XLR® POWERED
Engine Air Intake Precleaner & Pre-Filtration Technology

LSM TECHNOLOGIES

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Endeavouring to provide clean air to Engines has been a historical challenge for decades.

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However, Engines today are more powerful, operate hotter, have higher performance demands, utilise Turbos, Regen Systems and Catalytic Convertors with the need to deliver Tier4 exhaust emissions.

With increased demands upon Engines, it is also critical that Engine Air Intake System technology provide even better protection by removing even smaller contaminants from the working environment, whilst extending Filter service life even further!

So today- a new evolution- the **worlds first** and **only** **XLR® (Extra Low Restriction)** Engine Air In- take **Powered** **Precleaner** and **Pre- Filtration Technology!**

Evolution of Engine Air Intake Systems.

Lets look quickly of the Engine Air- intake evolution since their conception.

▪ Oil Baths- Digestive.

The earliest engine air intake systems were “digestive” in nature where contaminant was digested and held / collected within the system.

Oil Bath Filters were complexed in design with the simplest consisting of a coarse Mesh Filter Media that was soaked / immersed in a bath of oil.

Contaminated engine intake air would flow over the Oil and debris collected into the Mesh / Pan. At some point in servicing, the Oil was removed, filter mesh washed, replaced and the assembly refilled with new oil.

This type of Engine Air Intake technology- whilst better than using nothing- evolved quite rapidly.

Figure 1- Typical simple design Digestive Oil Bath Filter

▪ Dust Bowls- Digestive.

Dust Bowl Technology in some applications is still being used today for Engine Air Intake Precleaning.

Contaminated engine intake air enters the Bowl where heavier than air Particulate was collected inside the Bowl Housing.

Figure 2- Dust Bowl- Digestive Air Intake System

Dust Bowl’s (Precleaner) are very inefficient and require cleaning / removal of the collected debris before the Bowl filled.

▪ Radial Filtration Housings- Digestive.

The most common technology utilised today is the Radial Filter Housing. The Filter System Housing contains a Primary Filter + Secondary (emergency Filter Element).

Engine intake air is directed around the “dry” Filter Element which removes contamination.

The Primary Filter is typically between 25µ - 50µ arrestance and the Secondary Filter (as an emergency back- up if the Primary Filter media fails) between 50µ -100µ. These Particulate sizes are still very large indeed (it is well acknowledged that Particulate >5µ can rapidly wear out a Turbo).

As the Primary Filter Element loads / becomes embedded with contaminants, a Restriction Gauge connected to the Housing indicates airflow restriction and that the Primary Filter Element needs replacement.

During Engine stop and restart, contaminant falls from the Filter Element into the Housing and a Rubber Ejection Port (“duck- bill”) is supposed to eject the loose debris by the opening and closing of the Rubber Port. The “duck bill” was the first type of pseudo “ejective” Technology.

Figure 3- Radial Housing Filter System with Ejection Port

It is interesting to note that traditional practice when a Radial Filter Element becomes loaded is to stop the machine and "blow- out" the Filter Element. This practice not only interrupts productivity and inflicts labour costs but exposes the worker to Airborne Particulate / Fibre that can compromise the Filter Media, resulting in failed Engine and Components.

Venturi / Strata- Tube Precleaners- Digestive.

The Strata- tube was devised and is still used in a lot of common Engine Air Intake Filtration Systems.

Contaminated air is drawn through a multitude of strata- tubes where the contaminated air is "spun" through the tubes. Using a Venturi effect, the heavier- than- air Particulate falls into the housing and is ejected back into the operating environment via an Ejection Port or a connected Scavenger Port.

A Scavenger Port (where available) is connected to the Engine Exhaust with its own Venturi, that draws the loose debris inside the Filter Housing into the exhaust flow.

Issues with this type of Precleaner are:

- The Venturi tubes can easily block with larger debris and especially in humid / wet conditions it "muds" / blocks the tubes.
- Are very inefficient in arrestance, with removal of debris (40-50%).
- As the Filter Element Loads, air flow reduces and so does the efficiency of the precleaning function.

Figure 4- Strata- tube / Venturi Prelceaner- Blocked

"Ejective" Precleaner Technologies.

The introduction of Centrifugal "Ejective" Precleaners is the most common technology utilised today and certainly provides extension of Filter Element service life.

Ejective / Centrifugal Precleaners have an internal Impeller that spins at high speed with engine air intake flow and centrifugally ejects the debris through a Ejection Slot on the side of the Precleaner Dome.

Precleaned air then flows through to the Filter Element in the Filter Housing for further removal of contamination from the air flow onto the Engine.

Ejective Centrifugal Precleaners are very efficient (>85%). However, the efficiency can also be dramatically reduced as the Filter Element becomes loaded, air flow restriction increases which in turn reduces suction draw from the Precleaner (the Ejection Impeller slows down).

Figure 5- Radial Housing modified with attached Precleaner

XLR® - Powered Pre- cleaner and Pre- Filtration.

Today- a new evolution of Engine Filtration and Precleaner is **the XLR® (Extra Low Restriction) Powered Precleaner** and **Pre- Filtration Technology!**

The **XLR® System** is **worlds first** and **only Powered Precleaner** and **Pre- Filtration Technology!**

The **XLR® System** does not replace the Radial Housing Filtration System on the machine but acts as a **Precleaner + Pre- filtration** system which is placed **before** the air flow enters the standard / fitted Housing / Filtration System.

Because of the **XLR® System** powered **Precleaner's** (>90%) high efficiency, and specialised **Ultra- fine** (99.99% ISO 5011 fine dust) Filter Element Media then the **highest protection** of the Engine and its Components are achieved, with **extended** Filter Element Service Life- far beyond any other available technology.

The extreme efficiency of the **XLR®** technology means that the fitted Radial Housing Filters remain clean and virtually would never require replacement (for warranty protection, please follow OEM recommended filter element replacement intervals).

How It Works.

- **Step 1:** Debris-laden air enters the Precleaner.
- **Step 2:** The fan of the built-in Precleaner generates an air Vortex, causing the contaminants to ride along the outer walls of the housing.
- **Step 3:** More than 90% of the dirt and dust particles are ejected from the Precleaner through the ejection ports at the end of the Filter Cap.
- **Step 4:** The pre-cleaned air is now filtered to the ISO 5011 Standard after which the clean, filtered air flows to the machine's Radial Housing Engine air intake System.

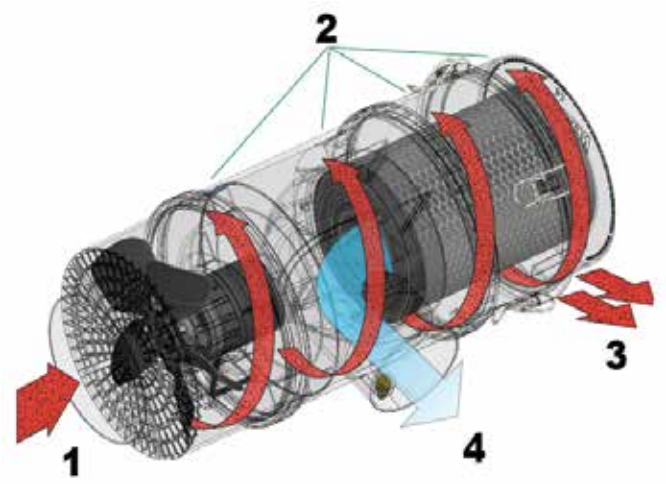

Figure 6- How the XLR® Powered Precleaner works

XLR®- Benefits and Advantages / ROI.

There are many enormous advantages, cost- downs which provide a quick ROI with the use of the XLR® technology:

- **High efficiency <u>Powered</u> Precleaner** that removes more than +90% of the dust before it reaches the XLR® Pre- Filters and maintains precleaning efficiency (>90%), no matter how loaded the Filter Elements become.
- **Self- cleaning Filter Elements / Housing:** Due to the unique Filter Element media which is "surface filtration" (not depth filtration) and the patented Vortex action of the Precleaner, air is forced consistently over the Filter Element surface and so debris is continually ejected from the Filter End of the Housing. As the Housing is always clean of debris, engine contamination during Filter Element replacement is avoided.
- **Ultra- fine Filtration:** The specialised **XLR®** Filter Element Media remove **99.99%** of ISO 5011 Fine Test Dust >1.0 micron.
- **Engine / Component Protection:** Combination of the **XLR®** Precleaner + Filter Element Media + High Arrestance of Finer contaminants maximise Engine and Component (Regen / Catalytical Convertors, etc) protection and cleaner Engine Oil.
- **Filter Element Service life:** Is massively extended with field experience proving that upto 40 x times of normal Radial Housing Filter Element replacement intervals can be achieved (maximum service life of 1,000 hours is recommended for the **XLR®** Filters).
- **Production / Labour Costs:** Maximising Filter Service life not only lowers Filter replacement costs but also reduces Labour costs and Production Downtime.
- **Radial Housing Filter Elements:** As the **XLR®** does all the heavy lifting, Radial Housing Filters remain clean and virtually would never require replacement (for warranty protection, please follow OEM recommended filter replacement intervals).
- **Extra Low Restriction:** Due the above patented benefits and capabilities of the **XLR®** provides very low restriction of the Engine Air intake System, which equates to optimum Engine Performance and Fuel Economy.
- **Motor:** Uses a long life (>30,000 hours) Brushless DC Motor.

XLR® Applications / Case Studies.

The **XLR®** System can be adapted to any Engine Air Intake System as either a single unit for smaller Engines (intake air of 8.0 m3 / minute) or multiple units can be manifolded together for larger Engine Air- intakes.

The **XLR®** System is ideal for any industrial environment and is especially suitable in the most severe of environments such as Mining / Earthmoving, Waste / Landfill Industries and especially where equipment is operating in enclosed buildings such as Internal Stockpiles, Ship Holds, Cement Clinker, Grain holding, etc.

Implementation of the **XLR®** Technology has proven significant ROI (return on investment), with some examples below.

Cement Stockpile Building.

- **Machine:** Wheel loader.
- **<u>Before</u> XLR®:** The restriction gauge light for engine filter came on after 4 hours. The engine and **2 x Catalytic Converters** had to be replaced within the first **5,000 hours**.
- **<u>After</u> XLR®:** The **XLR™ Filters** were still operational after **260 hours, Primary** engine filter **like new**.

Figure 7- Dual XLR® System on Volvo L110H

Environment: Waste Handling Facility.

- **Machine:** Excavator.
- **Before XLR®:** Radial Housing Filter Service life was **40 minutes**.
- **After XLR®:** Filters were still operational after **4 months**.

Figure 8- Dual XLR® System on Volvo EC250

Indoor Recycling Facility.

- **Machine:** Excavator.
- **Before XLR®:** Radial Housing Filter service life was **8 hours**.
- **After XLR®** Filters were still operational after **3 months**.

Figure 9- Dual XLR® System on CAT M320F Excavator- with RESPA CF2 for Cabin

Outdoor Waste Handling Facility.

- **Machine:** Wheel Loader.
- **Before XLR®:** Radial Housing Filter service life **40 hours**, Engine Life **300 hours**.
- **After XLR®:** Filters operational **1,000 hours** and **Engine still running**.

Figure 10- Triple XLR® System on CAT 836K Compacter

Chicken Manure Stockpile building.

- **Machine:** Wheel Loader.
- **Before XLR®:** Radial Housing Filter service life was **3 hours**.
- **After XLR®:** Filters operational after **3 months**.

Figure 11- Triple XLR® System on Doosan DL420 WLoader

Fleet Safety Tracking + Maintenance (FSM™).

LSM Technologies **FSM™** is an in- house developed, designed and supported IP SaaS (software as a service) on- line technology.

LSM Technologies **FSM™** not only provides users with standard Fleet **Tracking** information via a **GPS / GSM / Satellite Telemetry Hub** mounted in the vehicle / asset but also an intuitive web browser interface with a single click access to f**leet dashboards, customisable reports, compliance tools** as well as **real time, user defined alerts**.

FSM™ online back-to-base management solution is scalable from a **single** vehicle / asset up to **thousands**. The system is a management tool that can accessed via any internet connected PC or mobile device, including Apple iOS / Android mobile and tablet devices. It provides immediate alerts as required via SMS and email, anywhere in the **world- 24/7**.

LSM Technologies **FSM™** integrates to our unique product technologies for OH&S such as our:

- Q- CABAIR™ / RESPA™ Cabin Pressuriser / Filtration Systems
- Tyre Pressure / Temperature Monitoring.
- DFM (Driver Fatigue Monitor).
- CAS- Camera Viewing / Proximity Detection Systems.
- XLR Powered Engine Air intake Precleaner/ Pre- Filtration System.

Figure 12- FSM- Fleet Safety Tracking / Maintenance On- line System

Training / Education / Simulator Cabin.

So as to obtain your own hands- on experience with our OH&S Technologies, LSM Technologies provides:

- **Simulator / Demo Cabin:** This is an Excavator Cabin that has a number of our Safety Control Technologies installed and interfaced with our **FSM™ System** which displays live functionality on attached touch screens.
- **Education / Training:** We also have our own AV / Conference facilities for up to 20 people and so you and your colleagues are more than welcome to visit us, meet our Engineering Design Development Team for detailed discussions and / or technical presentations / Training of the technology solutions LSM Technologies has to offer.

Figure 13- Demonstration Cabin / Simulator

LSM Technologies- Specialists Solution Providers

LSM Technologies offers their extensive experience, expertise, research and technical developments that provides ROI.

As an industry champion we are also committed to the on- going development of unique and specialised fit- for- purpose technologies and systems that continually improve our client's objectives of enhanced Safety (Health), Equipment Damage Control and Productivity that best protect your Human and Equipment Assets.

For further information please contact us or visit www.lsmtechnologies.com.au

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