CLAIMS

~~1. A respiratory therapy system configured to detect the presence of liquid water in a breathing gases respiratory conduit for use in respiratory treatment of a patient, the system comprising a controller configured to:~~

- ~~a) retrieve at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit;~~
- ~~b) determine a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal; and~~
- ~~c) determine the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.~~

~~2. The respiratory therapy system of claim 1, wherein the controller is further configured to:~~

- ~~a) determine at least one further first parameter associated with flow perturbations and/or pressure perturbations for at least one further portion of the received at least one first signal; and~~
- ~~b) determine the presence of liquid in the respiratory conduit further based at least in part on the at least one further first parameter meeting the first threshold.~~

~~3. The respiratory therapy system of claim 1 or 2, wherein the controller is configured to identify the gases flow perturbations and/or pressure perturbations for the associated portion of the retrieved at least one first signal based at least in part on a comparison between that at least one portion of the retrieved signal and a reference.~~

~~4. The respiratory therapy system of claim any preceding claim, wherein the controller is further configured to:~~

- ~~a) retrieve information indirectly related to gases flow and/or pressure;~~
- ~~b) determine a measure of at least one second parameter associated with the retrieved information, and wherein the determination the presence of liquid in~~

the respiratory conduit is further based at least in part on the measure(s) of the at least one second parameter meeting a second threshold.

5. The respiratory therapy system of claim 4, wherein the at least one second parameter is associated with one or more of:

a) a temperature of the gases flow;

b) an ambient temperature;

c) a humidity of the gases flow;

d) an ambient humidity;

e) device geographic location;

f) environment weather forecast ; and/or

g) altitude.

6. The respiratory therapy system of any preceding claim, wherein the at least one first parameter is associated with spikes caused by perturbations in gases flow and/or pressure.

7. The respiratory therapy system of any one of claims 3 to 6, wherein the reference is associated with an estimated gases flow and/or pressure of the respiratory conduit.

8. The respiratory therapy system of claim 7, wherein the estimated gases flow and/or pressure is estimated at least in part on a set gases flow and/or pressure profile of a respiratory therapy device operatively connected to the respiratory conduit, in use, and/or one or more properties or characteristics associated with the patient's respiration, such as any one or more of respiratory pattern/rate, tidal volume, minute volume, lung compliance or lung restriction.

9. The respiratory therapy system of claim 7, wherein the estimated gases flow and/or pressure is further estimated at least in part on an estimated leak of breathing gases between the respiratory conduit and the patient.

10. The respiratory therapy system of claim 9, wherein the estimated gases flow and/or pressure of the respiratory conduit is estimated at least in part on the known gases flow and/or pressure profile or setting of a respiratory therapy system operatively connected to the

~~respiratory conduit, subtracted by the estimated leaks between the respiratory conduit and the patient, in use.~~

~~11. The respiratory therapy system according to any preceding claim, wherein the at least one first parameter relates to any one or more of:~~

~~a) a frequency,~~

~~b) an intensity,~~

~~c) an amplitude,~~

~~d) a period between peaks,~~

~~e) a period of peaks,~~

~~f) a location of changes in the breath cycle, and/or~~

~~g) a duration of flow perturbations and/or pressure perturbations of the at least one first signal in view of a reference.~~

~~12. The respiratory therapy system of any preceding claim, wherein the controller is further configured to output a control signal, the control signal being output in response to the determination of presence of liquid water in the respiratory conduit.~~

~~13. The respiratory therapy system of claim 12, comprising a breathing gases conduit heater wire, or humidifier heater.~~

~~14. The respiratory therapy system of claim 13, wherein the control signal is configured to control the operation of the breathing gases conduit heater wire, or humidifier heater, so as to increase the gases temperature of the gases in the respiratory conduit in response to the determination of presence of liquid in the respiratory conduit.~~

~~15. The respiratory therapy system of claim 12, wherein the control signal is configured to determine, vary or control one or more operational settings of the system.~~

~~16. The respiratory therapy system of claim 15, wherein the one or more operational settings are associated with any one or more of varying humidity, varying temperature, and/or varying power to a heater operationally connected to the system.~~

~~17. The respiratory therapy system of claim 12, wherein the control signal is configured to provide feedback to an algorithm executable by the system, said algorithm being any one or more of:~~

~~a) a bilevel triggering algorithm,~~

~~b) a breath detecting algorithm, and/or~~

~~c) a flow limitation detection algorithm.~~

~~18. The respiratory therapy system of claims 12 to 17, wherein the system comprises any one of:~~

~~a) a humidifier;~~

~~b) a flow generator; and/or~~

~~c) a breathing gases respiratory conduit.~~

~~19. The respiratory therapy system of any previous claim, wherein at least one of the first parameter(s) is determined based at least in part on a frequency analysis of the at least one first signal.~~

~~20. The respiratory therapy system of claim 18, wherein the frequency analysis is based at least in part on a Fast Fourier Transform (FFT) of the at least one first signal.~~

~~21. The respiratory therapy system of any previous claim, wherein at least one first parameter associated with flow perturbations and/or pressure perturbations is determined based at least in part on a wavelet analysis of the at least one first signal.~~

~~22. The respiratory therapy system of any previous claim, wherein the controller is further configured to filter at least one of the first signal(s) using a filter prior to determining the presence of liquid water in the respiratory conduit.~~

~~23. The respiratory therapy system of any previous claim, wherein the controller is further configured to filter at least one of the first signal(s) using a filter prior to determining at least one of the first parameter(s).~~

~~24. The respiratory therapy system of claim 19, wherein the frequency analysis of the at least one first signal is based at least in part on at least one spectrogram associated with the at least one first signal.~~

~~25. The respiratory therapy system of any preceding claims, wherein the first threshold is derived using machine learning.~~

~~26. The respiratory therapy system of claim 3 or claims 4 to 25 when dependent on claim 3, wherein the second threshold is derived using machine learning.~~

~~27. The respiratory therapy system of any preceding claim, further comprising at least one of:~~

~~a) a respiratory therapy device for providing a flow of breathing gas to a user;~~

~~b) a humidifier;~~

~~c) a breathing gases delivery respiratory conduit;~~

~~d) a flow generator; and~~

~~e) a patient interface.~~

~~28. The respiratory therapy system of any preceding claim, wherein the controller is configured to:~~

~~retrieve the at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit from at least one sensor during a first measuring period, and~~

~~determine the presence of liquid in the respiratory conduit when the measure of the at least one first parameter exceeds the first threshold.~~

~~29. The respiratory therapy system of any preceding claim, wherein the controller comprises a controller of a flow generator of the respiratory therapy system.~~

~~30. The respiratory therapy system of claim 3, wherein the controller is configured to identify at least one portion or at least one further portion of the retrieved at least one first signal being associated with gases flow perturbations and/or pressure perturbations based at least in part on said comparison.~~

31. A computer implemented method configured to detect the presence of liquid in a breathing gases respiratory conduit of a respiratory therapy system for use in a respiratory treatment of a patient, comprising

a) retrieving, by a controller, at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit;

b) determining, by the controller, a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal; and

c) determining, by the controller, the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.

32. The computer implemented method of claim 31, further comprising

carrying out, in the controller, any one of the functional steps carried out by the controller of any one or more of claims 2 to 30.

33. A non-transitory computer readable medium comprising instructions, when executed by a processor/controller of a respiratory therapy system, which cause the respiratory therapy system to detect the presence of liquid water in a breathing gases respiratory conduit for use in a respiratory treatment of a patient by:

a) retrieving, by a controller, at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit,

b) determining, by the controller, a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal, and

c) determining, by the controller, the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.

34. A respiratory therapy system comprising:

a flow generator;

a humidifier;

a respiratory conduit

~~a patient interface coupled to the respiratory conduit to deliver a gases flow to a patient;~~

~~a sensor configured to determine pressure or flow of the gases flow;~~

~~a controller configured to control the flow generator to generate the gases flow; and the controller configured to:~~

~~a) retrieve at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit;~~

~~b) determine a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal; and~~

~~c) determine the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.~~

~~35. A high flow respiratory therapy system comprising:~~

~~a flow generator;~~

~~a humidifier;~~

~~a respiratory conduit~~

~~an unsealed interface coupled to the respiratory conduit to deliver a gases flow to a patient;~~

~~a sensor configured to determine pressure or flow of the gases flow;~~

~~a controller configured to control the flow generator to generate the gases flow and provide the gases flow to a flow set point, and the controller configured to:~~

~~a) retrieve at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit;~~

~~b) determine a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal; and~~

~~c) determine the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.~~

~~36. A pressure delivery system comprising~~

~~a flow generator;~~

~~a respiratory conduit;~~

~~a sealed interface coupled to the respiratory conduit to deliver a gases flow from the flow generator to a patient;~~

~~a sensor configured to determine pressure and/or flow of the gases flow;~~

~~a controller configured to control the flow generator to generate the gases flow to a set pressure;~~

~~the controller being configured to:~~

~~a) retrieve at least one first signal associated with or indicative of the gases flow and/or pressure in the respiratory conduit;~~

~~b) determine a measure of at least one first parameter associated with the gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal; and~~

~~c) determine the presence of liquid in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold.~~

~~37. The pressure delivery system of claim 36, comprising a humidifier.~~

~~38. The pressure delivery system of claim 36 or 37 configured to provide constant positive airway pressure therapy or may provide bilevel pressure therapy.~~

~~39. The system of any one of claims 34 to 38 further comprising a humidifier heater and/or a respiratory conduit heater, wherein, if liquid is detected, the controller is configured to control the humidifier heater and/or the respiratory conduit heater in order to at least partially evaporate the liquid in the respiratory conduit.~~

~~40. The system of claim 39 wherein the controller is configured to detect liquid and increase power to the respiratory conduit heater to at least partially evaporate the liquid.~~

~~41. The system of claim 39 or claim 40 wherein the controller is configured to detect liquid, the controller being configured to reduce power to the humidifier heater and increase power to the respiratory conduit heater to at least partially evaporate the liquid.~~

~~42. The system of any one of claims 34 to 41, wherein the flow generator comprises a blower, the controller being configured to increase power to the blower to increase blower speed such that high flow of gases are provided to at least partially evaporate the liquid.~~

1. A respiratory therapy system configured to detect the presence of liquid water in a breathing gases respiratory conduit for use in respiratory treatment of a patient, the system comprising a controller configured to:

a) retrieve at least one first signal associated with or indicative of a gases flow and/or pressure in the respiratory conduit;

b) determine a measure of at least one first parameter associated with gases flow perturbations and/or pressure perturbations for at least one portion of the retrieved at least one first signal;

c) determine the presence of liquid water in the respiratory conduit based at least in part on the measure(s) of the at least one first parameter meeting a first threshold; and

d) upon determination of the presence of liquid water in the respiratory conduit, increase the temperature within the respiratory conduit by controlling one or more operation setting(s) of components of the respiratory therapy system, so as to reduce the presence of liquid water.

2. The respiratory therapy system of claim 1, wherein the controller is further configured to:

a) determine at least one further first parameter associated with flow perturbations and/or pressure perturbations for at least one further portion of the received at least one first signal; and

b) determine the presence of liquid in the respiratory conduit further based at least in part on the at least one further first parameter meeting the first threshold.

3. The respiratory therapy system of claim 1 or 2, wherein the controller is configured to identify the gases flow perturbations and/or pressure perturbations for the associated portion of the retrieved at least one first signal based at least in part on a comparison between that at least one portion of the retrieved signal and a reference.

4. The respiratory therapy system of any preceding claim, wherein the controller is further configured to:

a) retrieve information indirectly related to gases flow and/or pressure;

b) determine a measure of at least one second parameter associated with the retrieved information, and wherein the determination the presence of liquid in the respiratory conduit is further based at least in part on the measure(s) of the at least one second parameter meeting a second threshold.

5. The respiratory therapy system of claim 4, wherein the at least one second parameter is associated with one or more of:

a) a temperature of the gases flow;

b) an ambient temperature;

c) a humidity of the gases flow;

d) an ambient humidity;

e) device geographic location;

f) environment weather forecast; and/or

g) altitude.

6. The respiratory therapy system of any preceding claim, wherein the at least one first parameter is associated with spikes caused by perturbations in gases flow and/or pressure.

7. The respiratory therapy system of any one of claims 3 to 6, wherein the reference is associated with an estimated gases flow and/or pressure of the respiratory conduit.

8. The respiratory therapy system of claim 7, wherein the estimated gases flow and/or pressure is estimated based, at least in part, on a set gases flow and/or pressure profile of a respiratory therapy device operatively connected to the respiratory conduit, in use, and/or one or more properties or characteristics associated with the patient's respiration, such as any one or more of respiratory pattern/rate, tidal volume, minute volume, lung compliance or lung restriction.

9. The respiratory therapy system according to any preceding claim, wherein the at least one first parameter relates to any one or more of:

a) a frequency,

b) an intensity,

c) an amplitude,

d) a period between peaks,

e) a period of peaks,

f) a location of changes in the breath cycle, and/or

g) a duration of flow perturbations and/or pressure perturbations of the at least one first signal in view of a reference.

10. The respiratory therapy system of any previous claim, wherein at least one of the first parameter(s) is determined based, at least in part, on a frequency analysis of the at least one first signal;

wherein the frequency analysis is optionally based, at least in part, on a Fast Fourier Transform (FFT) of the at least one first signal.

11. The respiratory therapy system of any preceding claim, wherein the system comprises any one of:

a) a humidifier;

b) a flow generator; and/or

c) a breathing gases respiratory conduit.

12. The respiratory therapy system of any preceding claim, further comprising a breathing gases conduit heater wire, or a humidifier heater.

13. The respiratory therapy system of claim 12, wherein the controller is configured to control operation settings of components of the respiratory therapy system by controlling an operation setting of the breathing gases conduit heater wire, or the humidifier heater.

14. The respiratory therapy system of claim 13, wherein the controller is configured to maintain the increased temperature in the respiratory conduit at least until the presence of liquid water is no longer detected.

15. The respiratory therapy system of claim 13 or 14, wherein the controller is configured to control the breathing gases conduit heater wire to heat to a higher power or

maximum power, and/or control the humidifier heater to a reduced power or switch the humidifier heater off.