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(54) Title: UROFLOWMETRY SYSTEM OPERATING WITH DUAL CELL TECHNOLOGY AND BY THE METHOD OF URINATING INTO THE WATER

(57) Abstract: This invention relates to the uroflowmeter device with dual cell technology. The dual cell system (2) starts to perform accurate measurements when the person begins to urinate into the collection vessel (1), mounted to the urinal or the toilet bowl and containing a certain quantity of water, at the first contact of the urine with the collection vessel (1).

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UROFLOWMETRY SYSTEM OPERATING WITH DUAL CELL TECHNOLOGY AND BY THE METHOD OF URINATING INTO THE WATER

Technical field

In the present application for a uroflowmetry system with a water-containing vessel to improve hygienic conditions by trapping the urine odor in the water, the volume and flow rate of the urine are measured after the patient has urinated into the water-filled collection vessel (1) and the urine with water is discharged into the hospital drain, and the system is refilled with fresh water to prepare the test for the next patient.

Unlike the already tested uroflowmetry systems, with which measurements are carried out using load cells, the water-filled collection vessel (1) in which the urine is accumulated is mounted suspended on the mechanism developed according to the dual cell technology (2) directly under the toilet bowl or the opening of the urinal. The dual cell technology, the collection vessel (1) filled with water and the urine contact sensor (12) form the basis of the invention.

State of the art

The uroflowmetry test is a procedure to measure a person's urine volume and flow curves over time. The aim here is to see how different the urinary frequency of a person is from the standard values of a healthy person and to measure the approximate bladder capacity of the amount of urine. This provides us information about the lower urinary tract problems in a person. In traditional uroflowmetry systems, a person urinates into a urine vessel and speed measurement is done by different methods. The most common techniques used in these methods are the rotary disk technique, capacitive load cells and those operating according to the loss in weight principle. The patent application US 5078012 is exemplary of the rotary disk method, while the patent application US 5062304 exemplifies the capacitive uroflowmetry. Load cell uroflowmetry is the most widely technique applied today. An example of this is the patent application WO2017036952A1. In the case of the load cell type uroflowmeter, which is frequently found on the market, the urine vessel is placed directly on the load cell and the volume is calculated in this way. All these uroflowmetry systems are associated with difficulties for the user. The user has to remove the urine vessel and clean it. Particularly in the area of hygiene, this causes problems for both individuals and the environment, such as uncontrolled urine spillage, which can occur when vessels are removed. Some patent works to avoid this situation are CN2355679 Y, US2015/0105694A1 and WO2016153452A1. In these already tested systems, however, the urine is collected in the previously emptied dry vessel and the siphon mechanisms are activated after the measurement. It may become unavoidable that the vessel remained dry forms risk elements endangering the hospital hygiene due to bacterial growth and development of odours.

The dual cell technology is a structure used to convert the raw data into physical values by averaging in real time 2 different frequency values formed by 2 simultaneously operating weight sensors that have been placed symmetrically on the surface by means of a suspension device. On this twin structure symmetrically integrated in the surface, a downward curved collection unit is suspended, and this structure, which is suspended on the twin structure, is responsible for transmitting the pressure generated by the solids and liquids dripping / falling into the twin structure.

With the collection vessel (1) suspended on the dual cell system (2) and containing water before the test, the present invention maximizes the hygienic conditions which are vital for the hospital. The water in the collection vessel (1) traps the odor of urine and makes the working environment more pleasant

for the staff. Furthermore, the dual-cell technology we developed allows the flow rate of urine to be measured more accurately, resulting in a more stable result. With advanced software, the necessity of an operator has been reduced to a minimum.

With "the collection vessel (1) suspended on the dual cell system (2) and containing water", which is the subject of this application, the dual cell system (2) starts to perform accurate measurements when the person begins to urinate into the collection vessel (1) containing a certain quantity of water and at the first contact of the urine with the collection vessel (1). After the patient has urinated, the measurement is complete and the uroflow test results have been transferred to the system, the electronically actuated ball valve (5) located on the lower part of the collection vessel with funnel-shaped bottom opens and the liquid with urine contained in the collection vessel (1) is discharged by gravity through the electronically actuated ball valve (5) into the drain. If the position of the drain is higher than the drain hose (6), a pump (16) is connected and the urine with water is directed to the drain. Immediately after draining off the waste water, the electronically actuated ball valve (5) at the bottom is closed and an additional water is sent from the clean water network (11) to the collection vessel (1) for the next test. In another version of this invention, it is proposed that an elbow pipe (15), as used in urinals and toilet bowls according to international standards, be placed directly under the funnel-shaped bottom of the collection vessel and attached to the building drainage with a bellows pipe. The elbow pipe (15) is filled with some water similar to urinals and/or toilet bowls. After collecting the uroflowmetry test data of the patient, the clean water valves located in the upper part of the system are opened and the urine accumulated in the system is discharged into the waste water drain (10). There is no electronically actuated ball valve (5) or pump (16). In addition, analyses of the patient's urine (glucose level, pH, ketone level, blood level, protein level) can be performed using an electronic analysis sensor (12) attached to the lower end of the funnel, that allows the urine to be directed downwards.

In the 1st version of the present invention (Figure 1), the uroflowmetry system with dual cell measuring technology consists of 1 x collection vessel with funnel-shaped bottom (1), 1 x dual cell system (2), 1 x funnel (3), 1 x perforated hose (4) surrounding the opening of the funnel, 1 x electronically actuated ball valve (5) used for discharging, 1 x drain hose (6) with ribs or made of silicone, used for discharging, 1 x elbow pipe (7) for connecting the electronically actuated ball valve, 1 x support leg system (8) with suspension device, 1 x control unit (9), 1 x analysis sensor (12), 1 x fresh water valve (13) and 1 x delivery hose (14).

In the 2nd version of the present invention (Figure 2), the uroflowmetry system with dual cell measuring technology consists of 1 x collection vessel with funnel-shaped bottom (1), 1 x dual cell system (2), 1 x funnel (3), 1 x perforated hose (4) surrounding the opening of the funnel, 1 x electronically actuated ball valve (5) for discharging, 1 x drain hose (6) with ribs or made of silicone, 1 x elbow pipe (7) for connecting the electronically actuated ball valve, 1 x support leg system (8) with suspension device, 1 x control unit (9), 1 x analysis sensor (12), 1 x fresh water valve (13), 1 x delivery hose (14) and 1 x pump (16) discharging the urine or urine with water into the drain.

In the 3rd version of the present invention (Figure 3), the uroflowmetry system with dual cell measuring technology consists of 1 x collection vessel with funnel-shaped bottom (1), 1 x dual cell system (2), 1 x funnel (3), 1 x perforated hose (4) surrounding the opening of the funnel, 1 x elbow pipe (15) according to international standards, 1 x support leg system (8) with suspension device, 1 x control unit (9), 1 x analysis sensor (12), 1 x fresh water valve (13) and 1 x delivery hose (14).

With the test start command, the person urinates into the funnel (3) of the uroflowmetry system in the form of a urinal or a toilet bowl containing fresh water, and the urine is accumulated in the collection vessel (1) that is directly fixed under the funnel (3), suspended on the dual cell system (2) and filled with

a predefined amount of water. With the test start command, the weight of the pre-filled collection vessel (1) is assumed to be zero by the control unit (9). With the exception of fresh water, the weight of the collection vessel (1) increases in accordance with the flow rate of the urine and the data from the dual cell system (2) are averaged; the variations in the values are sent to the control unit (9) by means of electrical signals and when the control unit (9) is connected to an imaging monitor, the variation in the flow rate of the urine and the increase in volume can be graphically displayed on the screen via an interface. After the urine flow is complete, the control unit (9) waits for a predefined period of time and stops the data transmission. With the command to stop the test, the control unit (9) opens the electronically actuated ball valve (5) integrated in the lower end of the collection vessel (1) and discharges the accumulated liquid by gravity or via the pump (16) into the waste water drain (10). Deodorant or disinfectant tablets, such as naphthalene, can be put in the collection vessel (1), or reusable detergent collection vessels may be subsequently integrated. After cleaning is completed, the electronically actuated ball valve (5) closes. By opening the fresh water valve (13), the predefined amount of water for the next test accumulates in the collection vessel (1) and the fresh water valve (13) is then closed. In the 3rd version of this invention (Figure 3), the pump (16) or the electronically operated ball valve (5) are not used, and after opening the fresh water valve (13), the fresh water from the fresh water network (11) displaces the urine-containing wastewater accumulated in the elbow pipe into the drain (10) and is then on standby for the next test.

The collection vessel (1) suspended on the dual cell system (2) and containing water before the test maximizes the hygienic conditions which are vital for the hospital. The water in the collection vessel (1) traps the odor of urine and makes the working environment more pleasant for the staff. Furthermore, the dual-cell technology (2) we developed allows the flow rate of urine to be measured more accurately, resulting in a more stable result. With advanced software, the necessity of an operator has been reduced to a minimum. At the same time, it is intended to collect urine analysis data (glucose level, pH, ketone level, blood level, protein level) by means of the electronic urine analysis sensor (12) integrated into the system, thus reducing public expenditure to a minimum.

In the present invention, the flow rate and volume of urine can be graphically displayed by supporting the control unit (9) with a monitor that will process and visualize the information. In addition, the flow rate and volume of urine can be output in the form of a report by a printer connected to the control unit (9). Using the touch screen / keyboard / barcode reader, data can be entered into the control unit (9) so that the personal data of the urinating person is displayed in the report. The invention and its versions presented may be provided, for example, in a hospital institution and integrated in the hospital information system, so that reports can be sent to physicians' computers.

The present invention can be supported by a disinfection module for use in cleaning.

Figures:

Figure-1 Uroflowmetry system with collection vessel (1) containing water in small quantities and suspended on the dual cell system (2) (version with electronically actuated ball valve (5))

Figure-2 Uroflowmetry system with collection vessel (1) containing water in small quantities and suspended on the dual cell system (2) (version with electronically actuated ball valve (5) and the pump (16) discharging the urine or urine with water into the drain)

Figure-3 Uroflowmetry system with collection vessel (1) containing water in small quantities and suspended on the dual cell system (2) (version with elbow pipe (15) according to international standards)

Figure-4 Algorithm of work of the control unit (9) in the version shown in Figure 1.

Figure-5 Algorithm of work of the control unit (9) in the version shown in Figure 2.

Figure-6 Algorithm of work of the control unit (9) in the version shown in Figure 3.

References:

(1) Collection vessel with funnel-shaped bottom,

(2) Dual Cell,

(3) Funnel,

(4) Perforated hose surrounding the opening of the funnel,

(5) Electronically actuated ball valve (5) used for discharging,

(6) Drain hose (6) with ribs or made of silicone used for discharging,

(7) Elbow pipe for connecting the electronically actuated ball valve,

(8) Support leg with suspension device,

(9) Control unit,

(10) Discharge direction of the urine or urine with water,

(11) Inlet direction of fresh water from the fresh water network,

(12) Analysis sensor,

(13) Fresh water valve,

(14) Delivery hose,

(15) Elbow pipe (15) according to international standards

(16) Pump discharging the urine or urine with water into the drain.

CLAIMS

1. The uroflowmetry system with dual cell measuring technology characterized in that it comprises 1 x collection vessel with funnel-shaped bottom (1), 1 x dual cell system (2), 1 x funnel (3), 1 x drain hose (6) with ribs or made of silicone surrounding the opening of the funnel, 1 x elbow pipe (7) for connecting the electronically actuated ball valve, 1 x support leg system (8) with suspension device, 1 x control unit (9), 1 x analysis sensor (12), 1 x fresh water valve (13) and 1 x delivery hose (14).

2. The uroflowmetry system with dual cell measuring technology according to claim 1 characterized in that it comprises 1 x pump (16) discharging the urine or urine with water into the drain.

3. The uroflowmetry system with dual cell measuring technology according to any one of the claims 1 and 2 characterized by the following steps;

   i. the person begins to urinate into the collection vessel (1) containing a certain quantity of water,

   ii. the dual cell system (2) starts to perform accurate measurements at the first contact of the urine with the collection vessel (1),

   iii. after the patient has urinated, the measurement is complete and the uroflow test results are transferred to the system,

   iv. the electronically actuated ball valve (5) located on the lower part of the collection vessel with funnel-shaped bottom and the fresh water valve (13) are opened and the liquid with urine contained in the collection vessel (1) is discharged through the pump (16) into the drain (10),

   v. the electronically actuated ball valve (5) is closed and an additional water is sent from the clean water network (11) through the fresh water valve (13) to the collection vessel (1) for the next test.

4. The uroflowmetry system with dual cell measuring technology characterized in that it comprises 1 x collection vessel with funnel-shaped bottom (1), 1 x dual cell system (2), 1 x funnel (3), 1 x perforated hose (4) surrounding the opening of the funnel, 1 x elbow pipe (15) according to international standards, , 1 x support leg system (8) with suspension device, 1 x control unit (9), 1 x analysis sensor (12), 1 x fresh water valve (13) and 1 x delivery hose (14).

5. The uroflowmetry system with dual cell measuring technology according to claim 4 characterized by the following steps;

   i. the person begins to urinate into the collection vessel (1) containing a certain quantity of water,

   İi. the dual cell system (2) starts to perform accurate measurements at the first contact of the urine with the collection vessel (1).

   iii. after the patient has urinated, the measurement is complete and the uroflow test results are transferred to the system,

   iv. an additional water is sent through the fresh water valve (13) to the elbow pipe (15) according to international standards, located on the lower part of the collection vessel (1) with funnel-shaped bottom and the wastewater is displaced into the drain (10).

6. The uroflowmetry system with dual cell measuring technology according to any one of the previous claims characterized in that the laboratory measurements of the volume and flow rate of the urine taken from the patient are done before, during and/or after the measurement and reported to the health professionals.

Figure - 1.

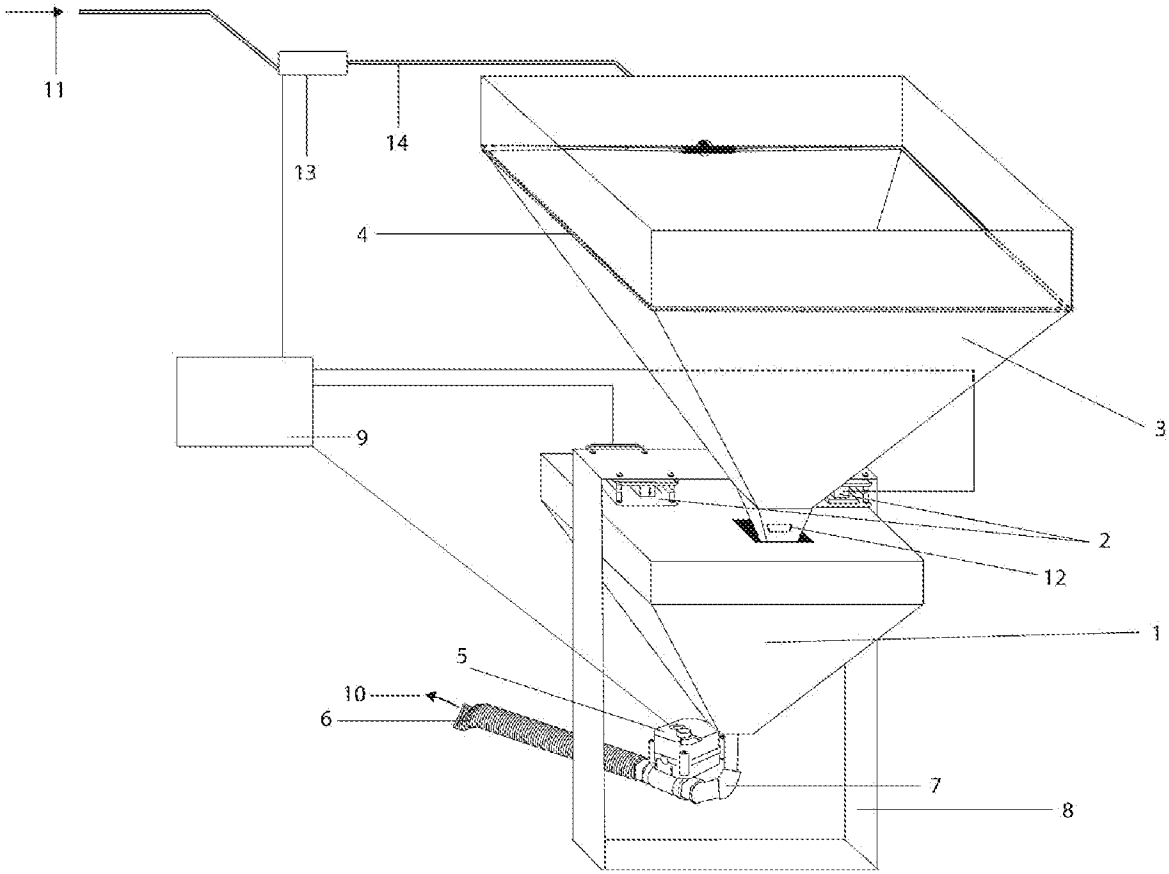


Figure - 2.

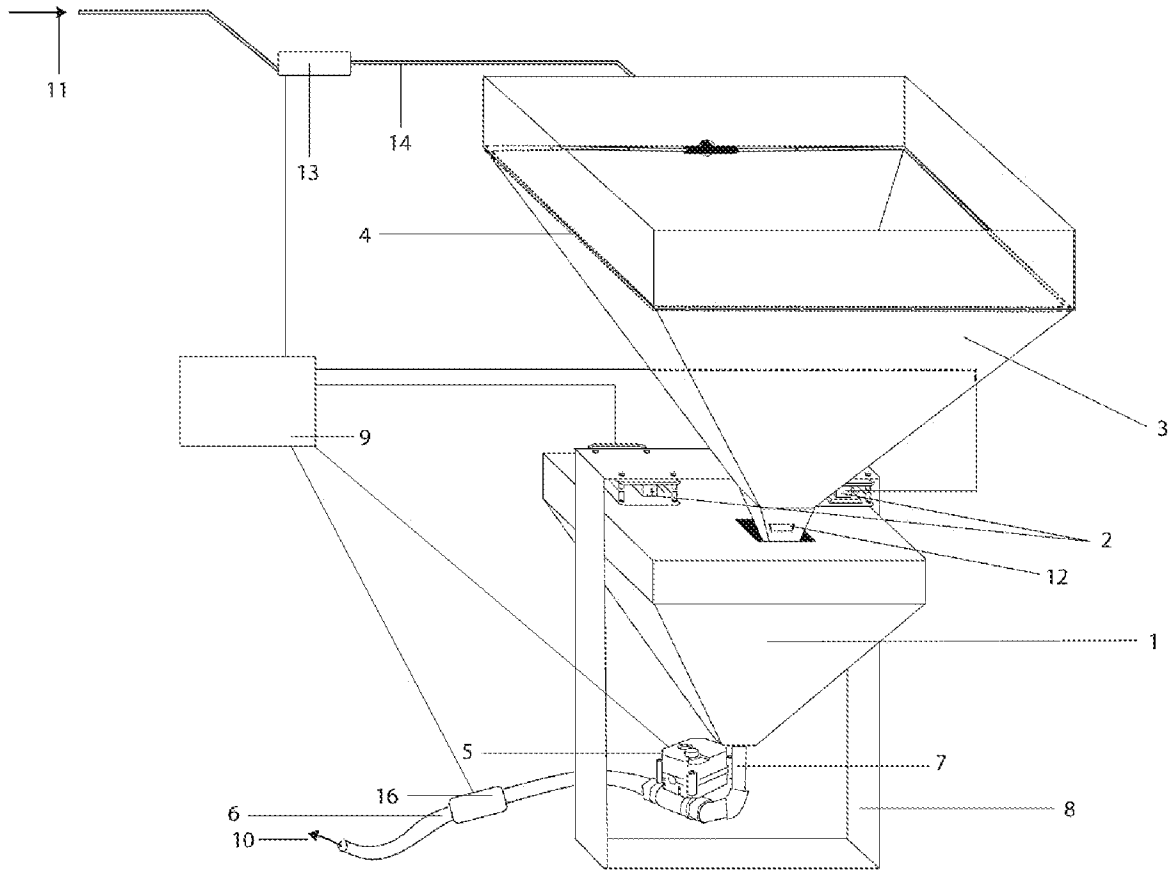


Figure - 3.

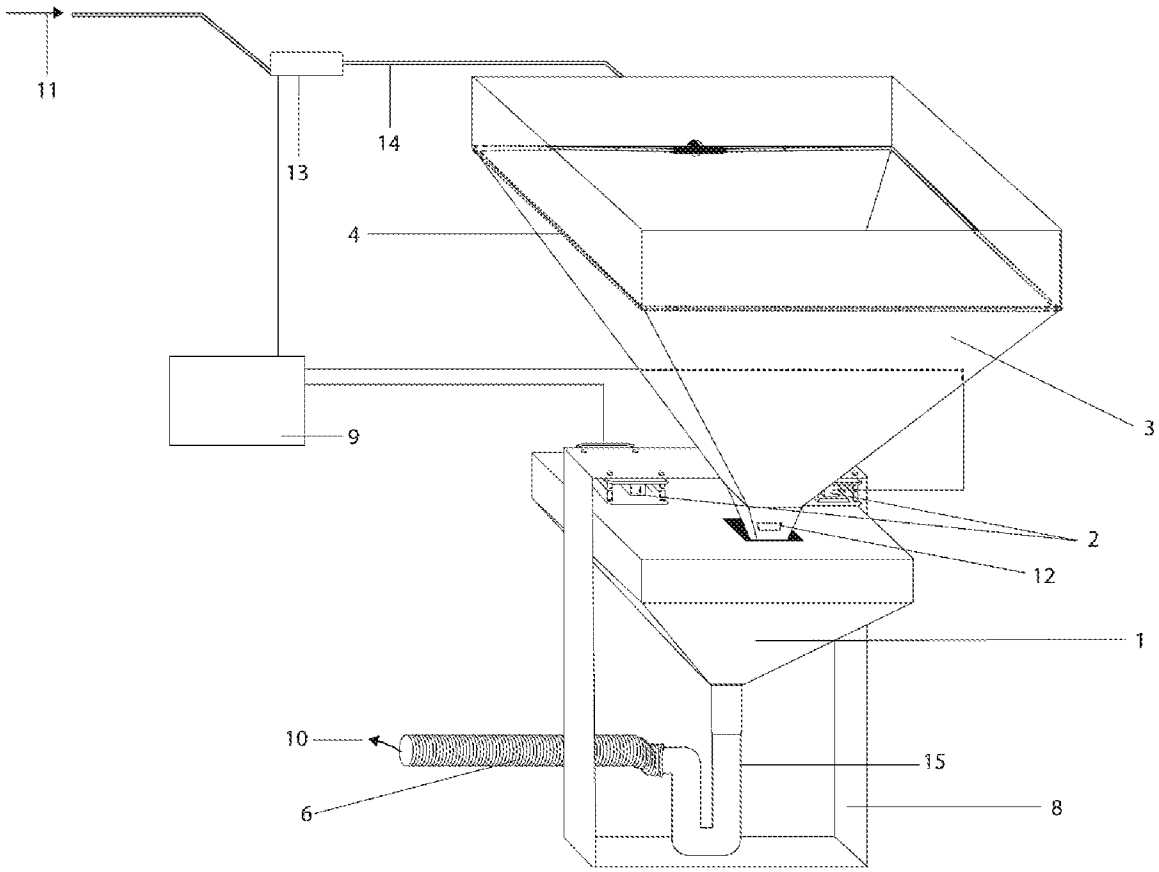


Figure - 4.

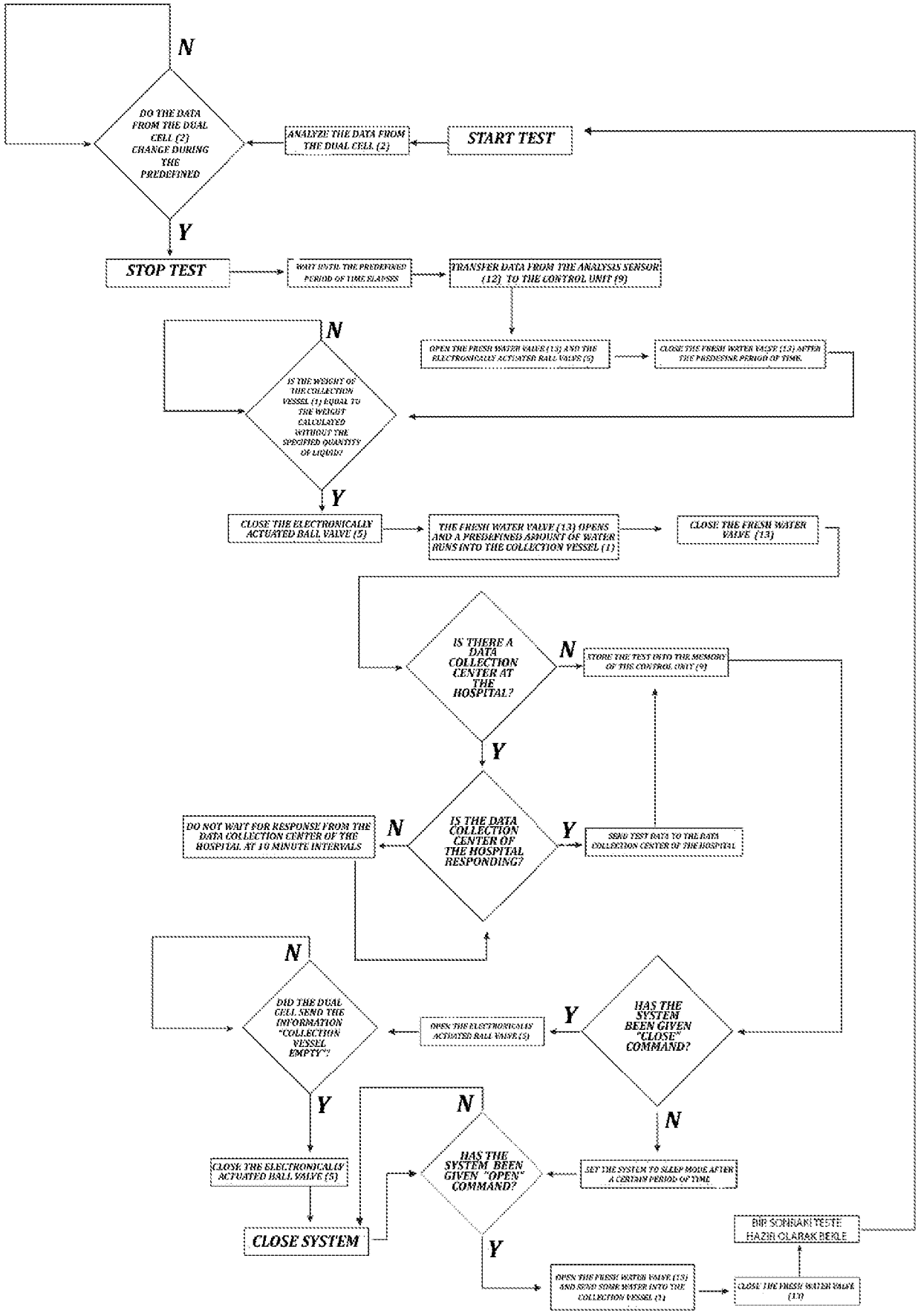

START TEST
ANALYZE THE DATA FROM THE DUAL CELL (2)
DO THE DATA FROM THE DUAL CELL (2) CHANGE DURING THE PREDEFINED
N
Y
STOP TEST
WAIT UNTIL THE PREDEFINED PERIOD OF TIME ELAPSES
TRANSFER DATA FROM THE ANALYSIS SENSOR (12) TO THE CONTROL UNIT (9)
OPEN THE FRESH WATER VALVE (13) AND THE ELECTRONICALLY ACTUATED BALL VALVE (5)
CLOSE THE FRESH WATER VALVE (13) AFTER THE PREDEFINE PERIOD OF TIME.
IS THE WEIGHT OF THE COLLECTION VESSEL (1) EQUAL TO THE WEIGHT CALCULATED WITHOUT THE SPECIFIED QUANTITY OF LIQUID?
CLOSE THE ELECTRONICALLY ACTUATED BALL VALVE (5)
THE FRESH WATER VALVE (13) OPENS AND A PREDEFINED AMOUNT OF WATER RUNS INTO THE COLLECTION VESSEL (1)
CLOSE THE FRESH WATER VALVE (13)
IS THERE A DATA COLLECTION CENTER AT THE HOSPITAL?
STORE THE TEST DATA TO THE MEMORY OF THE CONTROL UNIT (9)
IS THE DATA COLLECTION CENTER OF THE HOSPITAL RESPONDING?
SEND TEST DATA TO THE DATA COLLECTION CENTER OF THE HOSPITAL
DO NOT WAIT FOR RESPONSE FROM THE DATA COLLECTION CENTER OF THE HOSPITAL AT 10 MINUTE INTERVALS
HAS THE SYSTEM BEEN GIVEN "CLOSE" COMMAND?
OPEN THE ELECTRONICALLY ACTUATED BALL VALVE (5)
DID THE DUAL CELL SEND THE INFORMATION "COLLECTION VESSEL EMPTY"?
CLOSE THE ELECTRONICALLY ACTUATED BALL VALVE (5)
CLOSE SYSTEM
HAS THE SYSTEM BEEN GIVEN "OPEN" COMMAND?
SET THE SYSTEM TO SLEEP MODE AFTER A CERTAIN PERIOD OF TIME
OPEN THE FRESH WATER VALVE (13) AND SEND SOME WATER INTO THE COLLECTION VESSEL (1)
CLOSE THE FRESH WATER VALVE (13)
BIR SONRAKI TESTE HAZIR OLARAK BEKLE

Figure - 5.

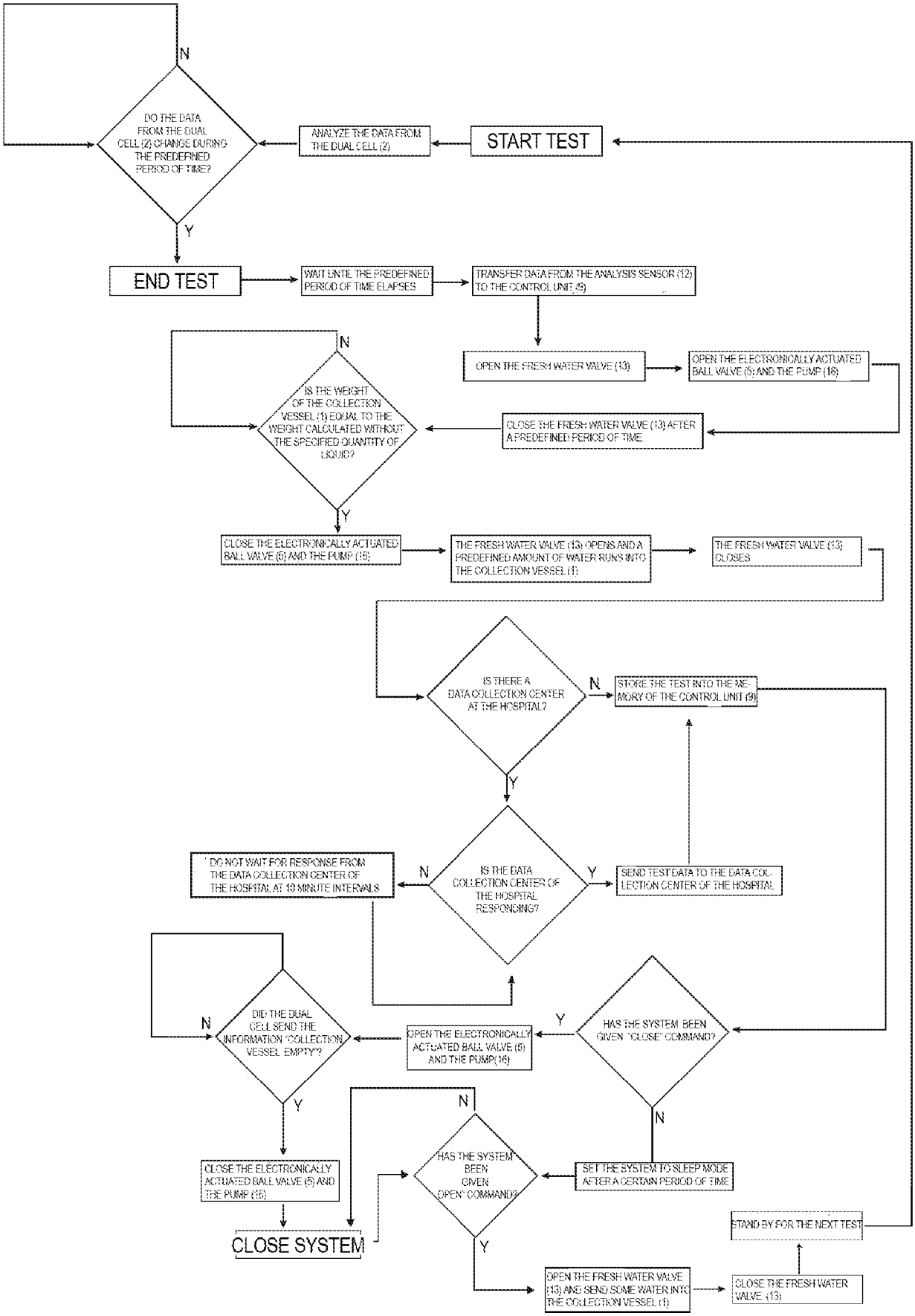
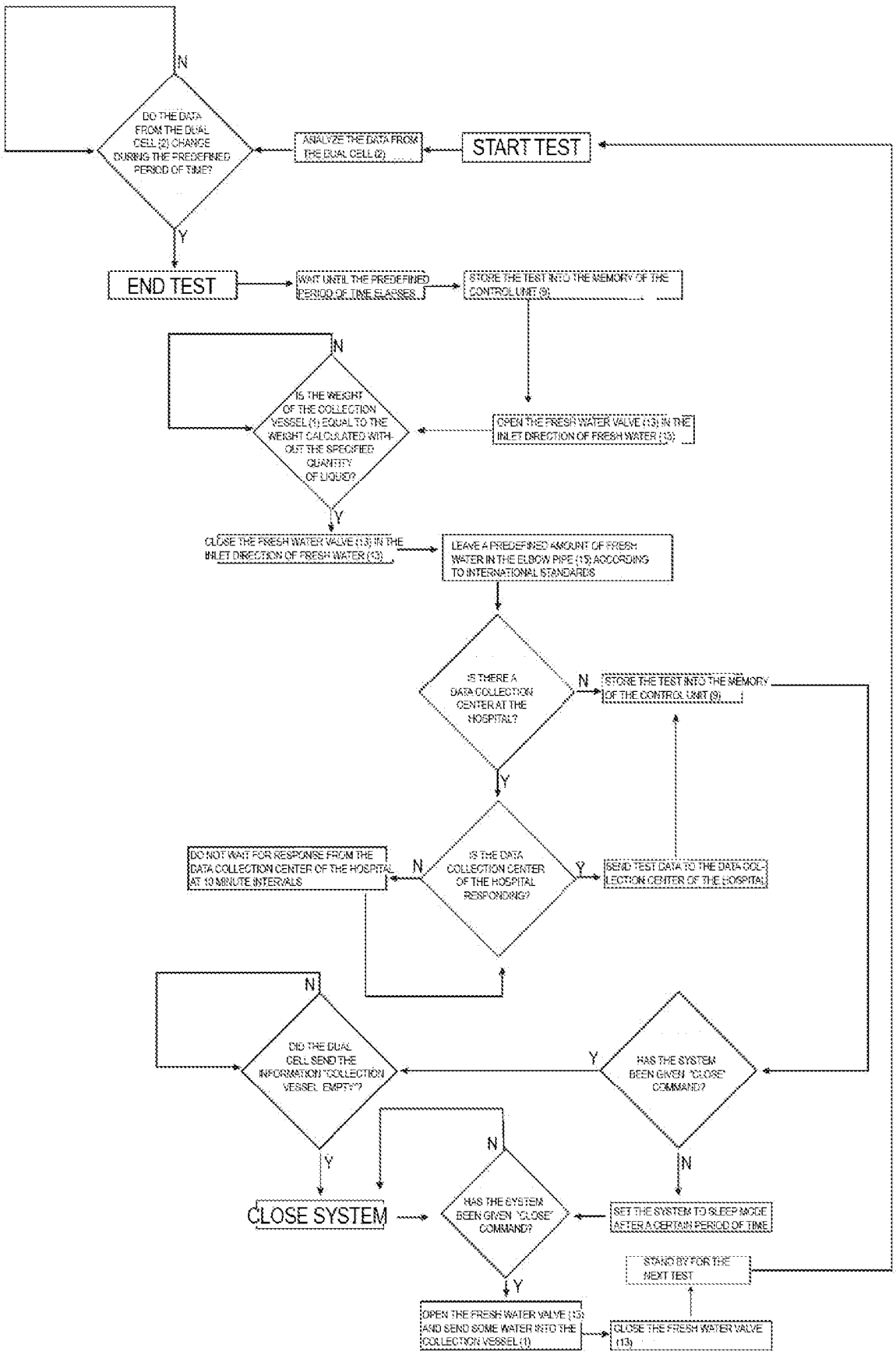

START TEST
ANALYZE THE DATA FROM THE DUAL CELL (2)
DO THE DATA FROM THE DUAL CELL (2) CHANGE DURING THE PREDEFINED PERIOD OF TIME?
N
Y
END TEST
WAIT UNTIL THE PREDEFINED PERIOD OF TIME ELAPSES
TRANSFER DATA FROM THE ANALYSIS SENSOR (12) TO THE CONTROL UNIT (9)
OPEN THE FRESH WATER VALVE (13)
OPEN THE ELECTRONICALLY ACTUATED BALL VALVE (5) AND THE PUMP (16)
CLOSE THE FRESH WATER VALVE (13) AFTER A PREDEFINED PERIOD OF TIME
IS THE WEIGHT OF THE COLLECTION VESSEL (1) EQUAL TO THE WEIGHT CALCULATED WITHOUT THE SPECIFIED QUANTITY OF LIQUID?
CLOSE THE ELECTRONICALLY ACTUATED BALL VALVE (5) AND THE PUMP (16)
THE FRESH WATER VALVE (13) OPENS AND A PREDEFINED AMOUNT OF WATER RUNS INTO THE COLLECTION VESSEL (1)
THE FRESH WATER VALVE (13) CLOSES
IS THERE A DATA COLLECTION CENTER AT THE HOSPITAL?
STORE THE TEST INTO THE MEMORY OF THE CONTROL UNIT (9)
IS THE DATA COLLECTION CENTER OF THE HOSPITAL RESPONDING?
SEND TEST DATA TO THE DATA COLLECTION CENTER OF THE HOSPITAL
DO NOT WAIT FOR RESPONSE FROM THE DATA COLLECTION CENTER OF THE HOSPITAL AT 10 MINUTE INTERVALS
HAS THE SYSTEM BEEN GIVEN "CLOSE" COMMAND?
OPEN THE ELECTRONICALLY ACTUATED BALL VALVE (5) AND THE PUMP(16)
DID THE DUAL CELL SEND THE INFORMATION "COLLECTION VESSEL EMPTY"?
CLOSE THE ELECTRONICALLY ACTUATED BALL VALVE (5) AND THE PUMP (16)
CLOSE SYSTEM
HAS THE SYSTEM BEEN GIVEN "OPEN" COMMAND?
SET THE SYSTEM TO SLEEP MODE AFTER A CERTAIN PERIOD OF TIME
OPEN THE FRESH WATER VALVE (13) AND SEND SOME WATER INTO THE COLLECTION VESSEL (1)
CLOSE THE FRESH WATER VALVE (13)
STAND BY FOR THE NEXT TEST

Figure – 6.


START TEST
ANALYZE THE DATA FROM THE DUAL CELL (2)
DO THE DATA FROM THE DUAL CELL (2) CHANGE DURING THE PREDEFINED PERIOD OF TIME?
N
Y
END TEST
WAIT UNTIL THE PREDEFINED PERIOD OF TIME ELAPSES
STORE THE TEST INTO THE MEMORY OF THE CONTROL UNIT (9)
OPEN THE FRESH WATER VALVE (13) IN THE INLET DIRECTION OF FRESH WATER (13)
IS THE WEIGHT OF THE COLLECTION VESSEL (1) EQUAL TO THE WEIGHT CALCULATED WITHOUT THE SPECIFIED QUANTITY OF LIQUID?
CLOSE THE FRESH WATER VALVE (13) IN THE INLET DIRECTION OF FRESH WATER (13)
LEAVE A PREDEFINED AMOUNT OF FRESH WATER IN THE ELBOW PIPE (15) ACCORDING TO INTERNATIONAL STANDARDS
IS THERE A DATA COLLECTION CENTER AT THE HOSPITAL?
STORE THE TEST INTO THE MEMORY OF THE CONTROL UNIT (9)
IS THE DATA COLLECTION CENTER OF THE HOSPITAL RESPONDING?
SEND TEST DATA TO THE DATA COLLECTION CENTER OF THE HOSPITAL
DO NOT WAIT FOR RESPONSE FROM THE DATA COLLECTION CENTER OF THE HOSPITAL AT 10 MINUTE INTERVALS
HAS THE SYSTEM BEEN GIVEN "CLOSE" COMMAND?
DID THE DUAL CELL SEND THE INFORMATION "COLLECTION VESSEL EMPTY"?
CLOSE SYSTEM
HAS THE SYSTEM BEEN GIVEN "CLOSE" COMMAND?
SET THE SYSTEM TO SLEEP MODE AFTER A CERTAIN PERIOD OF TIME
STAND BY FOR THE NEXT TEST
OPEN THE FRESH WATER VALVE (13) AND SEND SOME WATER INTO THE COLLECTION VESSEL (1)
CLOSE THE FRESH WATER VALVE (13)