CLAIMS

1. A method for a plurality of devices of a system, the method being performed by at least one controller and comprising:

for each device:

determining, by performing testing on the device~~,~~ using a testing facility where instant operating parameters can be controlled to be at a specific operating point, determined model values of a performance parameter of the device over an operating range of at least two operating parameters which affect the performance parameter, wherein each determined model value is representative of an operating point of the at least two operating parameters, the testing performed post manufacturing and prior to installation of the device,

wherein said determining further comprises measuring values of the performance parameter by operating the device over at least some of the operating range with respect to the at least two operating parameters, and extrapolating at least some of the determined model values of the performance parameter based on the measured values~~,~~;

storing to memory the determined model values of the performance parameter along with a time of said determining and a unique ~~device~~ identifier ~~for~~of the device, wherein said determined model values are stored in the memory as a stored multi-dimensional performance table;

detecting, when the device is installed in the system, ~~numerical properties~~during real-time normal operation of the system, detected model values of the performance parameter of the device, with respect to the at least two operating parameters, and storing to the memory the detected ~~numerical properties as determined~~ model values along with the unique identifier of the device and a time of said detecting, ~~and~~wherein said detected model values are stored in the memory as a detected multi-dimensional performance table;

comparing, when the device is installed in the system, in real-time during normal operation of the system, the detected ~~numerical properties with the stored determined model values~~multi-dimensional performance table of the performance parameter ~~from~~

~~different points in time;~~of the device, with respect to the at least two operating parameters, with the stored multi-dimensional performance table and with one or more earlier multi-dimensional performance tables detected when the device is installed in the system;

in response to said comparing ~~for any one of the devices satisfying criteria~~being within a respective threshold difference, repeating the detecting and the comparing; and

in response to said comparing exceeding the respective threshold difference, outputting an alert or sending the alert to a communication device~~.~~;

~~2.~~ wherein the performance parameter comprises power consumed by the device,

wherein at least one of the operating parameters includes at least one of pressure, flow, or temperature,

wherein at least one device comprises a pump.

2. The method as claimed in claim 1, wherein the testing is further performed pre shipping of the device.

3. The method as claimed in claim 1, wherein operation of one device in the system affects operation of at least one other device in the system with respect to the at least two operating parameters.

4. The method as claimed in claim 1, wherein the system comprises a chilled water plant, a heating circulating system, or a Heating Ventilation and Air Conditioning (HVAC) system.

~~5.~~ The method as claimed in claim 1, wherein ~~each model values comprise a value of the performance parameter in a standard unit of measurement.~~

~~6. The method as claimed in claim 1, wherein the model values comprise coefficients.~~

~~7. The method as claimed in claim 6, wherein the coefficients mathematically modify a rated performance parameter value of the device.~~

~~8. The method as claimed in claim 7, wherein the rated performance parameter value is a design day performance parameter value.~~

~~9. The method as claimed in claim 7, wherein the coefficients comprise at least one or both of a multiplier or an exponential of the rated performance parameter value of the device.~~

~~10. The method as claimed in claim 6, wherein the memory stores one or more equations, and wherein the coefficients are for use in the one or more equations.~~

5. ~~11. The method as claimed in claim 1, wherein said~~the ~~determining further comprises~~ measuring values of the performance parameter is in a standard unit of measurement ~~by operating the device over at least some of the operating range with respect to the at least two operating parameters~~.

6. ~~12.~~ The method as claimed in claim ~~11~~1, wherein said determining further comprises interpolating ~~or extrapolating~~ at least some of the determined model values of the performance parameter based on the measured values.

7. ~~13.~~ The method as claimed in claim 1, wherein, for said comparing, the method further includes receiving, from one or more respective sensors ~~are configured to~~, when the device is installed in the system, ~~provide~~respective data for the at least two operating parameters and/or data for the detected ~~numerical properties~~model values of the ~~the~~ performance parameter of the device.

~~14. The method as claimed in claim 1, wherein the performance parameter comprises energy consumed by the device.~~

8. ~~15.~~ The method as claimed in claim 1, wherein the ~~criteria includes exceeding a~~respective threshold difference is between one or more of the detected ~~numerical properties of the performance parameter~~model values of the device when installed ~~device~~ and one or more of the ~~stored~~ determined model values of the performance parameter.

~~16. The method as claimed in claim 1, wherein the criteria is a trend over two or more of the different points in time.~~

~~9.~~1. ~~17. The method as claimed in claim 1, further comprising repairing or replacing the device in response to the alert.~~

~~10.~~9. ~~18.~~ The method as claimed in claim 1, wherein the device comprises a mechanical device, a rotary device, and/or a device that requires electricity to operate.

~~11.~~10. ~~19.~~ The method as claimed in claim 1, wherein ~~the device comprises a pump, wherein~~ at least one of the operating parameters comprises at least one or all of: water flow ~~rate~~, impeller speed, pump head pressure, pump shaft power draw, number of active units, vibration, and/or noise sound level.

~~12.~~11. ~~20.~~ The method as claimed in claim 1, wherein the device comprises a chiller, wherein at least one of the operating parameters comprises at least one or all of: water flow ~~rate~~, refrigerant flow, evaporator entering temperature, evaporator leaving temperature, condenser entering temperature, condenser leaving temperature, refrigerant pressure difference, power consumed, and/or number of active units.

~~13.~~12. ~~21.~~ The method as claimed in claim 1, wherein the device comprises a cooling tower, wherein at least one of the operating parameters comprises at least one or all of: contact air-water area per cooling tower active volume, relative cooling tower volume, entering water temperature, leaving water temperature, wet bulb temperature, power consumed, fluid loss, water flow, and/or air flow.

~~14.~~13. ~~22.~~ The method as claimed in claim 1, wherein the determined model values are discrete values.

~~23. The method as claimed in claim 1, wherein said model values are stored in the memory as one or more tables or multi-dimensional maps.~~

~~15.~~14. ~~24.~~ The method as claimed in claim 1, wherein each determined model value is stored in the memory in association with a respective value of the at least two operating parameters.

~~16.~~15. ~~25.~~ The method as claimed in claim 1, wherein each determined model value is stored in the memory as a multi-parameter computer variable, a database, a vector or a tuple.

~~17.~~16. ~~26.~~ The method as claimed in claim 1, wherein said detecting the ~~numerical properties~~detected model values of the performance parameter of the device when installed ~~device~~ is performed by measuring values of the performance parameter in a standard unit of measurement.

17. The method as claimed in claim 1, further comprising repairing or replacing the device in response to the alert.

~~27. The method as claimed in claim 1, wherein the performance parameter is power consumed.~~

18. ~~28.~~ The method as claimed in claim 1, wherein at least one of the operating parameters is vibration.

~~29. The method as claimed in claim 1, wherein the at least two operating parameters are a speed parameter and a temperature parameter, and the performance parameter is power consumed.~~

~~30. The method as claimed in claim 1, wherein the at least two operating parameters are a load parameter and a temperature parameter, and the performance parameter is power consumed.~~

~~31. The method as claimed in claim 1, wherein the at least two operating parameters are a speed parameter and a flow parameter, and the performance parameter is power consumed.~~

19. ~~32.~~ The method as claimed in claim 1, wherein at least one of the operating parameters comprises an outdoor environmental condition.

~~20.~~1. ~~33. A system, comprising:~~

~~a plurality of devices;~~

~~memory; and~~

~~at least one controller configured to:~~

~~for each device:~~

20. ~~determine, in relation to testing performed on the device, using~~The method as claimed in claim 1, wherein the respective threshold difference is dependent on a time difference between the time of the detecting and the time of the determining or a time of the one or more earlier multi-dimensional performance tables.

21. A system, comprising:

a plurality of devices;

memory; and

at least one controller configured to perform the method as claimed in any one of claims 1 to 20.

22. A system, comprising:

a plurality of devices;

a testing facility for performing testing on each of the devices where instant operating parameters can be controlled to be at a specific operating point;

memory; and

at least one controller configured to:

for each device:

~~,~~determine, in relation to the testing performed on the device, determined model values of a performance parameter of the device over an operating range of at least two operating parameters which affect the performance parameter, wherein each determined model value is representative of an operating point of the at least two operating parameters, the testing performed post manufacturing and prior to installation of the device,

store to the memory the determined model values of the performance parameter along with a time of said determining and a unique ~~device~~ identifier for the device, wherein said determined model values are stored in the memory as a stored multi-dimensional performance table,

detect, when the device is installed in the system, ~~numerical properties~~during real-time normal operation of the system, detected model values of the performance parameter of the device, with respect to the at least two operating parameters, and storing to the memory the detected ~~numerical properties as determined~~ model values along with the unique identifier of the device and a time of said detecting, ~~and~~wherein said detected model values are stored in the memory as a detected multi-dimensional performance tables,

compare, when the device is installed in the system, in real-time during normal operation of the system, the detected ~~numerical properties with the stored determined~~

~~model values~~multi-dimensional performance table of the performance parameter ~~from different points in time; and~~

of the device, with respect to the at least two operating parameters, with the stored multi-dimensional performance table and with one ~~controller~~or more earlier multi-dimensional performance table detected when the device is ~~further configured to,~~installed in the system,

in response to said comparing ~~for any one of the devices satisfying criteria, outputting~~being within a respective threshold difference, repeating the detecting and the comparing, and

in response to said comparing exceeding the respective threshold difference, output an alert or sending the alert to a communication device~~.~~,

~~21.1. 34. A system, comprising:~~

~~a plurality of devices;~~

~~memory; and~~

~~at least one controller configured to perform the method as claimed in any one of claims 1 to 32.~~

wherein the performance parameter comprises power consumed by the device,

wherein at least one of the operating parameters includes at least one of pressure, flow, or temperature,

wherein at least one device comprises a pump.