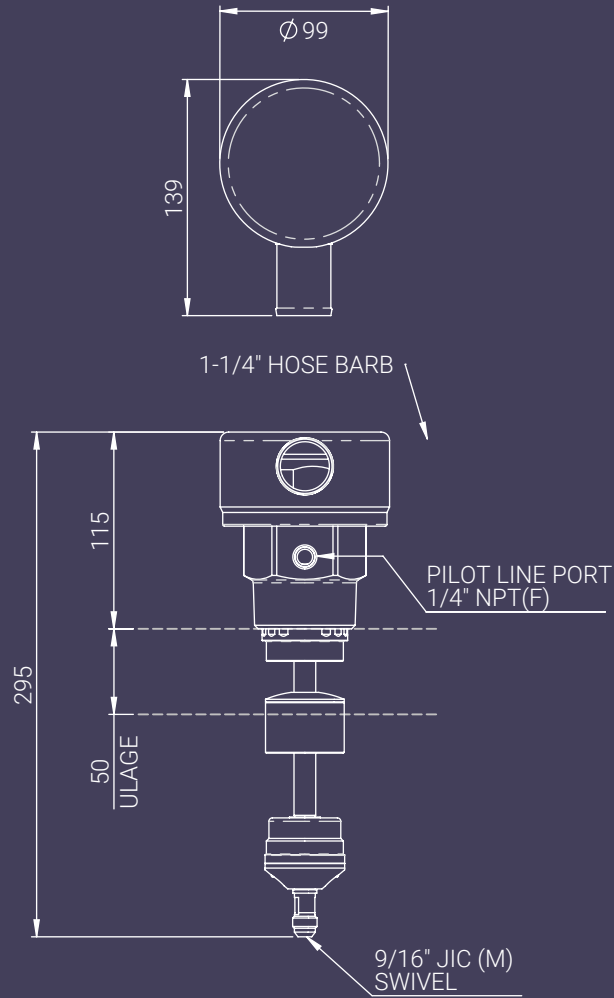
# FillSafe Zero Level Sensors Overall Dimensions

(All dimensions in mm unless noted otherwise)



### FillSafe Zero Vent Assembly Overall Dimensions

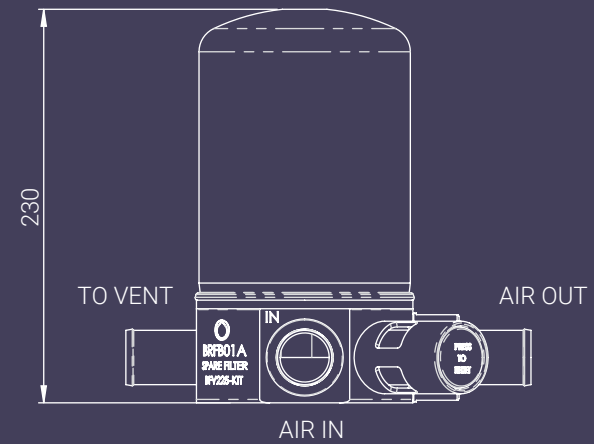
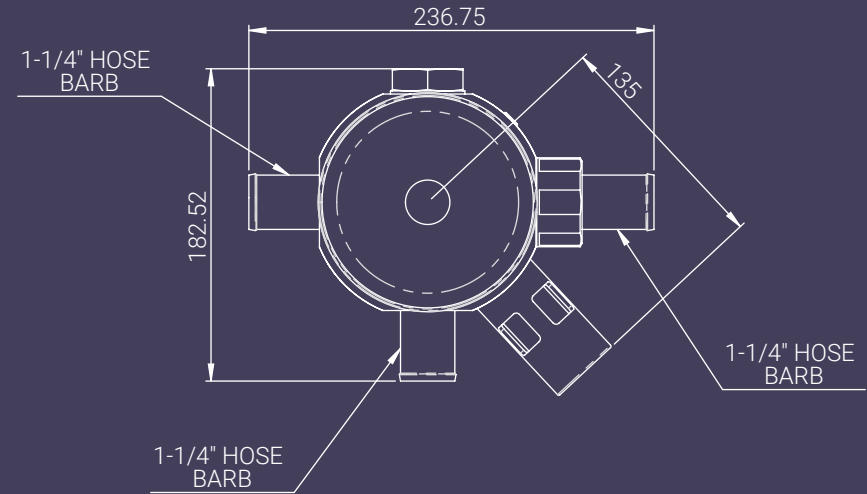
(All dimensions in mm unless noted otherwise)



**BV50 Series**

### FillSafe Zero Remote Filtered Tank Breather Overall Dimensions

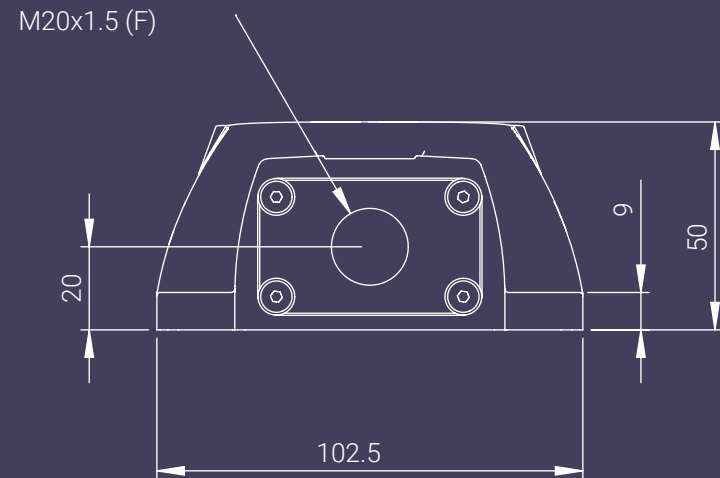
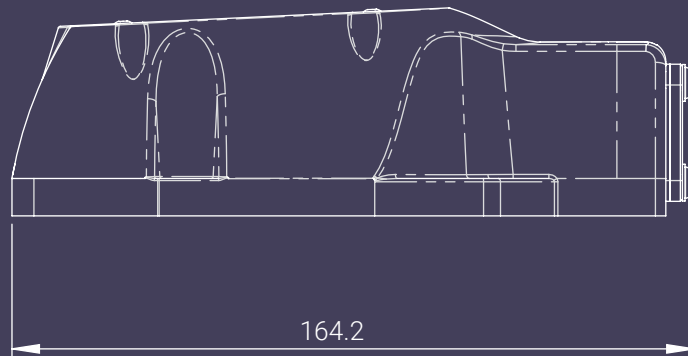
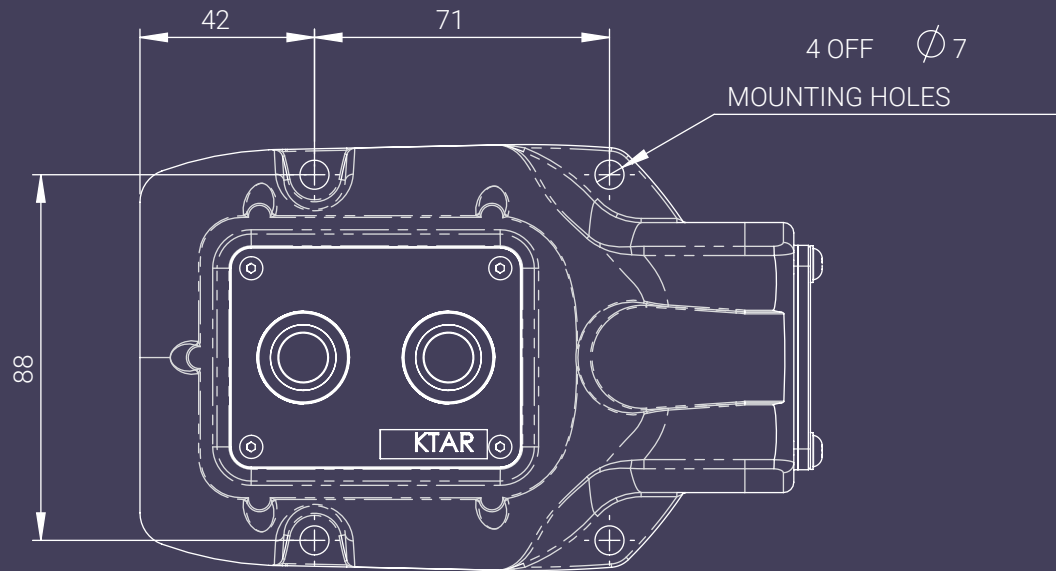
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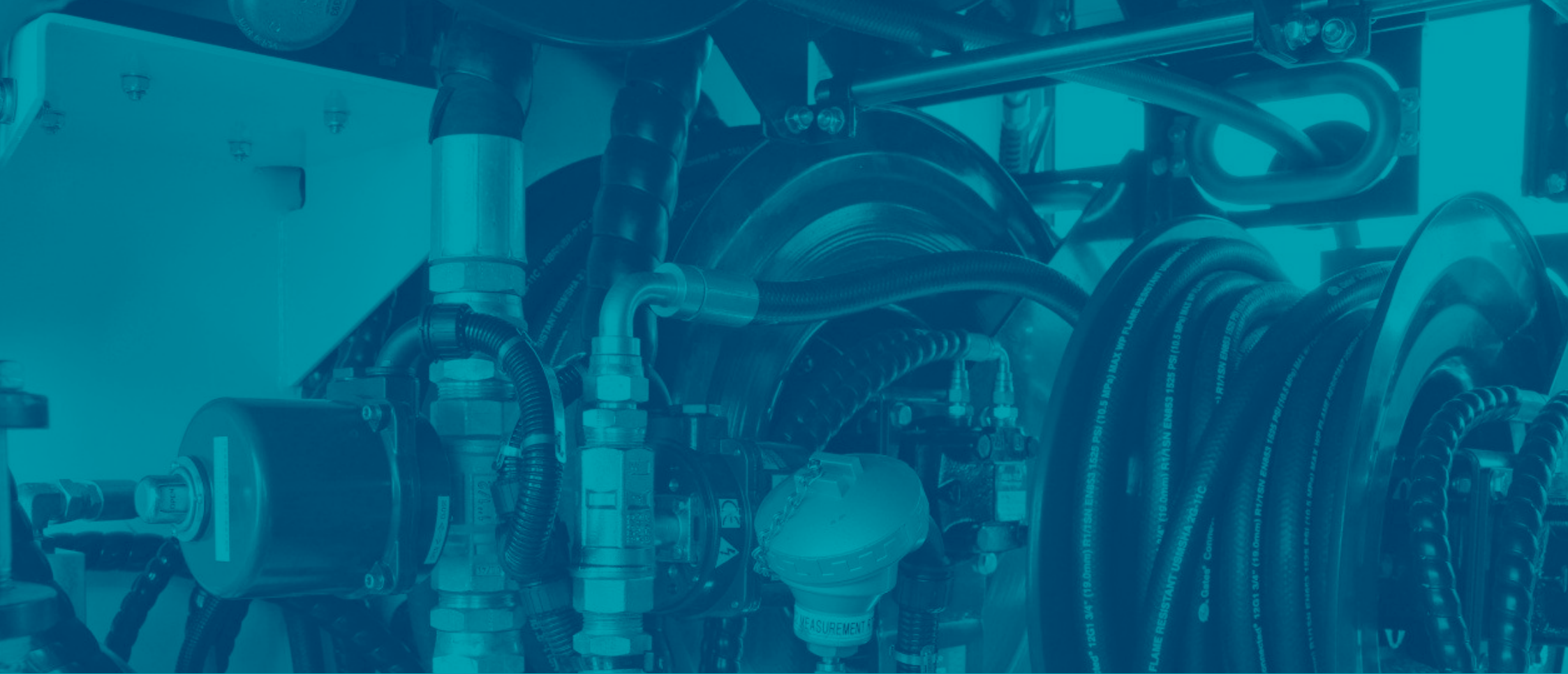


**BRFB01A**

### FillSafe Power Controller Overall Dimensions

Model BFSP2RKTAR Dimensions shown  
 (All dimensions in mm unless noted otherwise)





**Contact Banlaw today if you need Cleaner, Faster, Safer refuelling solutions.  
Think Fuel. Think Banlaw.**

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