AAF INTERNATIONAL

MARKET INSIGHT

Improving Energy Efficiency and Facility Optimisation

AAF has an in-depth understanding of the challenges and opportunities for improving efficiency and profitability. This understanding and technical ability makes AAF the preferred partner in optimising your HVAC system performance.

It's a Matter of Time

The #1 concern of Facility Managers is that they don't have enough time to get their work done. While time is the most valuable resource for the Facility Manager, the financial bottom line is the driving force for Decision Makers, creating conflict when organisations attempt to run too lean in critical areas.

The high cost of deferred maintenance:

Short-term solutions and price-driven shortcuts may be perceived as problem solving, but in reality they end up costing companies more.

€4.7 million annual facility cost of **deferred maintenance**

36% of companies say that **number** is **even higher!**

88% of facility managers say that **deferred maintenance is an issue**

Mitigate the urgent, work on the important

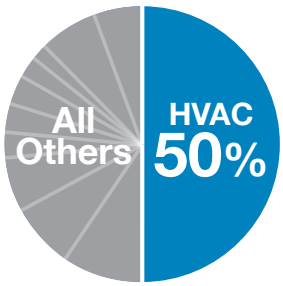
55% of Facility Managers fall into **reactive management**

Losing **228 hours every year!**

Reactive managers miss opportunities if they only improve as situations demand.

ENERGY IMPACT

HVAC–The system most affected by deferred maintenance



Energy costs up to **81%** higher in **facilities** with **deferred maintenance** issues

71% of this increase is **HVAC related**

Facility Managers put themselves at risk when failing to look for ways to analyse and improve processes to optimise the use of limited resources.

Gambling with deferred maintenance:
Today's solution, tomorrow's problem

55%
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Losing 228 hours every year!

The business landscape is becoming increasingly complex and competitive, and many companies are operating on a razor-thin edge.

In a push to succeed, organisations and business leaders are constantly looking for ways to streamline, reduce waste, and run as lean as possible. In other words, they're trying to do more with less—keeping costs down by balancing maintenance budgets, optimising labour schedules, and integrating processes.

As a Facility Manager, you control and oversee your building's critical operations, so you understand today's business pressures as much as anyone in your organisation. The upkeep of equipment and systems can have you running in all directions, all around the clock. Managing occupant complaints and expectations adds to the demands you face.

If you're working in an environment with budget and time constraints, your organisation may have defaulted into a deferred maintenance scenario, which can create job backlogs. In this case, you're probably reacting to issues, rather than preventing them.

The top challenge for Facility Managers is that they simply do not have enough time to get all of their work done.[1]

- 55% of Facility Managers fall into reactive management.[2] Reactive methods mean you can lose at least 11% of every day—at least 228 hours every year![3]
- 49% of Facility Managers spend 2 to 4 hours per day dealing with occupant complaints. Of those surveyed, 16% say they spend more than four hours per day doing this.[4]

of facility managers say that **deferred maintenance is an issue**

More pressure on facility managers

By definition, deferring maintenance is the practise of postponing system checks, repairs and upgrades to a later budget cycle due to a lack of time, money, or both. The idea is to minimise the investment into existing systems and personnel to improve cash flow and reduce expenses. In other words, spend less get more.

Deferring maintenance can deliver more, but not always in the ways you want. Instead, it can lead to:

- **More unplanned expenses** – Failure to replace worn or malfunctioning system components can lead to costly system breakdowns, and even facility shutdowns.
  - If you defer maintenance, you can expect future expenses to be equal to or greater than the cost of the part squared, or **15 times** the total repair cost.[5]
- **More safety risks** – Operating under a reactive mode can mean more safety liability, and that can lead to an increase in insurance claims.
  - **Insurance claims can rise by up to 71%** when facility teams are operating in a reactive manner, and each claim is 11% more expensive.
- **More system downtime** – Should repairs become necessary, you may have to wait for parts to be produced and shipped.

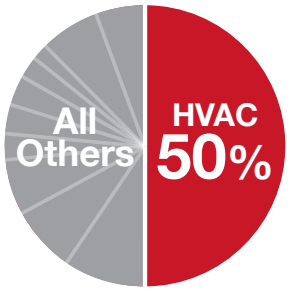
- **More production bottlenecks** – Without ongoing system maintenance, it can be difficult to keep equipment operating at peak performance.
- **More missed profit opportunities** – Energy and sustainability goals can fall by the wayside whenever preventive maintenance activities are delayed or halted.

The cost of waiting to maintain equipment could potentially be **30 times higher** than the early intervention cost.[6]

Why ongoing maintenance of HVAC Systems is critical

Half of a facility's energy costs are attributed to heating, cooling and moving air.[7] When HVAC systems are not maintained on time or as planned, they do not perform as they should. Air handler blower fans and other components may begin to short cycle and wear themselves out. The more that components turn on and off and on again, the more energy you waste, and the more likely it is that you'll be dealing with spikes in energy costs.

ENERGY IMPACT



Energy costs up to **81%** higher in **facilities** with **deferred maintenance** issues

71% of this increase is **HVAC related**

Proper filter maintenance is essential to keeping HVAC systems operating effectively and efficiently. Compared to components like motors and compressors, filter selection and maintenance may seem simple, but there are multiple facets of the filter and the system it's installed in that must be taken into consideration. These considerations include system airspeed, fan efficiency, filter resistance, service life, efficiency and cost. Filters are essential to your HVAC system's performance and can extend the life of the system components, decrease your energy spend, and reduce the labour burden of your team, saving you time and money.

Each **€1** avoided by **deferred maintenance** creates **€4** in **future expense**[6]

Impacts of filters on HVAC costs

- 15% to 40% of the **lifetime ownership cost of an air handler unit** is directly attributable to the air filters selected.[8]

Impacts of filters on HVAC efficiency

- Only **0.15mm of surface debris** can result in a **16% efficiency loss** for HVAC coils.
- Up to **37% more energy is consumed by** AHUs with **dirty coils** vs. clean coils.

One labour week for each set of **100 filters**

EQUALS

€90,433

in deferred maintenance

Overlooking air filters is a costly mistake

Filters can play an important role in reducing your deferred maintenance backlog, so having an optimised programme for filter maintenance and replacement is vital to a facility's operations. The time spent on filters and related maintenance, such as purchasing, inventory, staging, removal and installation, is highly labour-intensive.

- **20 to 25 labour hours** are required to replace 100 pocket/compact filters
- **10 to 15 labour hours** are required to replace 100 pleated filters
- One labour week for each set of filters equals **€90,433 in deferred maintenance**

By failing to look at ways to analyse and improve processes, reactive Facility Managers put themselves at risk. Short-term solutions and price-driven shortcuts may be perceived as problem solving, but in reality they end up costing companies more. The annual facility **cost of deferred maintenance is €4.7 million**. 36% of companies **say that number is even higher.**

Instead of reacting to HVAC issues in your facility, you can put in place a preventative maintenance strategy to help you minimise the time and cost involved in maintaining optimal indoor air quality.

Energy use in buildings could be **reduced by**

10% to 40%

by **improving operational strategies.**[8]

Now's the time to be proactive

When working with a tight budget and limited resources, it can be challenging to convince executives to allocate investment to HVAC maintenance and filter replacement.

The first step in optimising your clean air spending is to work through a Total Cost of Ownership (TCO) analysis. A locally optimised filtration analysis will provide the highest level of air filtration solutions, while also minimising your total life cycle costs. This is where an application and data analysis specialist can take a true consultative and technical approach to understanding your complete air filtration needs, application, and business goals in order to optimise your performance and lower your TCO.

Using advanced diagnostics software, this specialist can act as a partner, providing the insights needed to help you identify a filtration solution that can reduce operational time and costs while increasing energy savings.

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4. How Facility Managers Can Handle Occupant Complaints, Facilities Net, 2014, U.S.
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8. Study by the Energy Systems Lab at Texas A&M University, as reported by the Air Conditioning, Heating and Refrigeration News in "The High Cost of Deferred Maintenance," December 2008

Contact your AAF representative for a diagnostic evaluation that can help you identify an optimal filtration solution.

AAF Proves Validity of Energy Savings Through In-Situ Data Logging

VALIDATION STUDY – HEALTHCARE

Customer Profile

- Leading University Medical Centre located in Texas, serving the Southwestern U.S.
- 996-bed facility
- 49 owned, operated, joint-ventured and affiliated hospitals

Energy savings through filtration

One of the largest not-for-profit healthcare systems in Texas recently decided to reduce energy costs by engaging a leading real estate and environmental management firm. AAF advised that conducting a comparison study of the current filters through a direct method of measuring their HVAC system performance would identify improvement opportunities and provide evidence that alternative filter types would save energy and money.

The goals were to reduce energy costs and Total Cost of Ownership (TCO), reduce facility risk with final filters that did not suffer in performance, and select filters that would last at least 6 months or longer. The four-week comparison study used a direct method of energy logging, evaluating the hospital's current filters against recommended filters to document the reduced overall cost. This direct method of measuring the €iwgyr—euros per resistance iwg (inch of water gauge) per year—is extremely precise, yielding hard data in order to systematically evaluate the value of a proposed filtration solution.

Direct energy logging systematically evaluates savings

The direct energy logging data indicated that the current system added significant energy cost to the hospital's bottom line. The recommended AAF filters had significantly less resistance and greater airflow, minimising operating costs.

The hard data demonstrated that the €iwgyr for AHU 1 was €7,524 and the €iwgyr for AHU 2 was €4,610. It projected that the energy savings for AHU 1, if the recommended filters were adopted, was €11,098 per year, while the projected energy savings for AHU 2 was €6,678 per year. This recommended system, based on the precise results of hard data, was found to be a much more efficient and effective solution for the hospital's needs. A regular changeout schedule was also recommended to meet their objectives.

When the testing data was extrapolated to encompass all of the buildings on the hospital campus, the annual energy savings totalled an incredible €375,000. Based on this analysis, the projected annual energy savings for all 10 of their facilities added up to over €537,635.

TCO Diagnostic® proves the most accurate method to determine energy savings

AAF then revisited the site to perform the same testing using TCO Diagnostic, an advanced analytical software tool. The analysis projected the exact same calculations as the direct energy logging method. This validated that the energy savings and total cost of ownership calculations of TCO Diagnostic were accurate and proved the programme's reliability for energy savings through filtration. It is this ability to combine real-life, local filter performance results with local operating costs that differentiates TCO Diagnostic from all other total cost of ownership programmes.

TCO Diagnostic®

LOCALLY OPTIMISED FILTRATION ANALYSIS

Most advanced analytical software in the filtration industry

- Total Cost of Ownership (TCO) diagnostic analysis performed on your HVAC systems to identify financial opportunities and optimise time and expense
- Uses the proper simulation of your system environment to reveal the total impact of your buying decision
- The most complete database of independent test reports on manufacturers' filters
- Analyses up to 4 stages of filtration, current system and up to 3 optional systems
- Depicts the relative annual costs, by stage, for filters, energy and labour
- Energy usage and cost calculations assure uniformity in the methodology and results
- Dynamically adjusts to view values for total cost, energy cost, and filter cost change
- Documents potential energy savings that may qualify for tax credits or rebates
- Can be used to optimise total cost of ownership for fixed speed fan systems where energy savings are not realised
- Generates written reports clearly illustrating the assumptions used and the calculated savings
- Cross platform capability – PC, tablet or smartphone

TCO Diagnostic®—Analysis Based on your environment, your systems, and your processes

The purpose of TCO Diagnostic is to assist you in selecting the best filters for your air handling systems and to understand their sensitivity to your operating conditions, in order to operate your system in the most optimal and effective manner. TCO Diagnostic provides the insight to identify improvement opportunities, find the optimised options, and tailor to your specific needs for a comprehensive purchase perspective—improving air quality, energy savings and operational flexibility while reducing total cost of ownership. Working with application specialists with verifiable filter performance analysis who use this new tool reveals the most effective way to improve productivity, lower expenses, and decrease risk.

TCO Diagnostic® Overview

- Analytical approach to objectively evaluate how filter performance differences affect total cost of ownership
- Addresses life cycle, average pressure drop, and initial resistance driven by dust holding capacity
- Patented program calculates fan efficiency at actual airspeed (m^3/hour) for accurate, dependable values
- Analyses based on 4 levels of filter service cycle data to address any situation
- Evaluates up to 4 stages of filtration with selections for current system and up to 3 optional systems
- Optimises filter system based on filter cost, energy consumption and service cycle
- Identifies locally optimised changeout point
- All analysis and reports reflect local languages and units
- Reporting system requirements:
  - PC: compatible with the most current version of Chrome OS and Internet Explorer
  - iPad requirements: compatible with the most current version of Chrome OS and Safari

Contact your AAF Sales Representative for your optimised filtration solution.

Intelligent data. Your data.

TCO Diagnostic®

Total Cost of Ownership

The most significant cost normally affecting Total Cost of Filter Ownership is energy.

However, other costs, such as the filter itself, installation, disposal, freight, procurement, overhead, storage, and filter effectiveness in maintaining clean coils and ductwork to prevent ancillary maintenance costs, should also be considered in any total cost analysis.

The overall TCO includes direct and indirect expenses, as well as intangible ones that can have monetary values assigned to them. The direct and indirect factors impacting air filter TCO include:

- Energy costs
- Worker productivity costs
- Filter resistance
- Employee and student attentiveness
- Effective filter service life, or Dust Holding Capacity (DHC)
- Procurement activity costs
- Labour costs to change filters
- Duct cleaning frequency costs
- Disposal costs
- AC coil cleaning frequency costs
- Cost of the filter
- Compliance risk and liability costs

TCO Diagnostic accounts for all of these relevant variables while providing the most effective solution for your specific facility and needs.

Comprehensive Purchase Perspective

TCO Diagnostic uses the most accurate methodology and data sources to improve your total life cycle, hidden cost drivers, and expense of execution. It improves performance based on your environment, your systems, and your processes.

Analyses based on 4 levels of filter service cycle data

1. **Full Cycle Data** – filter full service cycle and filter resistance at changeout known
2. **Mid Cycle Data** – filter full service cycle, filter current service cycle, and filter current resistance known
3. **Dust Load Data** – filter full service cycle and dust loading rate (by experience or by measurement) known
4. **Life Cycle Value Data** – filter full service cycle, filter initial resistance, and filter resistance at changeout known

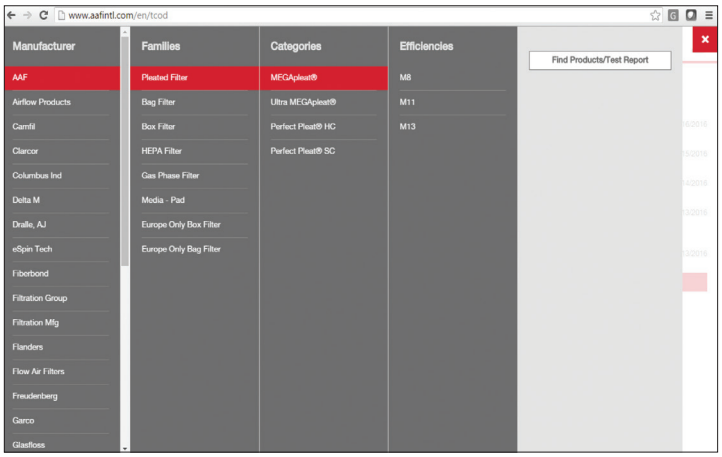
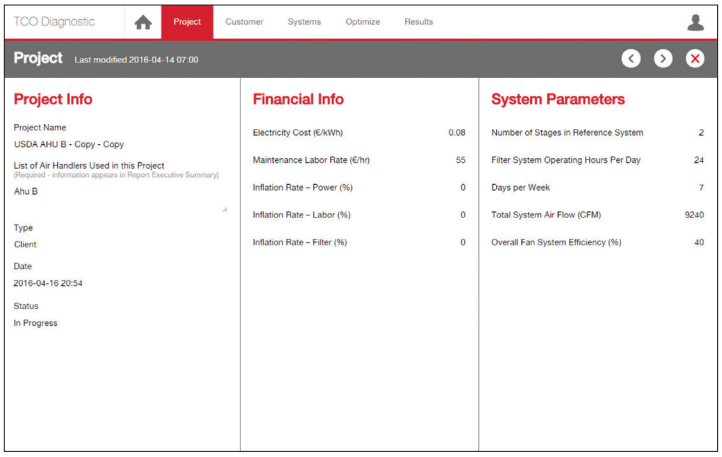
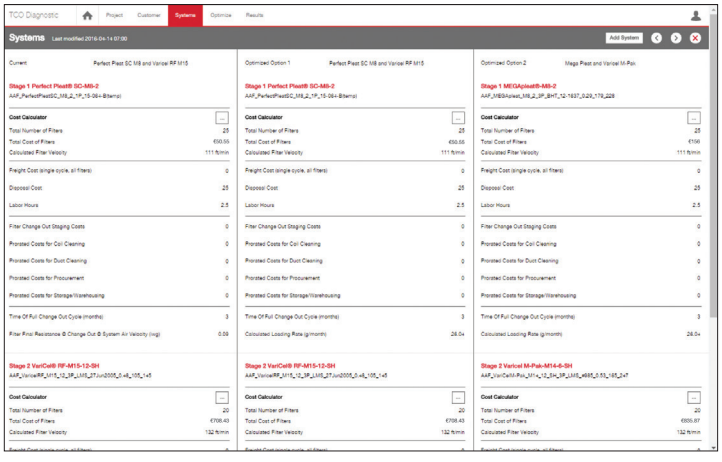


Table of Filters contains test reports on manufacturer's filters to select as the basis for the TCO Diagnostic energy usage and cost calculations, ensuring uniformity in the methodology and results.

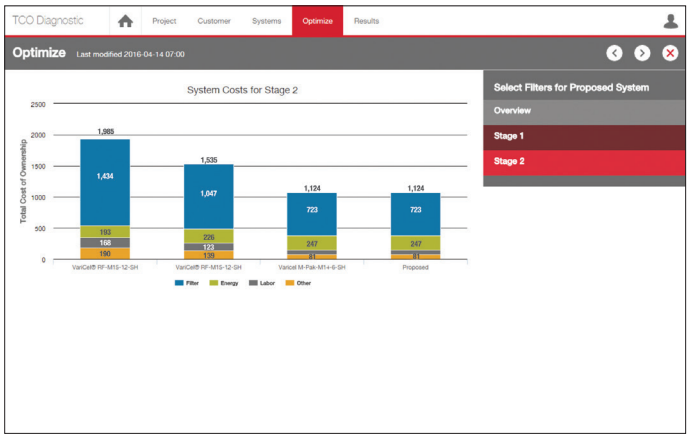


Key project and financial information, as well as key system parameters, are added for the project. Information is changeable to accommodate test sensitivity.

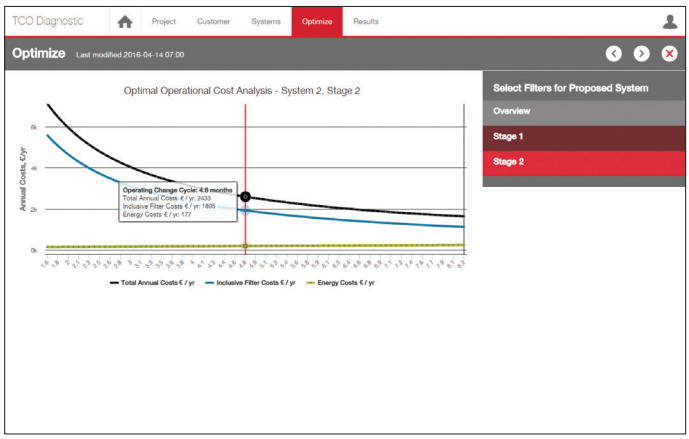


Systems user interface with selected filters in the current system and two optimised options is presented. Key data, such as filter count, sizes and costs are added for each system stage.

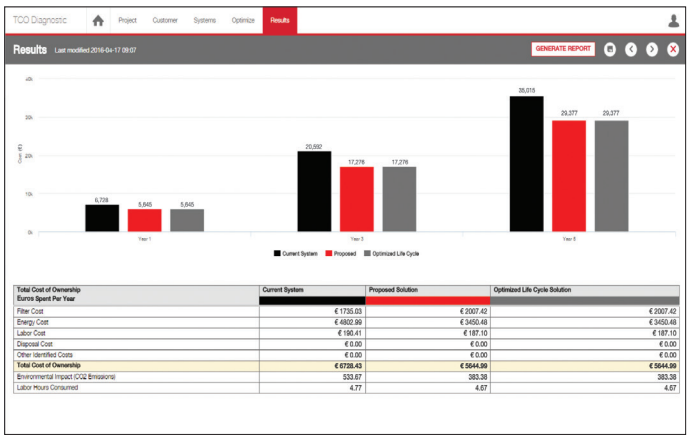
TCO Diagnostic®



This depicts filter cost optimisation relative to annual costs for filters, energy, labour, and other total cost of ownership for the Current System, two Optimised Options, and the Proposed System.



Service Cycle Optimiser allows the user to adjust the service cycle and see the values for total cost, energy cost, and filter cost change.



The results depict the Current System cost versus selected Proposed Solution and Optimised Life Cycle Solution.

The most accurate methodology and data sources

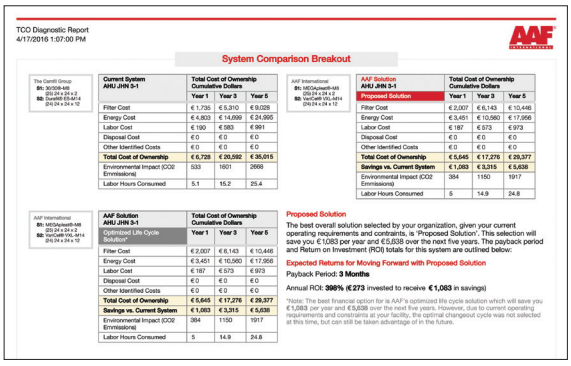
TCO Diagnostic is more than the typical software program that calculates total cost of ownership using generalised data and user assumptions, which in reality "assumes" the answer. The basis of TCO Diagnostic is to use the real-life, local filter performance information from your air handlers and their current state. This information is then benchmarked against standard loading testing results for the specific class of filters you use. It is your facility's information that is the basis for determining total cost of ownership on your current filters and the protocol under which they are being used.

The alternative filters, benchmarked against the current filters, are evaluated using your operating parameters. TCO Diagnostic will calculate a series of total cost of ownership solutions over a wide range of service cycles. The wide perspective of ownership costs over the service cycles allows you to make comprehensive decisions, as the cost of maintaining the same protocol with alternative filters can be compared. This service cycle optimiser dynamically presents the values for total cost, energy cost, and filter cost change, identifying significant financial and operational improvement opportunities.

TCO Diagnostic solutions have been validated by direct energy logging systems to ensure that the total cost of ownership calculations are accurate. It is this ability to combine real-life, local filter performance results with local operating costs that differentiates TCO Diagnostic from other total cost of ownership programmes.

Optimising to meet the needs of your facility will result in a Proposed Solution that takes your current operating requirements and constraints into account. This Proposed Solution will be the best optimum filter for each stage, based on the facility's objectives. A report utilising this real-time data is generated providing reliable, verifiable analysis:

- System Comparison Overview and Breakout
- Total Cost of Ownership Assessment
- Performance Analysis
- Annual Cost savings
- Environmental Impact Improvement
- Expected Returns



The first step in optimising your clean air spending

Executives and Facility Management teams need the support of a trusted advisor who can perform Air Filtration Audits and Diagnostics, to ensure that the most optimal effective solution is selected and installed in their air filtration systems. A thorough air filter audit of your HVAC Systems is the first step, in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilise TCO Diagnostic to identify how you can perform even better.

Our locally optimised filtration analysis will provide the highest level of air filtration solutions, while minimising your total life cycle costs. We do this by taking a true consultative and technical approach to understanding your complete air filtration needs, application, and business goals, to optimise your performance and lower your total cost of ownership.

A long history of technical knowledge

Only AAF has a long history with deep, technical knowledge and archives to bring the experience, expertise, and reliable data to the customer. Our mission is to help you protect your environment, reduce your business risk, and optimise your clean air related spending. We will always strive to invest our time and expertise to help you improve your business, not just to sell you a product.

AAF operates its Clean Air Innovation & Research Center (Clean AIR Center) near its World Headquarters in Louisville, Kentucky.

AAF ISO 16890 Testing Facility

AAF Sales Offices

Austria and Eastern Europe
AAF Luftreinigungssysteme
Gesellschaft m.b.H.
Campus 21, Europaring F12/401
2345 Brunn am Gebirge
Phone: +43 2236 677 628
Fax: +43 2236 677 628-1
Email: sales.austria@aafeurope.com

Dinair Finland
Dinair Clean Air,
Koivuvaarankuja 2,
01640 Vantaa
Phone: +358 10 3222610
Fax: +46 (0)143-125 81

France
AAF S.A.
9, Avenue de Paris
94300 Vincennes
Phone: +33 143 984 223
Fax: +33 158 641 142
Email: sales.france@aafeurope.com

Germany
AAF-Lufttechnik GmbH
Robert-Bosch-Straße 30-32
64625 Bensheim
Phone: +49 6251 80368-0
Fax: +49 6251 80368-20
Email: sales.germany@aafeurope.com

Great Britain and Ireland
Air Filters Ltd (AAF International)
Bassington Lane, Cramlington
Northumberland NE23 8AF
Phone: +44 1670 591 790
Fax: +44 1670 590 262
Email: airfilter@aafeurope.com

Greece
AAF-Environmental Control Epe
1 Ifaistou & Kikladon
15354 Glika Nera
Phone: +30 210 663 20 15
Fax: +30 210 663 51 09
Email: greece@aafeurope.com

Italy
AAF S.r.l.
Via Friuli, 28/30
21047, Saronno (VA)
Phone: +39 02.9624096
Fax: +39 02.9606409
Email: sales.italy@aafeurope.com

Dinair Norway
Dinair Ekonomifilter AS
Prof Birkelands vei 36
1081 Oslo
Phone: +47 22 90 59 00
Fax: +47 22 90 59 09

Spain
AAF S.A.
Severo Ochoa 38, Edificio B2, Planta 2,
Modulo 6-7, P.A.E. Casablanca I
28108 Alcobendas - Madrid
Phone: +34 916 624 866
Fax: +34 916 624 275
Email: info@aaf.es

Dinair Sweden
Dinair AB
Hamngatan 5
SE-592 30 Vadstena
Phone: +46 (0)143-125 80
Fax: +46 (0)143-125 81

Netherlands
AAF Verkoop Nederland
Phileas Foggstraat
7800 AC Emmen
Phone: +31 591 664 466
Fax: +31 591 664 477
Email: aaf.verkoop@aafeurope.com

Turkey
AAF Hava Filtreleri ve Ticaret A.S.
Zumrutevler Mahallesi
Nil Caddesi No : 4 A Blok / DAIKIN
Binasi Kat 3
34852 Maltepe - Istanbul
Phone: +90 216 449 51 64
Fax: +90 216 449 5150
Email: bilgi@aaf.com.tr

AAF International
European Headquarters
Robert-Bosch-Straße 30-32, 64625 Bensheim
Tel: +49 6251 80368 – 0, Fax: +49 6251 80368 – 20
aafintl.com

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