

CLAIMS

1. A self-cleaning particulate separator unit (10) for use in a ventilation system (1) configured to receive a flow (F) of exhaust air containing pollutants (Pa, Pb, Pb', Pc), wherein said particulate separator unit (10) comprises at least one conduit (11-16) with an outer surface (28), the conduit (11-16) being configured to receive a refrigerant (20), wherein the conduit (11) is configured to have a first temperature (T_{C1}) and a second temperature (T_{C2}), wherein when the conduit (11) has the first temperature (T_{C1}), condensation and a particle layer (25) of pollutants (Pa, Pb, Pb', Pc) is formed on the outer surface (28) of the conduit (11-16), and wherein when the conduit (11) has the second temperature (T_{C2}) the condensation freezes and subsequently cracks the particle layer (25) such that the particle layer (25) is detached from the conduit (11-16).
2. The self-cleaning particulate separator unit according to claim 1, wherein the refrigerant (20) is configured to have a first temperature (T_{R1}) and a second temperature (T_{R2}), wherein when the refrigerant (20) has the first temperature (T_{R1}) the conduit (11) has the first temperature (T_{C1}), and when the refrigerant (20) has the second temperature (T_{R2}) the conduit (11) has the second temperature (T_{C2}).
3. The self-cleaning particulate separator unit according to claim 2, wherein the second refrigerant temperature (T_{R2}) is in a range between 0 to -60°C , preferably between -3 to -20°C , and more preferably between -8 to -12°C .
4. The self-cleaning particulate separator unit according to any of the preceding claims, wherein the temperature of the conduit (11) is regulated by the flow of air (F).
5. The self-cleaning particulate separator unit according to claim 4, wherein the temperature of the conduit (11) is regulated by the flow of air (F) by reducing the flow of air.

6. The self-cleaning particulate separator unit according to claim 4 or 5, further comprising a shunting valve (31), wherein the temperature of the conduit (11) is regulated by the flow of air (F) by shunting in cooler air into the flow of air.
- 5 7. The self-cleaning particulate separator unit according to any of the preceding claims, wherein the conduit (11) is caused to assume the second conduit temperature (T_{C2}) by causing the refrigerant (20) to assume the second refrigerant temperature (T_{R2}) by regulating the temperature of the refrigerant.
- 10 8. The self-cleaning particulate separator unit according to any of the preceding claims, wherein the first temperature of the conduit (11) is above 0 degrees Celsius and the second temperature of the conduit (11) is below 0 degrees Celsius.
9. The self-cleaning particulate separator unit according to any of the
15 preceding claims, wherein the conduit (11) is arranged to first have a first temperature, then to have the second temperature, and then to have a temperature at least above 0 degrees Celsius.
10. The self-cleaning particulate separator unit according to any of the
20 preceding claims, wherein the conduits (11-16) are arranged in at least two rows of conduits (11'-16') wherein the conduits (11a-e) of the first row of conduits (11') are arranged to overlap the spaces between the conduits (12a-d) in an adjacent row of conduits (12').
- 25 11. The self-cleaning particulate separator unit according to any of the preceding claims, wherein the conduits (11-16) are arranged in at least two sections (11'', 14'') with a distance D1 there between.
12. The self-cleaning particulate separator unit according to any of the
30 preceding claims, wherein the conduits (11-16) are arranged in a circular, wavelike, (co)sinusoidal, or square formation.

13. The self-cleaning particulate separator unit according to any of the preceding claims, wherein the conduits (11-16) comprises a hollow portion (22).

14. The self-cleaning particulate separator unit according to claim 6, wherein
5 the conduits (11-16) are straight, bent, circular, spherical, square or shaped in any other geometrical configuration enabling the hollow portion (22) of the conduits (11-16) to receive the refrigerant (20).

15. The self-cleaning particulate separator unit according to any of the
10 preceding claims, wherein the particulate separator unit (10) comprises a collection means (35) configured to collect condensation, ice and pollutants (Pa, Pb, Pb', Pc).

16. The self-cleaning particulate separator unit according to any of the
15 preceding claims, wherein the particulate separator unit (10) comprises a source of moisture such as a sprinkle device (30).

17. A ventilation system comprising a self-cleaning particulate separator unit (10) according to any one of claims 1 to 16.

18. The ventilation system according to claim 17, further comprising a pump
20 (40) configured to pump the refrigerant (20) to the particulate separator unit (10) and into the conduits (11-16) through an inlet duct (21a) and out from the conduit (11-16) through an outlet duct (21b).

19. The ventilation system according to claim 17 or 18, wherein the
25 collection means (35) is connected with a chamber (29) for storage of liquids via a pipe (37).

20. The ventilation system according to any of claims 17, 18 or 19 and
30 comprising a self-cleaning particulate separator unit (10) according to claim 16, further

comprising a filter (31) configured to filter the liquid to be sprinkled by the sprinkle device (30) in order to remove pollutants (Pa, Pb, Pb', Pc).

21. The ventilation system according to any of claims 19 to 20, wherein the
5 chamber (29) for storage of liquid is connected to the sprinkler device (30).

22. The ventilation system according to any of claims 19 to 21, wherein the
ventilation system (1) further comprises a heating device (42) connected to the chamber
(29).

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23. A method for self-cleaning of a particulate separator unit (10) according
to any of claims 1-16, wherein the method comprises the steps of:
- causing (702) the at least one conduit (11-16) to assume a first
temperature (T_{C1}), whereby condensation and a particle layer (25) of pollutants (Pa, Pb,
15 Pb', Pc) is formed on the outer surface (28) of the at least one conduit (11-16); and
- causing (706) the conduits (11-16) to assume a second temperature (T_{C2}),
whereby the condensation and the particle layer (25) freezes and subsequently cracks
(707) such that the particle layer (25) is detached from the at least one conduit (11-16).

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