

# Rail Delivery Group



## RDG Guidance: Maintenance of On-Train HVAC Modules & Filters during the COVID-19 Pandemic

Version	Date	Author	Comment	Reviewed by	Authorised by
1.1	26/05/2020	Paschal Anozie	Initial Draft	Neil Ovenden Mark Molyneux	Neil Ovenden
1.2	16/06/20	Paschal Anozie	COVID-19 virus viability on material clarifications (Section 2).		Neil Ovenden

## 1. Purpose and Scope

This Guidance Note describes good practice that organisations should consider when reviewing their Heating, Ventilation, and Air Conditioning (HVAC) maintenance instructions during the current COVID-19 pandemic. The information provided is based on advice given by the World Health Organisation (WHO) and Public Health England (PHE) on the COVID-19 virus, together with analysis of information provided by GB Train Operating Companies regarding maintenance regime, frequency, required minimum Personal Protective Equipment (PPE) and filter grades.

As the country gradually recovers from the pandemic and rail transport returns to normal operation, organisations need to ensure that depot staff are continued to be provided with relevant, necessary PPE and that take all the necessary health and safety precautions while carrying out their day to day maintenance tasks.

## 2. Modes of Transmission of the COVID-19 Virus

According to the World Health Organisation (WHO)<sup>1</sup> the COVID-19 virus transmission is mainly through respiratory droplets propagated by coughing or sneezing which contaminates surfaces which is spread via hand to mouth, nose or eyes after contact. The respiratory droplet ranges in size from  $>5\mu\text{m}$  -  $10\mu\text{m}$  in diameter. Tests have shown detection of the COVID-19 virus in an aerosolised air sample (pressurised), generally considered to be particles  $<5\mu\text{m}$  in diameter and that can remain in the air for a period of time.

A recent publication from Harvard Medical School<sup>2</sup> notes that “A person infected with coronavirus — even one with no symptoms — may emit aerosols when they sneeze, cough or talk. Aerosols are infectious viral particles less than 2.5 microns that can float or drift around in the air for up to three hours”.

### Virus Decay Rate

The decay rate of the virus varies based on the materials that they land on and end up in contact with. A recent publication<sup>3</sup> by the New England Journal of Medicine on aerosolised air virus samples on different materials showed viral viability as follows:

Material	Viral Half-life (hours)
Aerosols	1.1
Cardboard	3.5
Steel	5.6
Plastic	6.8

Transmission of the COVID-19 virus can occur by direct contact with infected people emitting the virus and also by indirect contact with surfaces on which the virus is resting, in the

<sup>1</sup>Modes of transmission of virus causing COVID-19

<https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>

<sup>2</sup> How does coronavirus spread?

<https://www.health.harvard.edu/diseases-and-conditions/covid-19-basics>

<sup>3</sup> [https://www.nejm.org/doi/suppl/10.1056/NEJMc2004973/suppl\\_file/nejmc2004973\\_appendix.pdf](https://www.nejm.org/doi/suppl/10.1056/NEJMc2004973/suppl_file/nejmc2004973_appendix.pdf)

immediate environment. However, the amount of virus decreases over time, as described above, on contact surfaces, therefore implying that the risk of infection from touching these surfaces would also decrease over time.

### 3. Key Areas to Consider

#### 3.1. HVAC Filters

It is reported by Train Operating Companies that the HVAC filters used in the rail industry are made from pleated paper, foam and fabrics (synthetic & polyester) framed in a cardboard (Figure 1). This filter media can filter untreated air to a level at least equivalent to grade G4 in accordance with the EN779 classifications (now superseded by ISO 16890), which is within the COVID-19 respiratory droplet size, but potentially above the Covid-19 aerosol size, as shown in the table below.

EN779	ISO 16890	Particles size	Filtration Efficiency
COVID-19 Respiratory Droplet		>5µm - 10µm	
COVID-19 Aerosol		0.1µm < 5µm	
Filter Grade G4	ISO Coarse	>5µm	High

Therefore, it is plausible that the filter and its frame and associated ductwork may contain traceable viral droplets where air recirculation within the passenger saloon or cab has been occurring. However, the viral droplet viability on filter and duct material is very low, given the materials it is made from, but not zero.



Figure 1: HVAC Filter Samples

Comparison to Other Alternative Filters

Air filters are classified based on the ‘*Minimum Efficiency Reporting Value (MERV) Rating system*’ which is used internationally as a standard means of evaluating their efficiency. This system measures an air filters ability to capture particles and pollutants of different sizes (Figure 2) and trap them within the filter. The MERV scale for pleated filters starts from 6 and goes up to 16. The table below shows filters MERV ratings and their equivalent EN779 & ISO 16890 classifications.

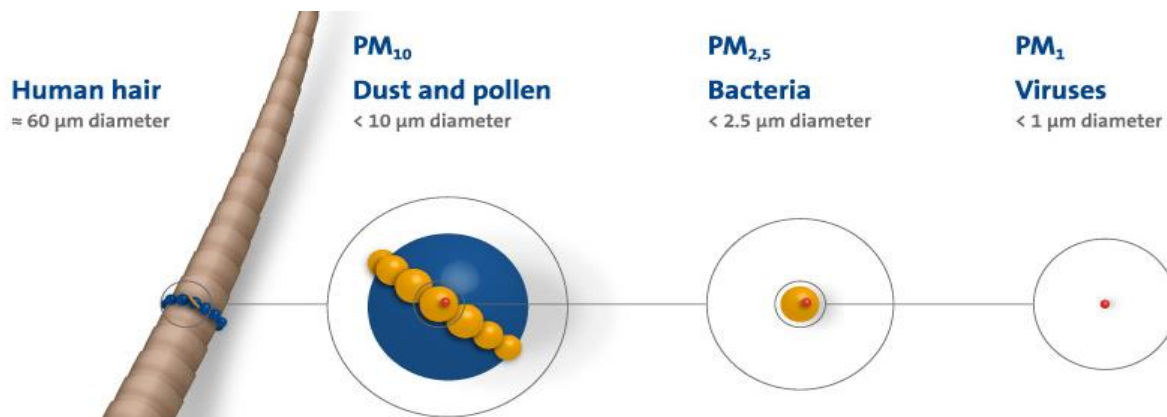


Figure 2: Particle sizes sample

Group	MERV Rating	EN779 Class	ISO 16890 Rating	Particles size - Efficiency		
				.3 – 1.0µm	1 - 3.0µm	3 - 10µm
Coarse	1 - 4	G1	ISO Coarse	-	-	< 20%
	5	G3				
Coarse	6 - 8	G4 (As typically fitted to train HVAC systems)	ISO Coarse	-	-	35% – 49% 50% – 69% 70% - 85%
Medium	9	M5 – M6	ISO ePM10 (≤10µm)	20%	35% - 49%	≥ 85%
	10				50% - 64%	≥ 85%
	11				65% - 79%	≥ 85%
	12				35%	≥ 90%
	13				50%	80%
Fine	14	F7 – F8	ISO ePM2.5 (≤2.5µm)	75% – 84%	90%	95% & above
	15			85% – 94%	90%	
	16	F9		95% & above	95%	
HEPA	-	H10 – H14	ISO ePM1	≥99.5%	≥99.95%	≥99.5%
ULPA	-	U15 – U17	(≤1µm)	≥99.99%	≥99.99%	≥99.99%

### 3.2. Air extraction components

These are the air extraction ducts, vents, fans and grilles within the passenger saloon, cab and kitchen (onboard catering), where the COVID-19 virus viability time will depend on the material as outlined in [section 2](#).

## 4. Maintenance Task

### 4.1. Filter Change

To be risk assessed and the following options taken into account

- To have some time gap between end of service and maintenance to account for the viral viability timeframe
- To be handled with caution and avoid stacking filters on seats.
- To be bagged once removed
- To be disposed of in accordance to each TOCs documented and risk assessed procedure

### 4.2. Air extraction components

To be risk assessed and the following options to be taken into account

- Where only a short time period, as informed by risk assessment, has elapsed between end of service and maintenance intervention. Surface disinfection with 0.1% Sodium Hypochlorite (bleach) or 62-71% ethanol-containing products, or products with similar performance should be considered. As these have been found to significantly reduce levels of the virus on surfaces within a 1-minute exposure time. For more details on the recommended cleaning products see - [RDG Guidance: The Cleaning of Train Interiors during the COVID-19 Pandemic](#).

### 4.3. HVAC Module Repair and Change.

Same as in [section 4.1 and 4.2](#)

## 5. Personal Protective Equipment (PPE)

The minimum PPE required to carry out HVAC maintenance tasks shall align with the perceived level of potential exposure to the virus, and to other hazards directly or indirectly. Suitable risk assessments may identify that some or all of the following PPE should be provided to all staff participating in HVAC modules and filters maintenance tasks:

- Disposable gloves in compliance with EN374 requirements
- Safety Footwear
- Safety Eyewear
- Disposable Overalls
- Dust, or other masks
- Hard Hats – (during HVAC module change or repair)

Regarding the *disinfectant chemicals* - The appropriate risk assessments informed by supplier COSHH documents should be carried out to determine any additional PPE, or procedures required when using the product(s).

Hand hygiene - Hands should be washed with soap and water for a minimum of 20 seconds after all PPE is removed.

## **6. Maintenance Regime - Filters and Air Extractors**

The maintenance regime is designed to keep the HVAC system performing at an optimal level as documented in the vehicle maintenance instructions. However, Train Operating Companies that have chosen to implement changes to the operation of the on-train HVAC system and/or to air filtration equipment as per the considerations contained in the RDG guidance on rolling stock ventilation during the COVID-19 pandemic; should review the associated vehicle maintenance instructions – since they may no longer be appropriate to keep the modified HVAC system performing at an optimal level.