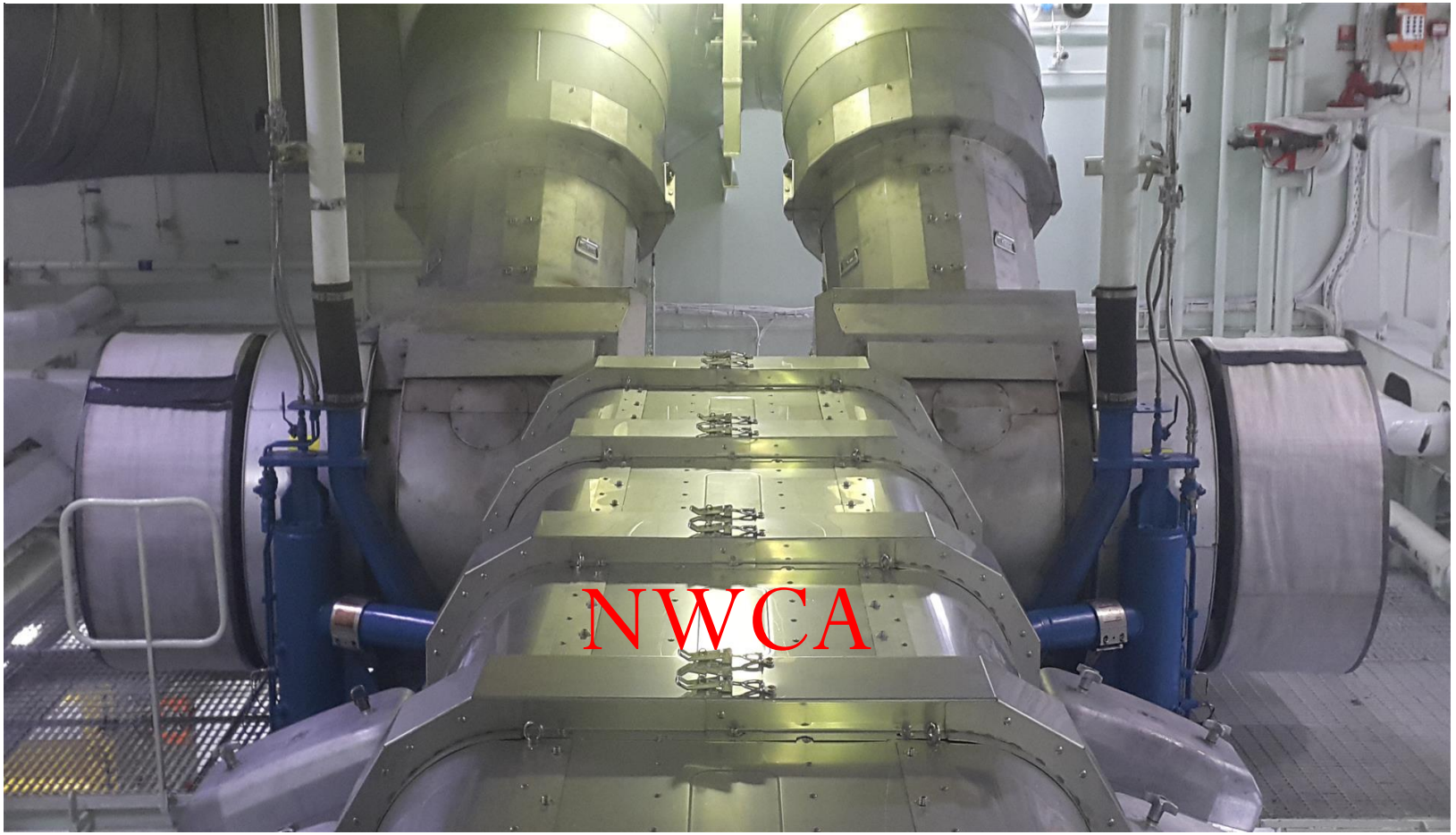
NorthWest
CLEAN AIR COMPANY INC.



ABOUT NWCA

As the market leading provider of high performance permanent air filters to the Marine Industry, our mission is to provide a sustainable return on investment so that our customers can maximize their economic and environmental bottom lines.

Our key customer base is worldwide and is comprised of leading cruise lines, ferry companies, merchant carriers and superyachts.

NWCA - A WISE SUSTAINABILITY STRATEGY

The Better the Turbocharger Performance

The Lower the Fuel Consumption

THE FIRST LINE OF DEFENCE

NWCA SERIES 2 WASHABLE TURBOCHARGER AIR FILTERS

NWCA Series 2 washable turbocharger air filters are custom fabricated to fit the silencer dimensions of leading turbocharger manufacturers such as ABB, MAN and Mitsubishi MET.

DIRECT BENEFITS:

- Low initial pressure drop
- Designed to reduce compressor contamination and protect the charge air cooler
- A key factor in the reduction of SFOC due to lower average differential pressure values across the cooler
- Complete silencer intake coverage eliminates blow-by
- Reduced filter maintenance time. Easily cleaned with a degreaser agent
- Eliminates disposable roll media inventories, cutting time and disposal costs of used filter media
- Significant cost savings (10 year warranty)
- Environmentally Responsible
- Endorsed by Wartsila

IMPROVING ENGINE FUEL AND OPERATIONAL EFFICIENCY

(excerpt from Wärtsilä Services Business White Paper)

SFOC EXAMPLE CALCULATIONS

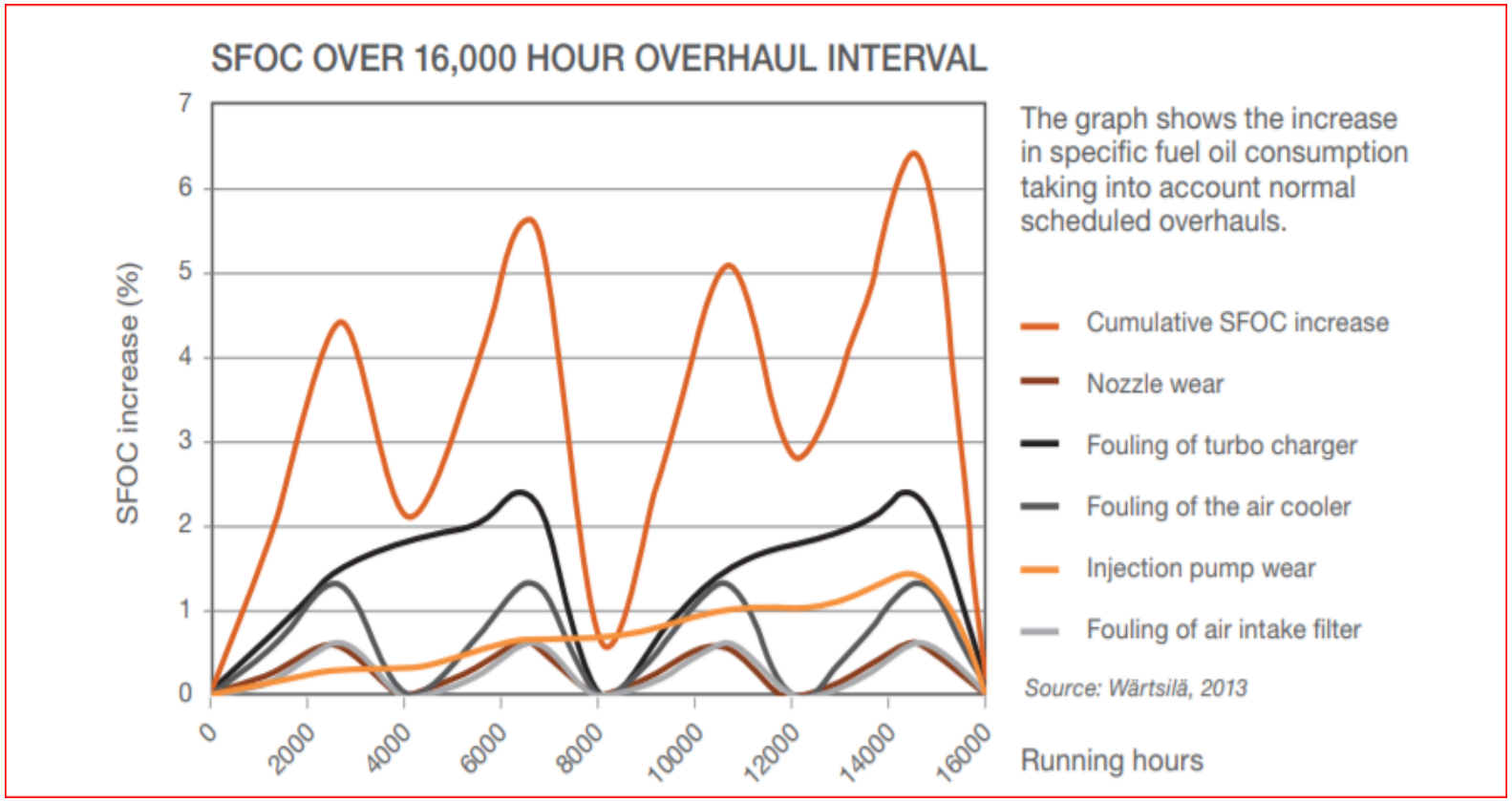
Calculations of increases in specific fuel oil consumption caused by various factors.

All examples are maximum loss of fuel calculations for 6000 operating hours and 5000 kW output.

Effect of equipment condition on SFOC	Loss of fuel
✓ **Turbocharger: partly blocked or dirty nozzle ring, turbine or compressor** Increased fuel consumption ~3g/kWh	90,000 kg
✓ **Dirty intake air filters** Δp /diff press increase 50 mm H2O Increased consumption ~2g/kWh	60,000 kg
✓ **Partly blocked charged air coolers** Δp increase 100 mm H2O Increased consumption ~2g/kWh	60,000 kg
Worn injection pump elements Increased fuel consumption ~5g/kWh	150,000 kg
Worn injection nozzles Increased fuel consumption ~2g/kWh	60,000 kg
Increased exhaust gas back pressure Back pressure increase 100 mm H2O Increased fuel consumption 0.3g/kWh	9,000 kg

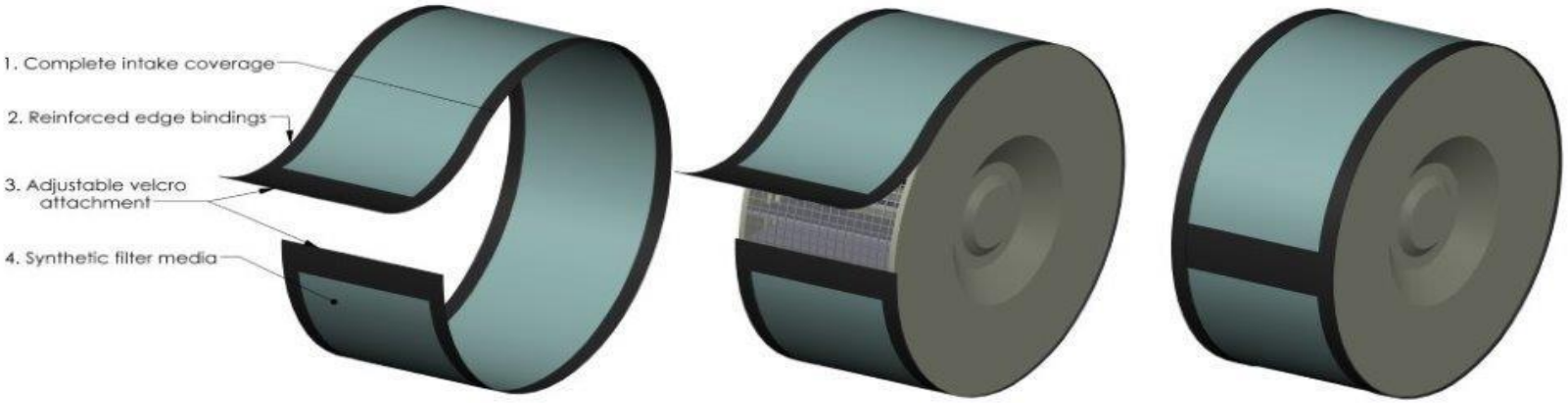
IMPROVING ENGINE FUEL AND OPERATIONAL EFFICIENCY (cont'd)

(excerpt from Wärtsilä Services Business White Paper)



INSTALLATION 1 - EASE OF INSTALLATION

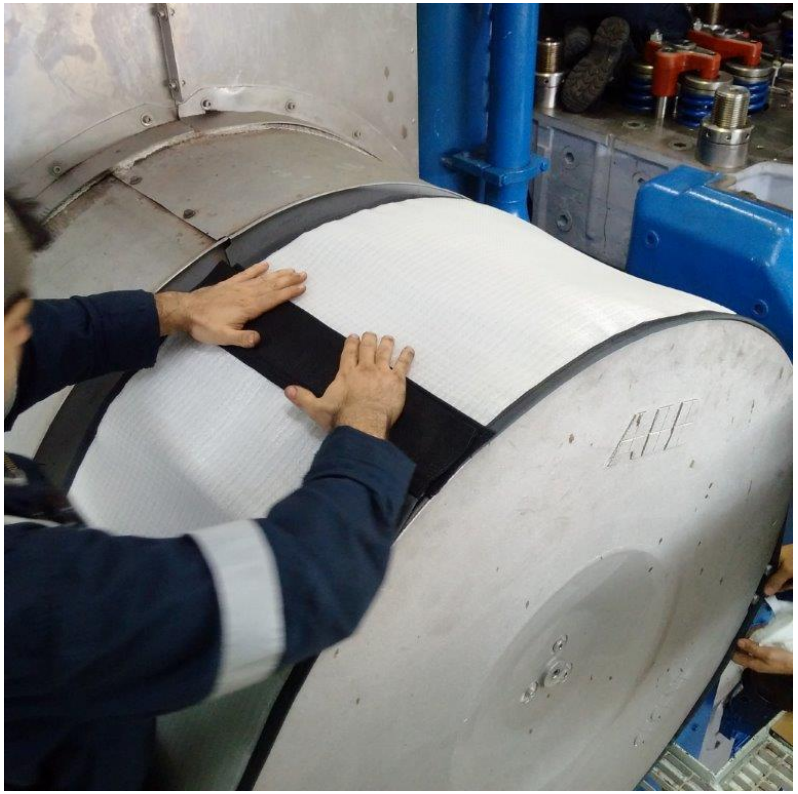
NWCA Series 2 Washable Turbocharger Air Filter



Simplicity at its best

NorthWest CLEAN AIR COMPANY INC.

INSTALLATION 2



Typically fitted in under one minute

INSTALLATION 3

Adjustable velcro attachment

INSTALLATION 4

Before - Viledon

After - NWCA Series 2

RECOMMENDED MAINTENANCE PROCEDURES

Examples of loaded filters

Oil mist build up

The engine room air which passes through the T/C intake filter is comprised of airborne dust, salt particles and oil mist.

- To effectively remove these captured contaminants from a loaded filter, employ one of the following methods.

OPTION 1 - EASILY CLEANED

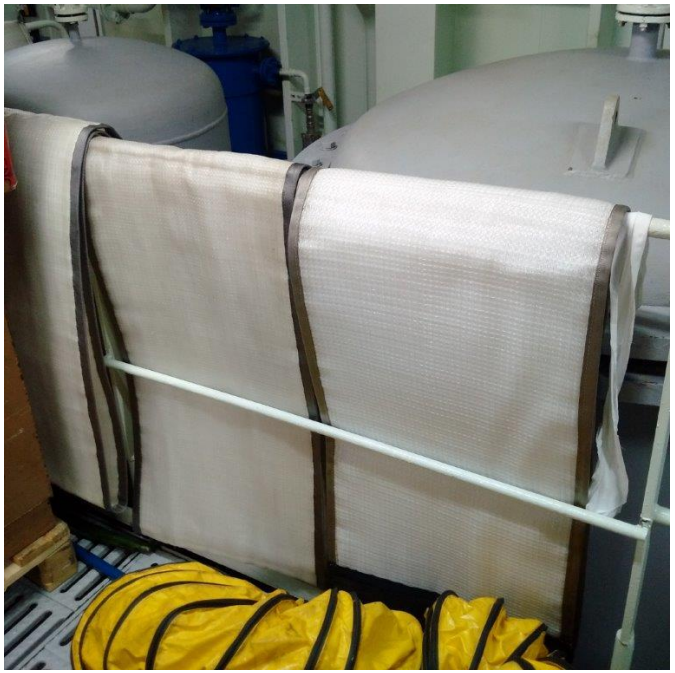
Using a soak tank immerse the filter element in a degreaser agent for one to two hours, rinse and hang to dry

OPTION 2 – ULTRASONIC

Fold the filter element and place in an ultrasonic cleaning machine using a degreaser bath.
Set the temperature control to NO HEAT.
Clean for one to two hours, rinse then hang to dry.

Degreaser recommendations: Aquabreak PX or EnviroClean

CLEANED FILTERS – Air Dry



CLEANING FREQUENCY

Scheduled maintenance should occur approximately every two weeks, however it is recommended that the change out time is increased or decreased dependant on condition monitoring by ship staff.

For marine diesel engines fitted with two turbochargers, it is recommended that both air filter elements are cleaned and replaced at the same time.

Note: Tests were conducted to establish the pressure drop values before and after cleaning. Results show a return to original condition.

TEST 1

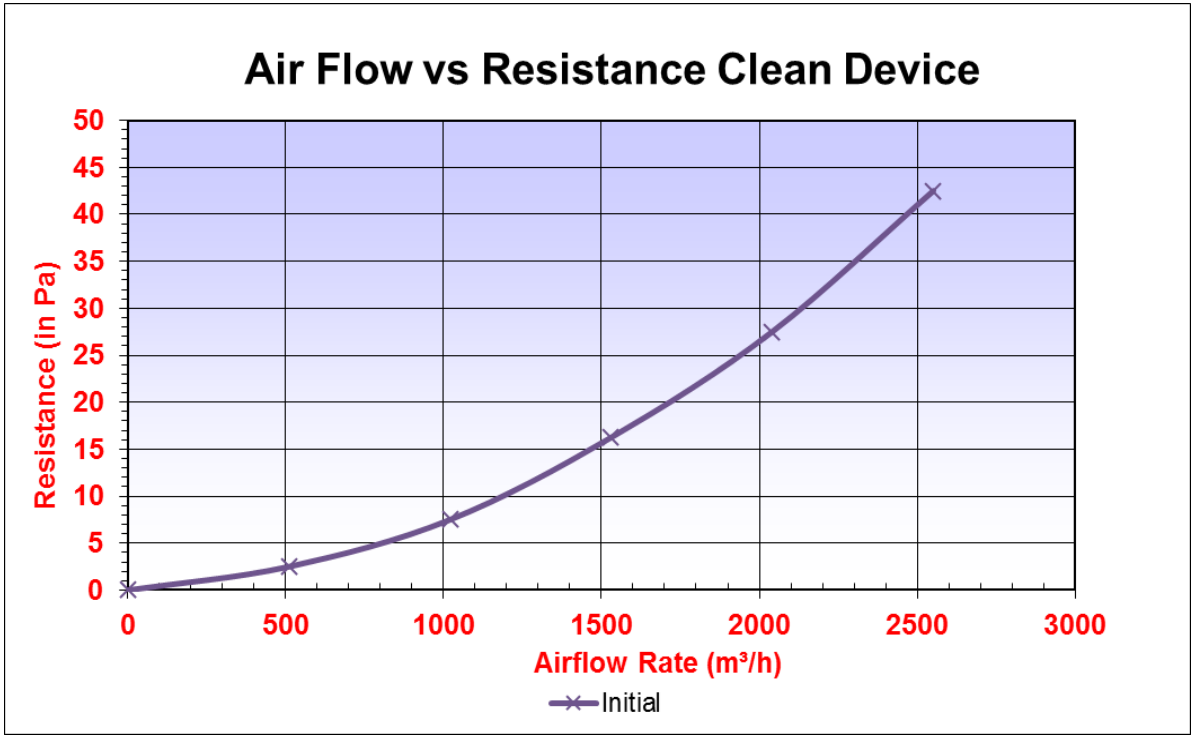
Air Flow vs. Resistance Chart

Delta P measurements - test dust loading

Manufacturer: North*West* Clean Air Co Inc. (NWCA)
Filter Test Method: ASHRAE 52.2-2017, **Loading Dust Type:** ASHRAE #1
Model: T/C – MAR-T

17-209-1 Initial			
Data - Air Flow vs Resistance (Clean Device)			
Airflow (CFM)	Resistance (in WG)	Airflow (m3/hr)	Resistance (Pa)
0	0	0	0
300	0.01	510	3
600	0.03	1020	8
900	0.07	1530	16
1200	0.11	2040	28
1500	0.17	2550	43

Data- Air Flow vs. Resistance



TEST 2

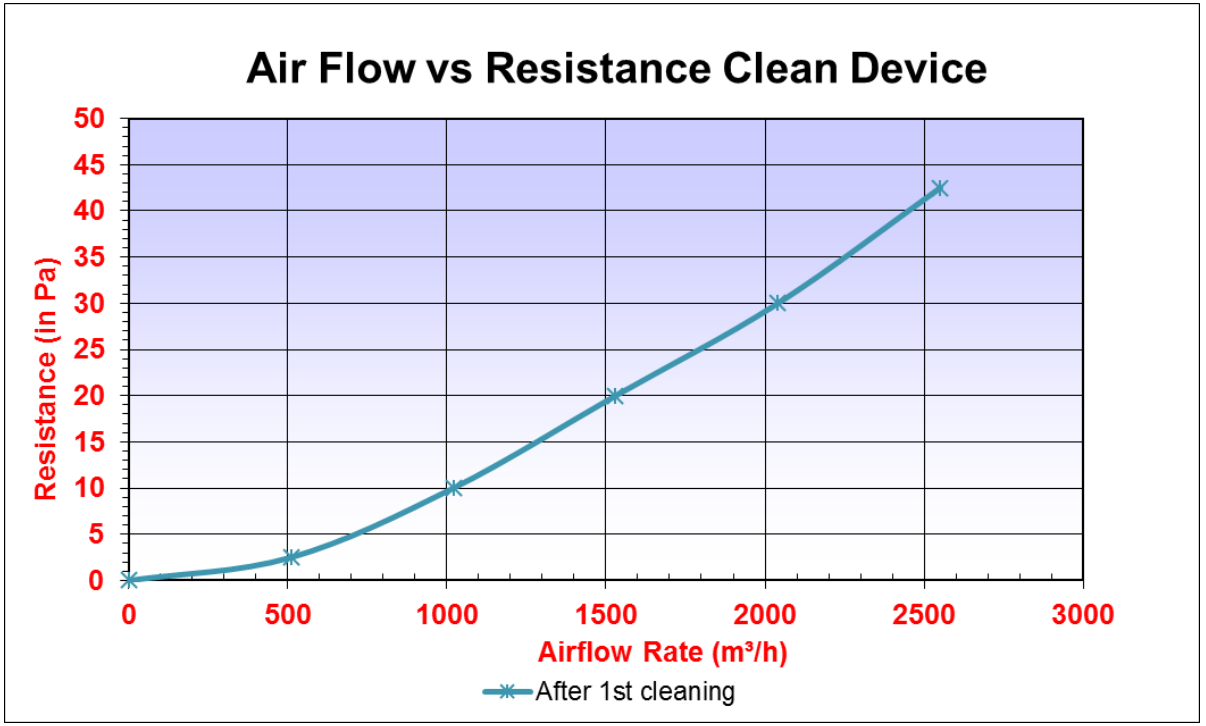
Air Flow vs. Resistance Chart

Delta P measurements after cleaning of loaded filter

Manufacturer: North*West* Clean Air Co. Inc. (NWCA)
Filter Test Method: ASHRAE 52.2-2017, **Loading Dust Type:** ASHRAE #1
Model: T/C – MAR-T

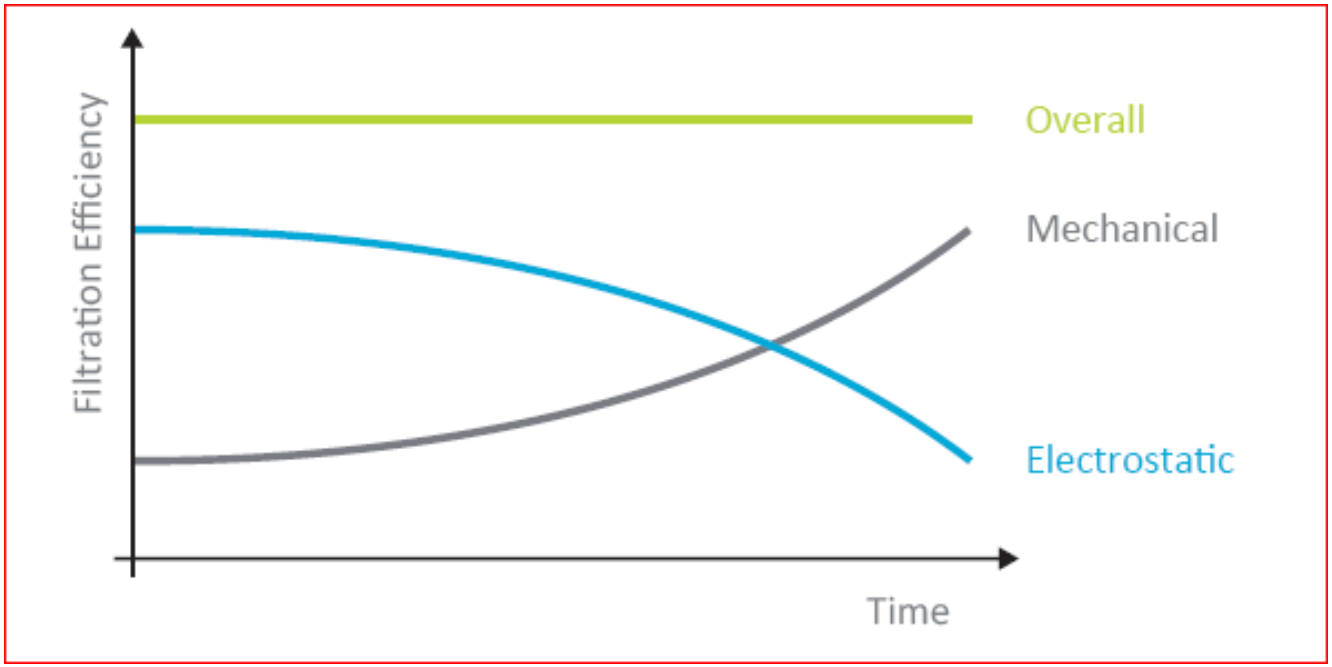
17-209-2 1st Cleaning			
Data - Air Flow vs Resistance (Clean Device)			
Airflow (CFM)	Resistance (in WG)	Airflow (m3/hr)	Resistance (Pa)
0	0	0	0
300	0.01	510	3
600	0.04	1020	10
900	0.08	1530	20
1200	0.12	2040	30
1500	0.17	2550	43

Data- Air Flow vs. Resistance



ELECTROMECHANICAL AIR FILTRATION – HOW IT WORKS

During the initial stage of filtration, a synthetic filter predominately attracts dust particles by an electrostatic charge that is supplemented by a lower level of mechanical filtration. As the filters fibres become coated in dust particles the electrostatic charge, although still present in the fibre, is shielded by the captured dust particles and becomes less effective. This reduction, however, is counteracted by the increase in mechanical filtration efficiency that the growing dust cake provides. So while electrostatic filtration fails, mechanical separation increases and nullifies the loss. *Simon Hughes, Vokes Air*



www.nwca.ca

43° 39' N , 79° 22' W