Inline Dirt Separator vs. Side-Stream Filtration

Technical comparison for closed-loop chilled and heating water systems.

Prepared For	Consultant/Contractor technical note
Prepared By	VEXO Technical Team
Purpose	To explain why an inline dirt separator is not functionally equivalent to side-stream filtration, and why fine-particle control matters in modern low-tolerance closed-loop systems.

Executive Summary

An inline dirt separator is valuable, but it does not do the same job as side-stream filtration. The separator provides point protection by slowing flow and allowing heavier debris to settle, while magnetic elements help capture magnetite. Side-stream filtration is used to keep the overall suspended solids burden low across the whole system over time, including very fine non-magnetic material that contributes to sedimentation, under-deposit corrosion, biofilm persistence, heat-transfer loss, control instability and premature plant wear.

- **BSRIA BG 50** states that filters and separators are used to permanently maintain a low concentration of suspended solids and reduce the risk of solids deposition and under-deposit corrosion in low-flow areas.
- **BSRIA BG 50** also states that an in-line filter or dirt separator does not remove soluble foulants or static debris and should never be regarded as an alternative to system cleaning and flushing.
- **BSRIA BG 29** states side-stream filtration is suitable for most systems, strongly recommends it for systems above 2,500 litres, and says removal of suspended solids also helps limit bacterial growth.
- **BG 29** highlights why this matters more in modern systems: small-bore heat exchangers, low-flow circuits and small-orifice control valves are more vulnerable to residual contamination than older systems.

Technical Comparison

The two devices are complementary, not equivalent. An inline dirt separator is primarily a bulk separation device located in the main flow. Side-stream filtration is a continuous water-quality maintenance strategy that repeatedly polishes a proportion of the circulating volume and can be specified for far finer contaminant capture.

CRITERION	INLINE DIRT SEPARATOR / MAGNETIC ROD + MESH	SIDE-STREAM FILTRATION
Primary Function	Separates heavier debris and captures magnetic particles at a single point in the main circuit.	Continuously removes suspended solids from the circulating water over time and can combine magnetic, non-magnetic, air and fine-media filtration.
Particle Capture	Good first-line protection for coarse debris and magnetite capture; not all debris is magnetic, and capture of very fine non-magnetic solids is limited.	Can use cartridge or bag media with progressively finer pore sizes to remove mobile contaminants and polish the system water.
Effect On Soluble Foulants/Static Debris	Does not remove soluble foulants or static debris; should not be treated as a substitute for cleaning and flushing.	Also not a substitute for cleaning, but is effective at keeping residual suspended contamination low after cleaning and during operation.
System Coverage	Acts on material passing through that local device at operating velocity.	Acts on the whole system volume over repeated passes; BG 50 notes side-stream sizing should allow the total system volume to pass through in a 24-hour period or 5% of full system flow rate (whichever is greater).

CRITERION	INLINE DIRT SEPARATOR / MAGNETIC ROD + MESH	SIDE-STREAM FILTRATION
Modern System Suitability	Helpful, but limited where systems contain small-bore controls, compact heat exchangers and low-flow areas sensitive to fine deposits.	Better suited to maintaining water quality in modern systems that are less tolerant of fine suspended solids, sedimentation and biofouling.
Blockage/ Maintenance Risk	Main-flow devices must not cause unacceptable restriction when loaded.	If properly arranged, blockage does not directly compromise the main system flow; easier to monitor with differential pressure indication and planned media changes.
Typical Positioning Role	Point protection / bulk separation in the circuit.	Ongoing whole-system maintenance and polishing, typically after correct cleaning and dosing.
Best Use In Practice	Retain as first-line protection.	Use to preserve low suspended solids, reduce deposition risk and support long-term system cleanliness.

Why Fine Contamination Matters In Modern Systems

The consultant discussion is often framed around visible dirt, but the operational risk usually sits at a much finer scale. In closed loops, contamination is not limited to large particles that can be seen and drained. It also includes very fine magnetite, corrosion residuals, suspended organic matter, fragmented biofilm and other non-magnetic debris that remain mobile in the water, settle in low-velocity areas, or accumulate on heat-transfer and control surfaces. Once these deposits accumulate, they can increase pressure drop, impair heat transfer, affect valve authority, create under-deposit corrosion cells and shorten component life.

BG 50 notes that magnetite has an average particle size of about 8 microns and that not all debris is magnetic. The same guide explains that disposable media filters can remove a wide range of mobile contaminants, including bacteria, and that media pore size can be reduced over time to polish the system water. This is the key technical reason side-stream filtration can do work that a conventional separator cannot: it can be specified for very fine, continuous contaminant removal rather than relying only on bulk separation.

Biofilm, Cloudiness and Abrasive Fines

BG 50 explains that bacteria can persist within biofilm and that, where bacterial problems are persistent, significant biofilm layers may have developed within the system. When biodispersants or other remedial actions are used, dislodged debris and biofilm have to go somewhere; BG 50 specifically notes that systems with side-stream filtration installed will require the filters to be monitored more frequently during this period. In practical terms, this means filtration is not optional during remediation - it is part of how the dislodged material is actually removed from the circulating water.

For consultant discussions, it is useful to distinguish between water that merely looks dirty and water that contains very fine suspended contamination. Some fouled systems present as cloudy water that appears to settle out only after prolonged standing, for example after around 24 hours. That indicates a burden of fine suspended matter small enough to stay mobile in circulation, yet heavy enough to deposit when velocities fall. Left in the system, this material behaves like an abrasive contaminant load against pumps, valves, seals and heat-transfer surfaces and can also shield bacteria within deposits.

Where contamination is especially fine, a staged filtration approach is often appropriate: start coarser to avoid rapid blinding, then reduce the pore size to polish the system. VEXO's X-POT literature shows cartridge media options down to 0.5 micron and bag media down to 1 micron, with a unique innovative magnetic chamber separated from the filter media – prolonging the filter life, whilst proving option to start with "magnet only". That does not mean every closed loop should automatically be filtered to 0.5 micron. It means there is a credible, technically relevant pathway for systems where standard filtration grades are insufficient - particularly where fine corrosion residuals or biofilm fragments are present.

High turbidity caused by fine suspended solids

Pre X-POT
(With ADS)

Post X-POT
(With ADS)

0.5 Micron Case Study (Dublin, Republic of Ireland)

System: Chilled Water

ADS Installed: Yes

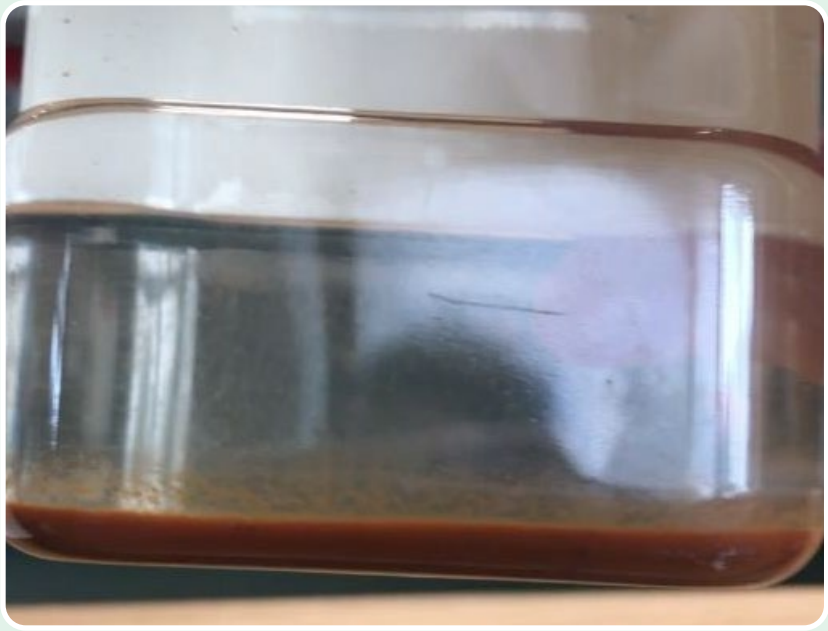
Problem: Plugged strainers , pump seal leaks, gasses.

X-POT added to remedy: Yes

Outcome: Water Treatment specialist carried out chemical clean and flush, but post works, turbidity occurred and suspended solids were exceeding BSRIA BG29/21 thresholds (>30 mg/l)

This case study demonstrates the importance of filtering very fine suspended solids in closed-loop water systems. Although the sample appeared relatively clear after standing undisturbed for 24 hours, simple agitation immediately re-suspended the settled material and turned the water visibly cloudy again, confirming that fine particulate remained present in the water. In this instance, 5-micron filtration was not sufficient, and the water treatment specialist reduced filtration to 0.5 micron to remove the remaining solids, which, if left in circulation, can contribute to abrasive wear, fouling, and wider system performance issues.

Settled for 24 hours



Closeup View of Sediment

Slightly Agitated

Moderately Agitated

Fully Agitated

VEXO 0.5-Micron Cartridge Filter

Why X-POT Removal Should Not Be Value-Engineered Out

- Poor water quality does not just create a maintenance issue; it creates an energy and lifecycle issue. BG 50 states that corrosion, scale, sedimentation and biofouling lead to energy wastage, poor performance and early replacement of plant and components.
- The water treatment programme objective in BG 50 explicitly includes prolonging system life, maintaining efficiency, and preventing leaks that can harm the environment through loss of water and chemicals.
- BG 50 notes that only devices that are incapable of blockage or causing flow restriction, even when full, should be considered for main-flow installation. Other devices should be installed on a side-stream basis.
- BG 50 also notes several online-cleaning advantages of side-stream filtration: smaller housing, easier retrofit, no direct impact on main system performance if the filter blocks, and the ability to leave the unit in place for long-term maintenance operation.
- VEXO's evidence note should only be used for VEXO-specific claims, but it is still relevant that the mechanism is consistent with the standards: poor water quality increases hydraulic resistance and can degrade heat transfer, while field and rig evidence support measurable energy reduction where filtration improves water quality.

Statement

- An inline dirt separator should be viewed as Second-line protection (after Y-Strainers), not as a complete substitute for side-stream filtration.
- The separator is useful for bulk dirt and magnetic capture, but it cannot match the function of continuous fine-media side-stream filtration for maintaining low suspended solids across the whole system volume.
- This distinction matters in modern chilled and heating water systems because control valves, pumps, compact heat exchangers, sensors and terminal units are far less tolerant of fine particulate contamination, sedimentation and biofilm-related debris than older systems. Furthermore the remedial work required from such issues becomes a burden to the building owner and/or even the contractor trying to achieve handover.
- Retaining side-stream filtration protects energy performance, controls stability, equipment life and the integrity of the water-treatment regime. Removing it may reduce first cost, but it materially increases the risk of fouling, pressure loss, corrosion, leakage, additional chemical consumption and premature equipment failure.

Practical note on filtration fineness:

To put micron size into perspective, many inline dirt separators only remove relatively coarse material at around 90 micron, roughly the thickness of an average human hair, while hydrocyclonic separation at around 20 micron is still only about a quarter of that size. The real challenge in modern closed-loop systems is often the much finer suspended material below this level. A red blood cell is about 7–8 micron in diameter, so 5 micron contamination is already smaller than that, while 1 micron and 0.5 micron particles are at a microscopic level that conventional separation methods may not adequately remove.

Why X-POT Is The Right Choice

X-POT is not simply a filter, but a multi-tool for closed-loop water quality management, combining:

- **Air separation**
- **Magnetic filtration**
- **Fine filtration**
- **Chemical dosing pot**

All the above into one engineered side-stream unit. Its highly concentrated magnetic chamber removes magnetic contamination before the water enters the filter chamber, which significantly reduces filter loading and gives longer operating periods before maintenance is required. This staged design is especially valuable in systems already fitted with conventional air and dirt separators, where finer suspended solids often remain in circulation and quickly overwhelm basic filters. X-POT has therefore been widely adopted by water treatment professionals as a practical retrofit solution, including progressive clean-up strategies moving from magnetic separation to 5 micron and below where system conditions demand it. The result is a more robust, lower-maintenance and more specifiable solution for projects where whole-life performance matters more than lowest first cost.

Below: X-POT heavy lifting /low maintenance benefits seen visually below.

X-POT Magnet Grate

X-POT Cartridge Filter
(Peeling Biofilm)

Slightly Agitated

Source Basis Used In This Note

This document is grounded primarily in the BSRIA guides BG 29/2021 and BG 50/2021, with VEXO documents used only for VEXO-specific capability and evidence statements. Public web sources are limited to official / reputable pages used to identify the current guide context and a CIBSE-hosted CPD presentation.

References And Source Links

1. BSRIA BG 50/2021, Water Treatment for Closed Heating and Cooling Systems. Key points used in this note include: problems with corrosion, scale, sedimentation and biofouling causing energy wastage and early replacement; side-stream filtration maintaining low suspended solids; dirt separators not being a substitute for cleaning; magnetite average particle size around 8 microns; disposable media filters removing a wide range of contaminants including bacteria; and online cleaning advantages of side-stream filtration.

2. BSRIA BG 29/2021, Pre-commissioning Cleaning of Pipework Systems Key points used include: contaminants block strainers / control valves / small-bore heat exchangers; side-stream filtration should be applied as soon as possible after cleaning; is suitable for most systems and strongly recommended over 2,500 litres; typically 5% of circulating water should be diverted through the side-stream filter; and removal of suspended solids helps limit bacterial growth.

3. VEXO X-POT Energy Savings (UK), dated 16/02/26. Used only for VEXO-specific claims on evidence basis, including the conservative 1–3% site-level energy saving position and the cited field / rig findings.

4. VEXO X-POT Brochure, dated 01/05/2024. Used only for product capability statements such as filtration options down to 0.5 micron (cartridge) and 1 micron (bag), and the availability of 5 micron and 0.5 micron replacement media.

5. BSRIA product page for BG 50/2021 - confirms current guide context and scope. Link: https://www.bsria.com/uk/product/Bxmbgr/water_treatment_for_closed_heating_and_cooling_systems_bg_502021_a15d25e1/

6. BSRIA commissioning guides collection - confirms BG 29/2021 remains the relevant pre-commission cleaning guide. Link: https://www.bsria.com/uk/publications/collections/commissioning_guides/

7. CIBSE-hosted VEXO CPD PDF, Hydronic Closed Loop System Water Quality (July 2023). Used cautiously and identified as VEXO-authored CPD hosted by CIBSE, not as an independent standard. It is referenced in this note only where explicitly described as industry guidance / presentation material, for example the practical pathway of filtering down to 5 micron before plant upgrade and the hosted presentation statement that BG 29/21 recommends 5 micron filtration. Link: https://www.cibse.org/media/2dpj3mnt/cibse-uk-closed-system-cpd-jul-2023.pdf