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(54) **Simplified method for testing a backflow preventer assembly.**

(57) The present invention relates to a method of testing a backflow preventer assembly (1), the backflow preventer assembly comprising at least a backflow preventer (2), an upstream test cock (16) positioned upstream of an upstream check valve, a downstream test cock (18) positioned downstream of the downstream check valve, wherein both test cocks are configured to be attached to a liquid pressure measurement device (17), an upstream shut off valve (21) positioned upstream of the upstream test cock, wherein an upstream zone (18) is defined between the upstream check valve assembly and the upstream shut off valve, a downstream shut off valve (22) positioned downstream of the downstream test cock, wherein a downstream zone (20) is defined between the downstream check valve assembly and the downstream shut off valve. The method of testing the backflow preventer assembly comprises testing the downstream shut off valve and the downstream check valve assembly by measuring a first pressure (23) development over time in the downstream zone at the downstream test cock. It furthermore comprises testing an opening pressure (24) of a relief valve by closing the upstream shut off valve, gradually lowering the pressure in the upstream zone by tapping off liquid from the upstream zone via the upstream test cock and by measuring a second absolute pressure (25) at the upstream test cock at which fluid starts to discharge via the discharge opening and comparing said absolute pressure to a required threshold pressure for the relief valve.

Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift wijkt af van de oorspronkelijk ingediende stukken. Alle ingediende stukken kunnen bij Octrooicentrum Nederland worden ingezien.

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Title: Simplified method for testing a backflow preventer assembly.

Field of the invention

The present invention relates to a method of testing a backflow preventer assembly and to a backflow preventer assembly.

Background of the invention

Backflow preventer assemblies are known from the prior art. Said backflow preventers restrict a backflow into a liquid supply line. Liquid flowing back from a separate conduit system is often contaminated. In some situations a backflow of the contaminated liquid could be hazardous for people's health and should therefore be prevented. A typical situation is a situation in which water from a pipeline is supplied to one or more taps which are used for drinking and other types of human consumption of water and also to a central heating installation. In such a situation it is undesirable that water from the central heating installation would flow back into the pipeline and subsequently be used for human consumption. The backflow preventer prevents such a backflow.

A backflow preventer assembly comprises several moving parts. Failure of only a single part can already result in a failure of the entire backflow preventer assembly and result in health risks. In most countries it is therefore required by standards to periodically test, or inspect, the backflow preventer assembly. When a part of the assembly is not functioning, the backflow preventer assembly needs to be repaired or replaced.

US6675110B2 discloses a method for determining flow through a valve and for testing a relief valve in a backflow preventer. Said testing method includes determining differential pressures. The measuring of differential pressures requires a complex and expensive device, for instance the device disclosed in US5566704(A). A problem with such a device is that the user needs to attach a number of conduits to the test cocks in a specific order. This becomes even a bigger problem when a user only rarely uses the device, because he tends to forget the specific order of attachment.

The invention is amongst others based on the recognition that there is a need in the field of the art for a simpler and more cost-effective alternative and the insight that such a simpler and more cost-effective alternative is possible.

Object of the invention

It is an object of the invention to provide a simpler testing method for backflow preventer assemblies.

It is another object of the invention to provide a more cost-effective testing method for backflow preventer assemblies.

Yet another object of the invention is to provide a more robust backflow preventer.

Summary of the invention

In order to achieve at least one object, the present invention provides a method of testing a backflow preventer assembly, the backflow preventer assembly comprising at least:

- a backflow preventer comprising:
  - a housing comprising an inlet and an outlet,
  - an upstream check valve assembly positioned in the housing downstream of the inlet and being biased to a closed position,
  - a downstream check valve assembly positioned in the housing downstream of the upstream check valve and being biased to a closed position,
  - an intermediate chamber positioned between the upstream check valve assembly and the downstream check valve assembly, the intermediate chamber comprising a discharge opening at a bottom side thereof for emptying the intermediate chamber,
  - a relief valve located in the housing, the relief valve being positioned upstream of the downstream check valve assembly and being configured to move between a closed position in which it closes off the discharge opening and an open position in which the discharge opening is open,
- an upstream test cock positioned upstream of the upstream check valve, wherein the upstream test cock is configured to be attached to a liquid pressure measurement device,
- a downstream test cock positioned downstream of the downstream check valve, wherein the downstream test cock is configured to be attached to a liquid pressure measurement device,

- an upstream shut off valve positioned upstream of the upstream test cock, wherein an upstream zone is defined between the upstream check valve assembly and the upstream shut off valve,
- a downstream shut off valve positioned downstream of the downstream test cock, wherein a downstream zone is defined between the downstream check valve assembly and the downstream shut off valve,

wherein the method of testing the backflow preventer assembly comprises:

- testing the downstream shut off valve and the downstream check valve assembly by measuring a first pressure development over time in the downstream zone at the downstream test cock,
- testing an opening pressure of the relief valve by closing the upstream shut off valve, gradually lowering the pressure in the upstream zone by tapping off liquid from the upstream zone via the upstream test cock and by measuring a second absolute pressure at the upstream test cock at which fluid starts to discharge via the discharge opening and comparing said absolute pressure to a required threshold pressure for the relief valve.

With the method according to the present invention a backflow preventer can be tested without using any differential pressure meter. This is a substantial advantage, because an absolute pressure can be measured with a simpler device, which does not require a user to remember a specific and complex order of attachment, which is required in case a differential pressure meter is used.

In an embodiment of the method, the first pressure and the second absolute pressure are measured with a manometer. The use of a manometer adds to the simplicity of the testing method, for the manometer only needs to be attached to one test cock at a time.

In an embodiment of the method, an order of testing the backflow preventer assembly comprises the following steps in the given order:

a) testing the entire backflow preventer assembly on external leakage,
b) testing the upstream shut off valve and upstream check valve assembly on shutting off,
c) testing the downstream shut off valve and the downstream check valve assembly on shutting off,
d) testing the relief valve on shutting off, on being stuck, and on the opening pressure.

In an embodiment of the method, testing the backflow preventer assembly on external leakage comprises the steps of:

- drying an outer surface of the backflow preventer assembly,
- waiting a predetermined period of time, in particular at least one minute,
- visually check the backflow preventer assembly for leakages.

In an embodiment of the method, testing the upstream shut off valve comprises the steps of:

- closing the downstream shut off valve and subsequently closing the upstream shut off valve,
- opening the upstream test cock,
- drying the upstream test cock while maintaining a visible liquid level in the upstream test cock,
- determining whether the liquid level remains constant or rises, wherein when the liquid level rises, the upstream shut off valve is considered to malfunction,
- [closing the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.]

In an embodiment of the method, testing the upstream check valve assembly comprises the steps of:

- closing the downstream shut off valve and subsequently closing the upstream shut off valve,
- opening the upstream test cock,
- drying the upstream test cock while maintaining a visible liquid level in the upstream test cock,
- determining whether the liquid level remains constant or falls, wherein if the liquid level falls:
    - drying the discharge opening, and:
    - waiting a predetermined period of time, in particular 30 seconds, and
    - checking the discharge opening for dripping, wherein when liquid drips from the discharge opening, then the relief valve is considered not to shut off adequately, and wherein when no liquid drips from the discharge opening, the upstream check valve assembly is considered to malfunction,
- repairing or replacing the backflow preventer when the upstream check valve assembly is not functioning, and repeating the previous steps,

- closing the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.

In an embodiment of the method, testing the downstream shut off valve comprises the steps of:

- coupling the liquid pressure measurement device to the downstream test cock,
- opening the downstream test cock,
- closing the downstream shut off valve and subsequently closing the upstream shut off valve,
- opening the upstream test cock,
- depressurizing a conduit system downstream of the downstream shut off valve,
- determining the liquid pressure level with the liquid pressure measurement device, wherein when the liquid pressure decreases and the discharge opening remains dry, then the downstream shut off valve is considered to malfunction,
- repairing the downstream shut off valve if the downstream shut off valve is considered to malfunction, and repeating the previous steps,
- closing the downstream test cock and the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.

In an embodiment of the method, testing the downstream check valve assembly comprises the steps of:

- coupling the liquid pressure measurement device to the downstream test cock,
- opening the downstream test cock,
- closing the downstream shut off valve and subsequently closing the upstream shut off valve,
- opening the upstream test cock,
- depressurizing a conduit system downstream of the backflow preventer assembly,
- determining the liquid pressure level with the liquid pressure measurement device, wherein if the liquid pressure decreases and the discharge opening

leaks liquid, then the downstream check valve assembly is considered to malfunction,

- replacing the backflow preventer if the downstream check valve assembly is not functioning, and repeating the previous steps,
- closing the downstream test cock and the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.

In an embodiment of the method, testing the relief valve on shutting off comprises the steps of:

- closing the downstream shut off valve,
- drying the discharge opening,
- waiting a predetermined period of time, in particular at least 30 seconds,
- inspecting whether liquid drips from the discharge opening, wherein if liquid drips from the discharge opening, then the relief valve is considered not to shut off adequately,
- replacing the backflow preventer if the relief valve does not shut off adequately, and repeating the previous steps,
- opening the downstream shut off valve.

In an embodiment of the method, testing the functioning of the relief valve comprises the steps of:

- closing the downstream shut off valve and subsequently closing the upstream shut off valve,
- opening the upstream test cock,
- determining whether liquid exits the discharge opening, wherein if no liquid exits the discharge opening, then the relief valve is stuck and thus considered to malfunction,
- replacing the backflow preventer if the relief valve is not functioning, and repeating the previous steps,
- closing the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.

In an embodiment of the method, testing the required opening pressure of the relief valve comprises the steps of:

- attaching a liquid pressure measurement device to the upstream test cock,

- opening the upstream test cock,
- closing the upstream shut off valve,
- opening a draining facility in a conduit of the liquid pressure measurement device,
- closing the draining facility in the conduit of the liquid pressure measurement device as soon as liquid starts exiting the discharge opening,
- determining the liquid pressure level with the liquid pressure measurement device, wherein if the liquid pressure level is below a threshold value, then the relief valve is not opening at the required liquid pressure level and thus not functioning,
- replacing the backflow preventer if the relief valve is not functioning adequately, and repeating the previous steps,
- closing the upstream test cock,
- opening the downstream shut off valve and subsequently opening the upstream shut off valve.

The invention further provides a backflow preventer assembly, comprising:

- a backflow preventer comprising:
    - a housing comprising an inlet and an outlet,
    - an upstream check valve assembly positioned in the housing downstream of the inlet and being biased to a first closed position,
    - a downstream check valve assembly positioned in the housing downstream of the upstream check valve and being biased to a second closed position,
    - an intermediate chamber positioned between the upstream check valve assembly and the downstream check valve assembly, the intermediate chamber comprising a discharge opening at a bottom side thereof for emptying the intermediate chamber,
    - a relief valve located in the housing, the relief valve being positioned upstream of the downstream check valve assembly and being configured to move between a third closed position in which it closes off the discharge opening and an open position in which the discharge opening is open,
- an upstream test cock positioned upstream of the upstream check valve, wherein the upstream test cock is configured to be attached to a liquid

pressure measurement device, wherein an upstream zone is defined between the upstream check valve assembly and the upstream shut off valve,

- a downstream test cock positioned downstream of the downstream check valve, wherein the downstream test cock is configured to be attached to a liquid pressure measurement device, wherein a downstream zone is defined between the downstream check valve assembly and the downstream shut off valve,
- an upstream shut off valve positioned upstream of the upstream test cock,
- a downstream shut off valve positioned downstream of the downstream test cock,

characterized in that the intermediate chamber is free of test cocks / the backflow preventer assembly is free of a third test cock.

In an embodiment of the backflow preventer assembly, the upstream check valve assembly and the relief valve are integrally connected.

These and other aspects of the invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description and considered in connection with the accompanying drawings in which like reference symbols designate like parts.

Brief description of the figures

Figures 1 and 2 schematically show cross-sections of a backflow preventer assembly in different operating configurations according to the invention.

Figures 3 and 4 schematically show perspective views of a backflow preventer assembly attached to a liquid pressure meter according to the invention.

Figures 5 and 6 show a flow chart of a testing method for the backflow preventer assembly according to the invention.

Detailed description of the figures

Figures 1 shows a cross-section of a backflow preventer assembly 1. The backflow preventer assembly 1 comprises a backflow preventer 2. The backflow preventer 2 comprises several parts. First, the backflow preventer 2 has a housing 3 which comprises an inlet 4 and an outlet 5. An upstream check valve assembly 6 is positioned in the housing 3 downstream of the inlet 4. The upstream check valve assembly 6 is biased to a first closed position 7. In the housing 3, downstream of the upstream check valve, a downstream check

valve assembly 8 is provided. The downstream check valve is also biased to a second closed position 9.

An intermediate chamber 10 is positioned between the upstream and downstream check valve assemblies. The intermediate chamber 10 has a discharge opening 11 at a bottom side 12 thereof. The discharge opening 11 is provided for emptying the intermediate chamber 10.

A relief valve 13 is located in the housing 3, upstream of the downstream check valve assembly 8. The relief valve 13 is configured to move between a third closed position 14 (figure 2) in which it closes off the discharge opening 11, and an open position 15 (figure 1) in which the discharge opening 11 is open, and vice versa. The relief valve 13 and upstream check valve assembly 6 are integrated into a single valve assembly having two separate functions. Due to the integral construction, the relief valve 13 is biased to an open position 15.

The backflow preventer assembly 1 furthermore comprises an upstream test cock 16. The upstream test cock 16 is positioned upstream of the upstream check valve assembly 6. The upstream test cock 16 is configured to be attached to a liquid pressure measurement device 17. Figure 3 shows a manometer 27 as liquid pressure measurement device 17.

A downstream test cock 19 is positioned downstream of the downstream check valve. The downstream test cock 19 is also configured to be attached to a liquid pressure measurement device 17, or manometer 27 as shown in figure 4.

The backflow preventer assembly 1 further comprises an upstream shut off valve 21 positioned upstream of the upstream test cock 16, and a downstream shut off valve 22 positioned downstream of the downstream test cock 19. The upstream shut off valve 21 and downstream shut off valve 22 each have an operating member.

An upstream zone 18 is defined between the upstream test check valve assembly and the upstream shut off valve 21. A downstream zone 20 is defined between the downstream check valve assembly 8 and the downstream shut off valve 22.

The above described backflow preventer assembly can be provided as an assembly of interconnected parts, or as an integral device.

As most of the abovementioned parts are prone to failure, it is required by standards in most countries to test, or inspect, said backflow preventer assembly 1 at regular time intervals.

Turning to figures 5 and 6, a flow chart of a testing method for the backflow preventer assembly 1 is shown. An order of testing the backflow preventer assembly 1 comprises the following steps in the given order:

a) testing the entire backflow preventer assembly 1 on external leakage,
b) testing the upstream shut off valve 21 and upstream check valve assembly 6 on shutting off,
c) testing the downstream shut off valve 22 and the downstream check valve assembly 8 on shutting off,
d) testing the relief valve 13 on shutting off (D1), on being stuck (D2), and on the opening pressure 24 (D3).

First the entire backflow preventer assembly 1 is tested on external leakage, see box A: leakage in figure 5. Testing on external leakage is done by first completely drying the outer surface 28 of the backflow preventer assembly 1. Drying is achieved by using a towel, or any other tool suited for drying the outer surface 28 of the backflow preventer assembly 1. After waiting a predetermined period of time, in particular one minute, the backflow preventer assembly 1 is visually checked for leakages. If a leakage is detected, it needs to be repaired.

After checking, and possibly repairing any external leakages, the upstream shut off valve 21 and upstream check valve assembly 6 are tested on shutting off. Testing the upstream shut off valve 21 first entails the step of closing the downstream shut off valve 22 and subsequently closing the upstream shut off valve 21. Next the upstream test cock 16 is opened. When opening said upstream test cock 16, water tends to discharge from it. Also water tends to exit the discharge opening 11 during this step. Therefore a next step is to dry the upstream test cock 16 while maintaining a visible liquid level in the upstream test cock 16. Then it has to be determined what happens to the liquid level in the upstream test cock 16. There are three possibilities: the liquid level may rise, fall, or remain constant.

In case the liquid level rises, the upstream shut off valve 21 is considered to malfunction. To solve this problem, the upstream shut off valve 21 needs to be repaired, and the backflow preventer assembly 1 needs to be tested again starting with step B.

In case the liquid level in the upstream test cock 16 falls, either the upstream check valve assembly 6, the relief valve 13, or both are considered to malfunction. In all cases, the backflow preventer 2 needs to be replaced, after which the backflow preventer assembly 1 needs to be tested again starting with step B. After completing the prescribed steps, the upstream test cock 16 is closed, and the downstream shut off valve 22 is opened. Then the upstream shut off valve 21 is opened.

In order to determine whether the upstream check valve assembly 6 malfunctions, start from an operation position. The backflow preventer assembly 1 is in the operation position when all shut off valves are opened.

First the downstream shut off valve 22 is closed, then the upstream shut off valve 21 is closed. The upstream test cock 16 is opened. When opening the upstream test cock 16, liquid tends to discharge from the said upstream test cock 16. Also liquid tends to exit the discharge opening 11. The next step is therefore drying the opened upstream test cock 16, while keeping a liquid level inside the upstream test cock 16 visible. The step that follows is determining whether the liquid level remains constant or drops.

If the liquid level drops, the procedure continues by drying the discharge opening 11, and waiting a predetermined period of time, in particular 30 seconds. Then the discharge opening 11 is checked for dripping, wherein when liquid drips from the discharge opening 11, then the relief valve 13 is considered not to shut off adequately. When no liquid drips from the discharge opening 11, the upstream check valve assembly 6 is considered to malfunction. In both cases the backflow preventer 2 needs to be replaced, after which the backflow preventer assembly 1 needs to be tested again starting with step B. Then the upstream test cock 16 is closed, and the downstream shut off valve 22 is closed and subsequently the upstream shut off valve 21 is opened.

The next step in the testing method involves testing the downstream shut off valve 22 and the downstream check valve assembly 8: step C. To this end a liquid pressure measurement device 17 is coupled to the downstream test cock 19, after which the downstream test cock 19 is opened. Next the downstream test cock 19 is closed and subsequently also the upstream shut off valve 21 is closed. Next, the upstream test cock 16 is opened. Liquid tends to discharge from the upstream test cock 16 when opening said upstream test cock 16. Next a conduit system 30 which is located downstream of the downstream shut off valve 22 is depressurized. This can be done for example by opening a water tap and letting the liquid flow, thereby depressurizing said conduit system 30.

The liquid pressure measurement device 17, in particular a manometer 27, is used to determine the liquid pressure level at the downstream test cock 19. In particular a first pressure 23 development over time in the downstream zone 20 at the downstream test cock 19 is measured. When the liquid pressure decreases over time and the discharge opening 11 remains dry, then the downstream shut off valve 22 is considered to malfunction. If this is the case, then the downstream shut off valve 22 needs to be repaired, after which the steps of step C are repeated.

However, when the liquid pressure decreases and the discharge opening 11 leaks liquid, then the downstream check valve assembly 8 is considered to malfunction. In that case, the backflow preventer 2 needs to be replaced, after which the steps of step C are repeated.

After either repairing the downstream shut off valve 22, replacing the backflow preventer 2, or doing nothing in case both parts are functioning adequately, the downstream test cock 19 and the upstream test cock 16 are closed. Then the downstream shut off valve 22 is opened and subsequently the upstream shut off valve 21 is opened. The manometer 27 may be detached.

If the pressure in the downstream zone 20 remains constant during step C, the testing method continues with testing the relief valve 13. Figure 5 shows that the relief valve 13 is tested threefold, namely on shutting off, on being stuck, and on its opening pressure 24.

Firstly the relief valve 13 is tested on shutting off, see box D1. The first step entails closing the downstream shut off valve 22, and then drying the discharge opening 11. After waiting a predetermined period of time, in particular 30 seconds, the discharge opening 11 is inspected on dripping. If liquid drips from the discharge opening 11, then the relief valve 13 is considered not to shut off adequately. In that case the backflow preventer 2 needs to be replaced, and the previous steps of step D1 are repeated. Then the downstream shut off valve 22 is opened.

Secondly the relief valve 13 is tested on functioning, in particular on being stuck. Therefore the downstream shut off valve 22 and subsequently the upstream shut off valve 21 are closed. The upstream test cock 16 is opened. Liquid tends to discharge from the upstream test cock 16 when opening said upstream test cock 16. Now it is determined whether liquid exits the discharge opening 11. The backflow preventer 2 should discharge liquid from the discharge opening 11. If this is not the case, then the relief valve 13 is stuck and thus

considered to malfunction. The backflow preventer 2 then has to be replaced and the previous steps of step D2 are repeated. Then the upstream test cock 16 is closed, and the downstream shut off valve 22 is opened. Subsequently the upstream shut off valve 21 is opened.

Thirdly the required opening pressure 24 of the relief valve 13 is tested. This entails attaching a liquid pressure measurement device 17, a manometer 27, to the upstream test cock 16. Then the upstream test cock 16 is opened, after which the upstream shut off valve 21 is closed. A draining facility 31 is provided at substantially the same location as the manometer 27. The draining facility 31 may also be provided on a conduit of the manometer 27 itself, namely at the upstream zone 18. The next step is opening the draining facility 31. This lowers the pressure in the upstream zone 18. At a predetermined liquid pressure level the relief valve 13 should open resulting in a discharge of liquid from the discharge opening 11. As soon as liquid starts exiting the discharge opening 11, the draining facility 31 needs to be closed. Then the liquid pressure level is determined by reading the manometer 27. If the liquid pressure level is below a predetermined threshold value, then the relief valve 13 does not open at the required liquid pressure level and thus does not function properly. In practice a threshold value of 0.14 bar is required. The backflow preventer 2 is to be replaced if the relief valve 13 does not functioning properly, and the previous steps of step D3 are repeated. Then the upstream test cock 16 is closed, the downstream shut off valve 22 is opened. Subsequently the upstream shut off valve 21 is opened.

An advantage of the present testing method is that only a simple manometer 27 is needed to be able to perform all steps. The method thus entails testing the downstream shut off valve 22 and the downstream check valve assembly 8 by measuring a first pressure 23 development over time in the downstream zone 20 at the downstream test cock 19. It furthermore entails testing an opening pressure 24 of the relief valve 13 by closing the upstream shut off valve 21, gradually lowering the pressure in the upstream zone 18 by tapping off liquid from the upstream zone 18 via the upstream test cock 16 and by measuring a second absolute pressure 25 at the upstream test cock 16 at which fluid starts to discharge via the discharge opening 11 and comparing said absolute pressure to a required threshold pressure for the relief valve 13. The manometer 27 measures the first pressure 23 and the second absolute pressure 25.

For the average plumber a manometer 27 is standard equipment. Said method therefore requires no special equipment for testing the backflow preventer assembly 1. This is advantageous, as said special equipment is often expensive.

Turning to figure 3, a backflow preventer assembly 1 according to the invention is shown, comprising:

- a backflow preventer 2 comprising:
  - a housing 3 comprising an inlet 4 and an outlet 5,
  - an upstream check valve assembly 6 positioned in the housing 3 downstream of the inlet 4 and being biased to a first closed position 7,
  - a downstream check valve assembly 8 positioned in the housing 3 downstream of the upstream check valve and being biased to a second closed position 9,
  - an intermediate chamber 10 positioned between the upstream check valve assembly 6 and the downstream check valve assembly 8, the intermediate chamber 10 comprising a discharge opening 11 at a bottom side 12 thereof for emptying the intermediate chamber 10,
  - a relief valve 13 located in the housing 3, the relief valve 13 being positioned upstream of the downstream check valve assembly 8 and being configured to move between a third closed position 14 in which it closes off the discharge opening 11 and an open position 15 in which the discharge opening 11 is open,
- an upstream test cock 16 positioned upstream of the upstream check valve, wherein the upstream test cock 16 is configured to be attached to a liquid pressure measurement device 17, wherein an upstream zone 18 is defined between the upstream check valve assembly 6 and the upstream shut off valve 21,
- a downstream test cock 19 positioned downstream of the downstream check valve, wherein the downstream test cock 19 is configured to be attached to a liquid pressure measurement device 17, wherein a downstream zone 20 is defined between the downstream check valve assembly 8 and the downstream shut off valve 22,
- an upstream shut off valve 21 positioned upstream of the upstream test cock 16,
- a downstream shut off valve 22 positioned downstream of the downstream test cock 19,

The intermediate chamber 10 is free of test cocks. An advantage of the testing method according to the invention, is that a backflow preventer assembly 1 only requires two test

cocks: a downstream test cock 19 connected to the downstream zone 20, and an upstream test cock 16 connected to the upstream zone 18. There is no need for a third test cock 33 connected to the intermediate chamber 10. This simplifies the backflow preventer assembly 1, thereby obtaining a more robust construction, as less parts are needed.

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. Further, the terms and phrases used herein are not intended to be limiting, but rather, to provide an understandable description of the invention.

The terms "a"/"an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms including and/or having, as used herein, are defined as comprising (i.e., open language, not excluding other elements or steps). Any reference signs in the claims should not be construed as limiting the scope of the claims or the invention.

The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

C O N C L U S I E S

1. Werkwijze voor het testen van een terugstroombeveiligersamenstel (1), waarbij het terugstroombeveiligersamenstel ten minste omvat:
   - een terugstroombeveiliger (2) omvattende:
     - een behuizing (3) die een inlaat (4) en een uitlaat (5) omvat,
     - een stroomopwaarts keerklepsamenstel (6) dat stroomafwaarts van de inlaat gepositioneerd in de behuizing is en is voorgespannen naar een eerste gesloten positie (7),
     - een stroomafwaarts keerklepsamenstel (8) dat in de behuizing stroomafwaarts van het stroomopwaarts keerklepsamenstel gepositioneerd is en is voorgespannen naar een tweede gesloten positie (9),
     - een tussenkamer (10) die gepositioneerd is tussen het stroomopwaartse keerklepsamenstel en het stroomafwaartse keerklepsamenstel, waarbij de tussenkamer aan een bodemzijde (12) daarvan een ontlastopening (11) omvat voor het legen van de tussenkamer,
     - een ontlastklep (13) die zich in de behuizing bevindt, waarbij de ontlastklep stroomopwaarts van de stroomafwaartse keerklep is gepositioneerd en is ingericht om te bewegen tussen een derde gesloten positie (14) waarbij deze de ontlastopening afsluit en een open positie (15) waarbij de ontlastopening open is,
   - een stroomopwaartse controlekraan (16) die stroomopwaarts van de stroomopwaartse keerklep is gepositioneerd, waarbij de stroomopwaartse controlekraan is ingericht om te worden verbonden met een vloeistofdrukmeterinrichting (17),
   - een stroomafwaartse controlekraan (19) die stroomafwaarts van de stroomafwaartse keerklep is gepositioneerd, waarbij de stroomafwaartse controlekraan is ingericht om te worden verbonden met de vloeistofdrukmeterinrichting,
   - een stroomopwaartse afsluitklep (21) die stroomopwaarts van de stroomopwaartse controlekraan is gepositioneerd, waarbij een stroomopwaartse zone (18) is gedefinieerd tussen het stroomopwaartse keerklepsamenstel en de stroomopwaartse afsluitklep,
   - een stroomafwaartse afsluitklep (22) die stroomafwaarts van de stroomafwaartse controlekraan is gepositioneerd, waarbij een

stroomafwaartse zone (20) is gedefinieerd tussen het stroomafwaarts keerklepsamenstel en de stroomafwaartse afsluitklep,

de werkwijze voor het testen van het terugstroombeveiligersamenstel omvattende:

- het testen van de stroomafwaartse afsluitklep en het stroomafwaartse keerklepsamenstel door het meten van een eerste drukontwikkeling (23) over de tijd in de stroomafwaartse zone bij de stroomafwaartse controlekraan,
- het testen van een openingsdruk (24) van de ontlastklep door middel van het sluiten van de stroomopwaartse afsluitklep, het geleidelijk verlagen van de druk in de stroomopwaartse zone door vloeistof af te tappen van de stroomopwaartse zone via de stroomopwaartse controlekraan en door het meten van een tweede, absolute druk (25) bij de stroomopwaartse controlekraan wanneer er vloeistof begint stromen via de ontlastopening en het vergelijken van genoemde absolute druk met een vereiste drempeldruk voor de ontlastklep.

2. Werkwijze volgens conclusie 1, waarbij de eerste druk en de tweede, absolute druk gemeten worden met een manometer (27).

3. Werkwijze volgens conclusie 1 of 2, waarbij een volgorde van het testen van het terugstroombeveiligersamenstel de volgende stappen in de gegeven volgorde omvat:
   a) het testen van het gehele terugstroombeveiligersamenstel op externe lekkages,
   b) het testen van de stroomopwaartse afsluitklep en het stroomopwaartse keerklepsamenstel op afsluiten,
   c) het testen van de stroomafwaartse afsluitklep en het stroomafwaartse keerklepsamenstel op afsluiten,
   d) het testen van de ontlastklep op afsluiten, op blijven hangen, en op de openingsdruk.

4. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van het terugstroombeveiligersamenstel op externe lekkages de stappen omvat van:
   - het drogen van een buitenoppervlak (28) van het terugstroombeveiligersamenstel,
   - het wachten gedurende een vooraf bepaalde tijd, in het bijzonder ten minste een minuut,

- het visueel checken van het terugstroombeveiligersamenstel op lekkages.

5. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van de stroomopwaartse afsluitklep de stappen omvat van:
    - het afsluiten van de stroomafwaartse afsluitklep en het vervolgens sluiten van de stroomopwaartse afsluitklep,
    - het openen van de stroomopwaartse controlekraan,
    - het drogen van de stroomopwaartse controlekraan terwijl een zichtbaar vloeistofniveau in de stroomopwaartse controlekraan wordt behouden,
    - het bepalen of het vloeistofniveau constant blijft of stijgt, waarbij wanneer het vloeistofniveau stijgt, de stroomopwaartse afsluitklep wordt beschouwd als niet-functionerend,
    - het sluiten van de stroomopwaartse controlekraan,
    - het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

6. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van het stroomopwaartse keerklepsamenstel de stappen omvat van:
    - het sluiten van de stroomafwaartse afsluitklep en daaropvolgend het sluiten van de stroomopwaartse afsluitklep,
    - het openen van de stroomopwaartse controlekraan,
    - het drogen van de stroomopwaartse controlekraan terwijl een zichtbaar vloeistofniveau in de stroomopwaartse controlekraan wordt behouden,
    - het bepalen of het vloeistofniveau constant blijft of daalt, waarbij wanneer het vloeistofniveau daalt:
        - het drogen van de ontlastopening, en:
        - het wachten gedurende een vooraf bepaalde tijd, in het bijzonder 30 seconden, en
        - het checken van de ontlastopening op druppelen, waarbij wanneer vloeistof uit de ontlastopening druppelt, de ontlastklep wordt beschouwd als niet adequaat afsluitend, en waarbij wanneer geen vloeistof uit de ontlastopening druppelt, het stroomopwaartse keerklepsamenstel wordt beschouwd als niet-functionerend,
    - het vervangen van de terugstroombeveiliger wanneer het stroomopwaartse keerklepsamenstel niet functioneert, en het herhalen van de vorige stappen,
    - het sluiten van de stroomopwaartse controlekraan,

- het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

7. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van de stroomafwaartse afsluitklep de stappen omvat van:
    - het koppelen van de vloeistofdrukmeterinrichting met de stroomafwaartse controlekraan,
    - het openen van de stroomafwaartse controlekraan,
    - het sluiten van de stroomafwaartse afsluitklep en daaropvolgend het sluiten van de stroomopwaartse afsluitklep,
    - het openen van de stroomopwaartse controlekraan,
    - het drukloos maken van een leidingsysteem (30) stroomafwaarts van de stroomafwaartse afsluitklep,
    - het bepalen van het vloeistofdrukniveau met de vloeistofdrukmeterinrichting, waarbij wanneer de vloeistofdruk afneemt en de ontlastopening droog blijft, de stroomafwaartse afsluitklep wordt beschouwd als niet-functionerend,
    - het repareren van de stroomafwaartse afsluitklep als de stroomafwaartse afsluitklep wordt beschouwd als niet-functionerend, en het herhalen van de vorige stappen,
    - het sluiten van de stroomafwaartse controlekraan en de stroomopwaartse controlekraan,
    - het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

8. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van het stroomafwaartse keerklepsamenstel de stappen omvat van:
    - het koppelen van de vloeistofdrukmeterinrichting met de stroomafwaartse controlekraan,
    - het openen van de stroomafwaartse controlekraan,
    - het sluiten van de stroomafwaartse afsluitklep en daaropvolgend het sluiten van de stroomopwaartse afsluitklep,
    - het openen van de stroomopwaartse controlekraan,
    - het drukloos maken van een leidingsysteem stroomafwaarts van het terugstroombeveiligersamenstel,
    - het bepalen van het vloeistofdrukniveau met de vloeistofdrukmeterinrichting, waarbij wanneer de vloeistofdruk afneemt en

uit de ontlastklep vloeistof lekt, het stroomafwaartse keerklepsamenstel wordt beschouwd las niet-functionerend,

- het vervangen van de terugstroombeveiliger als het stroomafwaartse keerklepsamenstel niet functioneert, en het herhalen van de vorige stappen,
- het afsluiten van de stroomafwaartse controlekraan en de stroomopwaartse controlekraan,
- het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

9. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van de ontlastklep op afsluiten de stappen omvat van:
   - het sluiten van de stroomafwaartse afsluitklep,
   - het drogen van de ontlastopening,
   - het wachten gedurende een vooraf bepaalde tijd, in het bijzonder ten minste 30 seconden,
   - het inspecteren of vloeistof uit de ontlastopening druppelt, waarbij als vloeistof uit de ontlastopening druppelt, de ontlastklep wordt beschouwd als niet adequaat afsluitend,
   - het vervangen van de terugstroombeveiliger als de ontlastklep niet adequaat afsluit, en het herhalen van de vorige stappen,
   - het openen van de stroomafwaartse afsluitklep.

10. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van het functioneren van de ontlastklep de stappen omvat van:
   - het sluiten van de stroomafwaartse afsluitklep en daaropvolgend het sluiten van de stroomopwaartse afsluitklep,
   - het openen van de stroomopwaartse controlekraan,
   - het bepalen of vloeistof uit de ontlastopening komt, waarbij als geen vloeistof uit de ontlastopening komt, de ontlastklep blijft hangen en dus wordt beschouwd als niet-functionerend,
   - het vervangen van de terugstroombeveiliger als de ontlastklep niet functioneert, en het herhalen van de vorige stappen,
   - het sluiten van de stroomopwaartse controlekraan,
   - het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

11. Werkwijze volgens een der voorgaande conclusies, waarbij het testen van de vereiste openingsdruk van de ontlastklep de stappen omvat van:
    - het aanbrengen van een vloeistofdrukmeterinrichting op de stroomopwaartse controlekraan,
    - het openen van de stroomopwaartse controlekraan,
    - het afsluiten van de stroomopwaartse afsluitklep,
    - het openen van een aftapfaciliteit (31) van de vloeistofdrukmeterinrichting,
    - het sluiten van de aftapfaciliteit van de vloeistofdrukmeterinrichting zodra er vloeistof uit de ontlastopening begint te komen,
    - het bepalen van het vloeistofdrukniveau met de vloeistofdrukmeterinrichting, waarbij als het vloeistofdrukniveau onder een drempelwaarde is, de ontlastklep niet opent op het vereiste vloeistofdrukniveau en dus niet naar behoren functioneert,
    - het vervangen van de terugstroombeveiliger als de ontlastklep niet adequaat functioneert, en het herhalen van de vorige stappen,
    - het sluiten van de stroomopwaartse controlekraan, het openen van de stroomafwaartse afsluitklep en daaropvolgend het openen van de stroomopwaartse afsluitklep.

12. Terugstroombeveiligersamenstel, omvattende:
    - een terugstroombeveiliger omvattende:
        - een behuizing die een inlaat en een uitlaat omvat,
        - een stroomopwaarts keerklepsamenstel dat stroomafwaarts van de inlaat gepositioneerd is in de behuizing en is voorgespannen naar een eerste gesloten positie,
        - een stroomafwaarts keerklepsamenstel dat in de behuizing stroomafwaarts van het stroomopwaartse keerklepsamenstel gepositioneerd is en is voorgespannen naar een tweede gesloten positie,
        - een tussenkamer die gepositioneerd is tussen het stroomopwaartse keerklepsamenstel en het stroomafwaartse keerklepsamenstel, waarbij de tussenkamer aan een bodemzijde daarvan een ontlastopening omvat voor het legen van de tussenkamer,
        - een ontlastklep die zich in de behuizing bevindt, waarbij de ontlastklep stroomopwaarts van het stroomafwaartse keerklepsamenstel is gepositioneerd en is ingericht om te bewegen

tussen een derde gesloten positie waarbij het de ontlastopening afsluit en een open positie waarbij de ontlastopening open is,

- een stroomopwaartse controlekraan die stroomopwaarts van de stroomopwaartse keerklep is gepositioneerd, waarbij de stroomopwaartse controlekraan is ingericht om te worden verbonden met een vloeistofdrukmeterinrichting, waarbij een stroomopwaartse zone is gedefinieerd tussen het stroomopwaartse keerklepsamenstel en de stroomopwaartse afsluitklep,
- een stroomafwaartse controlekraan die stroomafwaarts van de stroomafwaartse keerklep is gepositioneerd, waarbij de stroomafwaartse controlekraan is ingericht om te worden verbonden met de vloeistofdrukmeterinrichting,
- een stroomopwaartse afsluitklep die stroomopwaarts van de stroomopwaartse controlekraan is gepositioneerd,

met het kenmerk, dat

- een stroomafwaartse afsluitklep stroomafwaarts van de stroomafwaartse controlekraan is gepositioneerd, waarbij een stroomafwaartse zone is gedefinieerd tussen het stroomafwaartse keerklepsamenstel en de stroomafwaartse afsluitklep, en dat

het terugstroombeveiligersamenstel vrij is van elke controlekraan (33) bij de tussenkamer.

13. Terugstroombeveiligersamenstel volgens conclusie 12, waarbij het stroomopwaartse keerklepsamenstel en de ontlastklep integraal verbonden zijn.

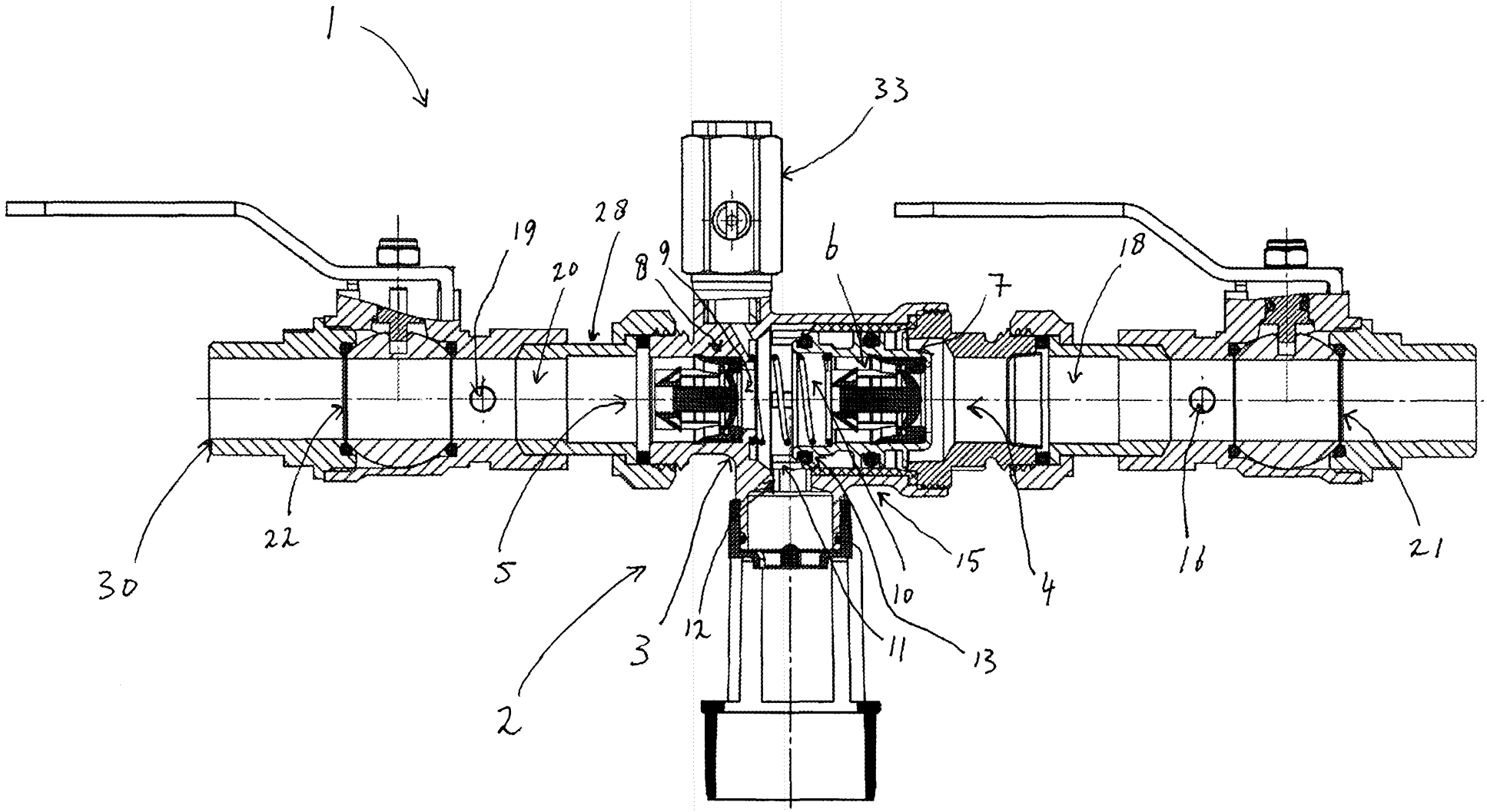


FIG. 1

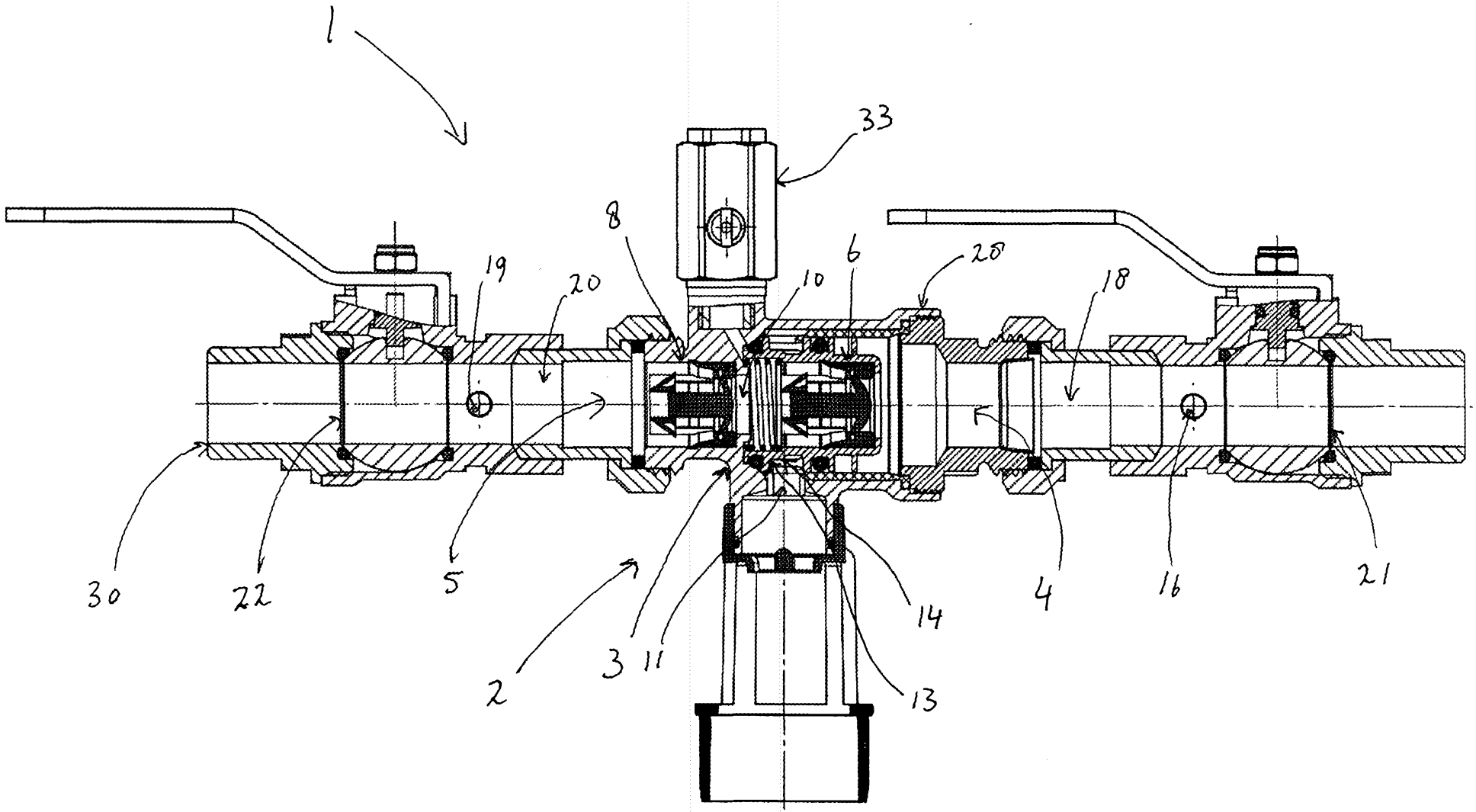


FIG.2

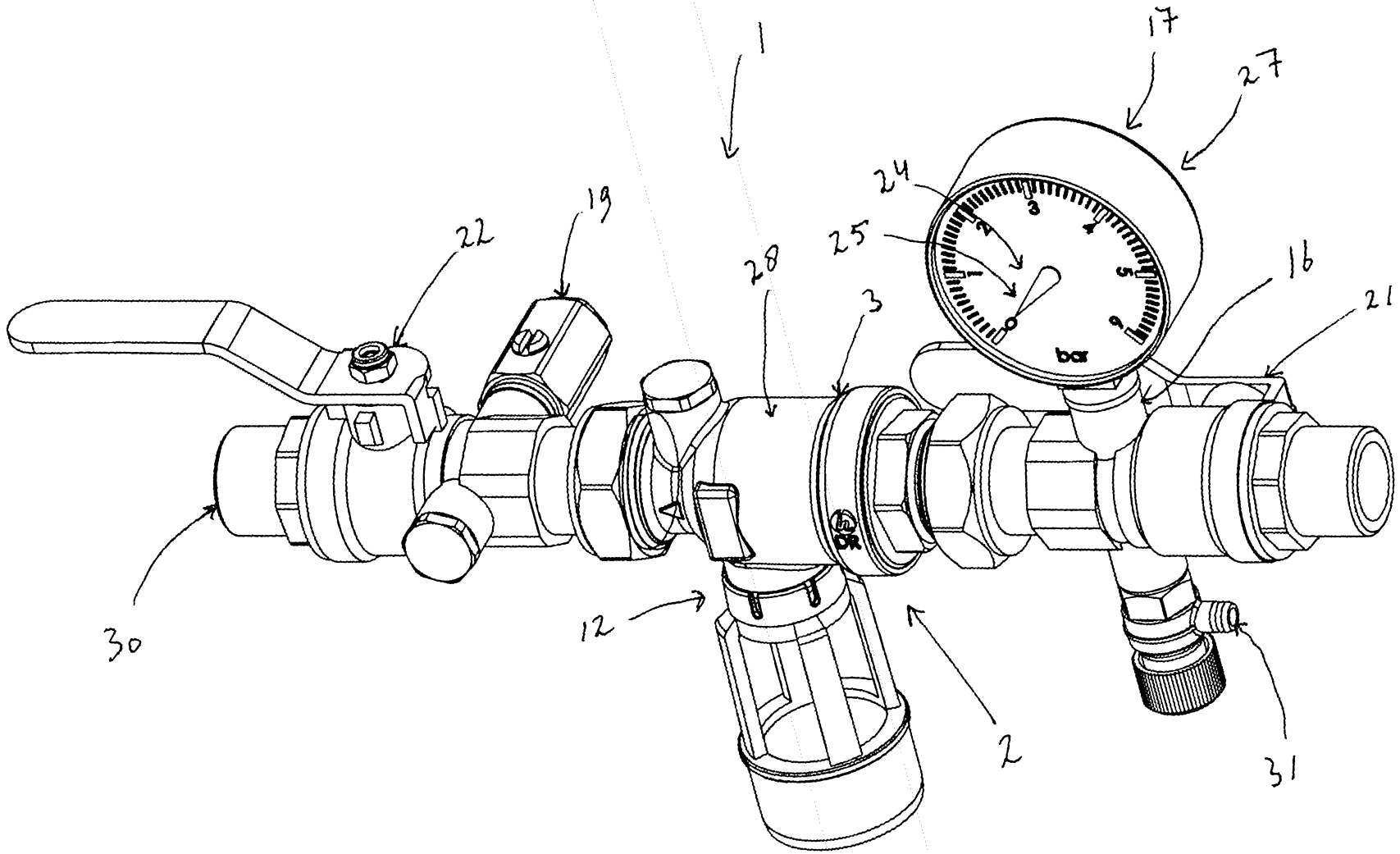


FIG.3

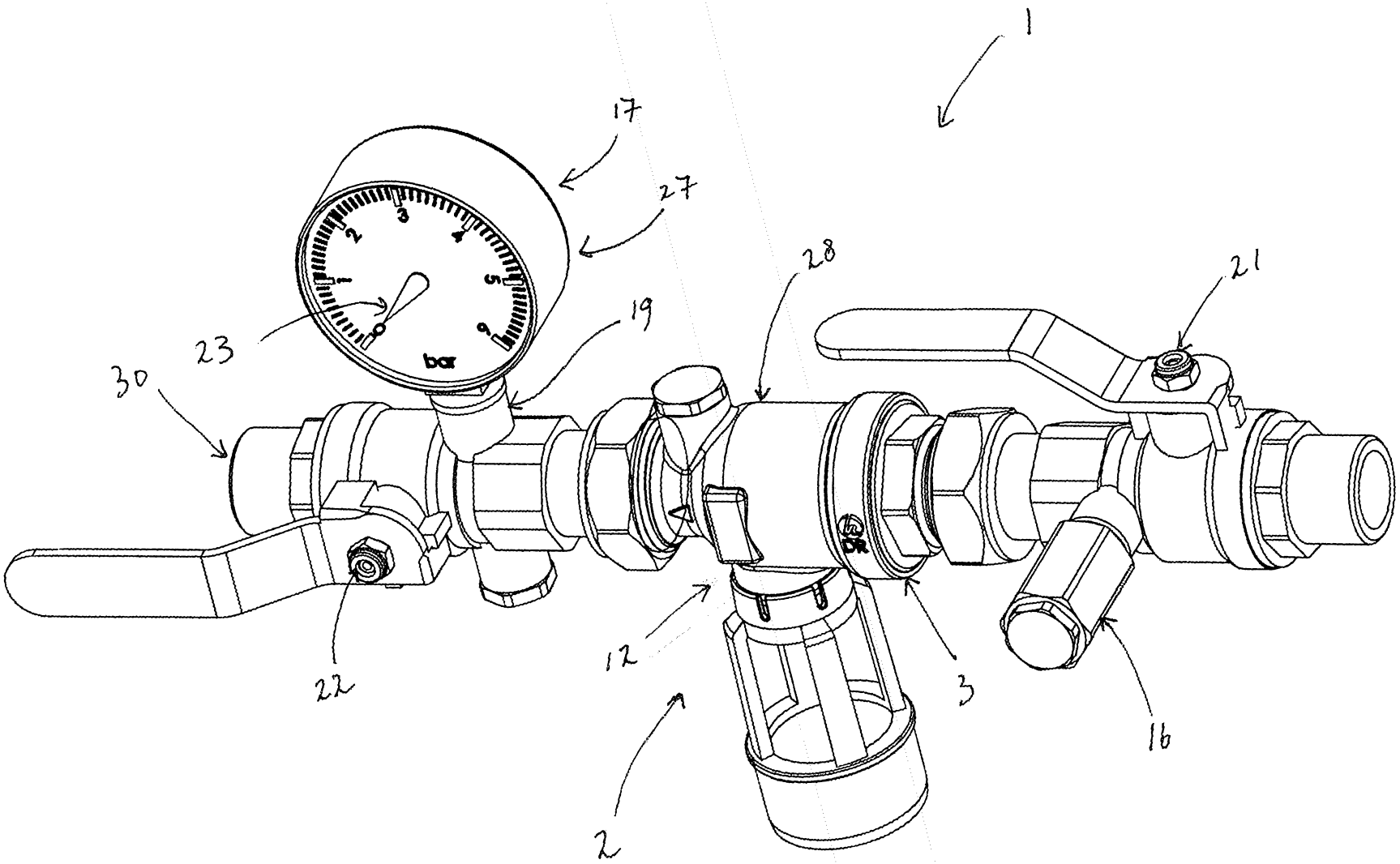


FIG. 4

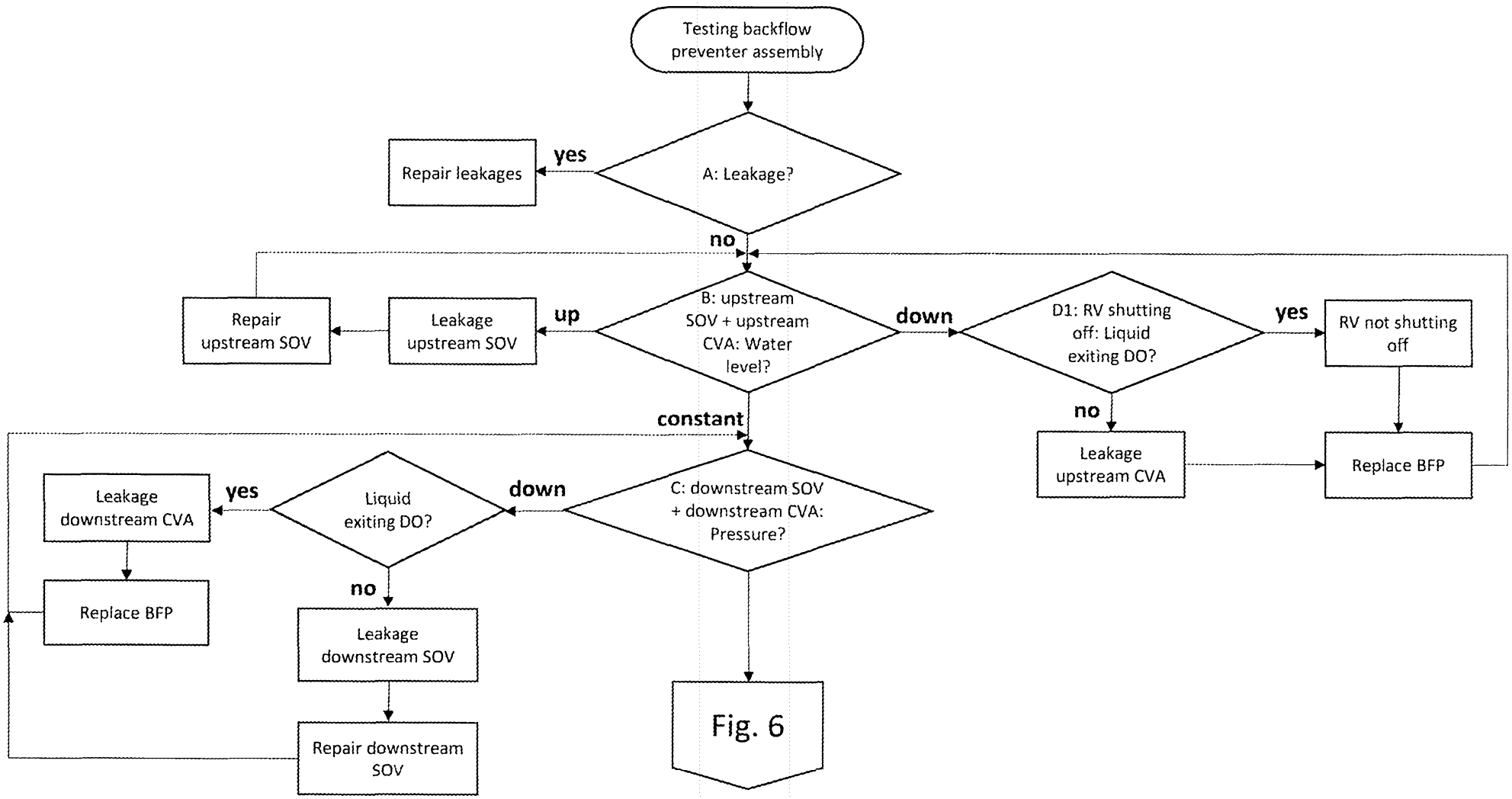

Testing backflow preventer assembly
A: Leakage?
yes
Repair leakages
no
B: upstream SOV + upstream CVA: Water level?
up
Leakage upstream SOV
Repair upstream SOV
down
D1: RV shutting off: Liquid exiting DO?
yes
RV not shutting off
no
Leakage upstream CVA
Replace BFP
constant
C: downstream SOV + downstream CVA: Pressure?
down
Liquid exiting DO?
yes
Leakage downstream CVA
Replace BFP
no
Leakage downstream SOV
Repair downstream SOV

Fig. 6

FIG. 5

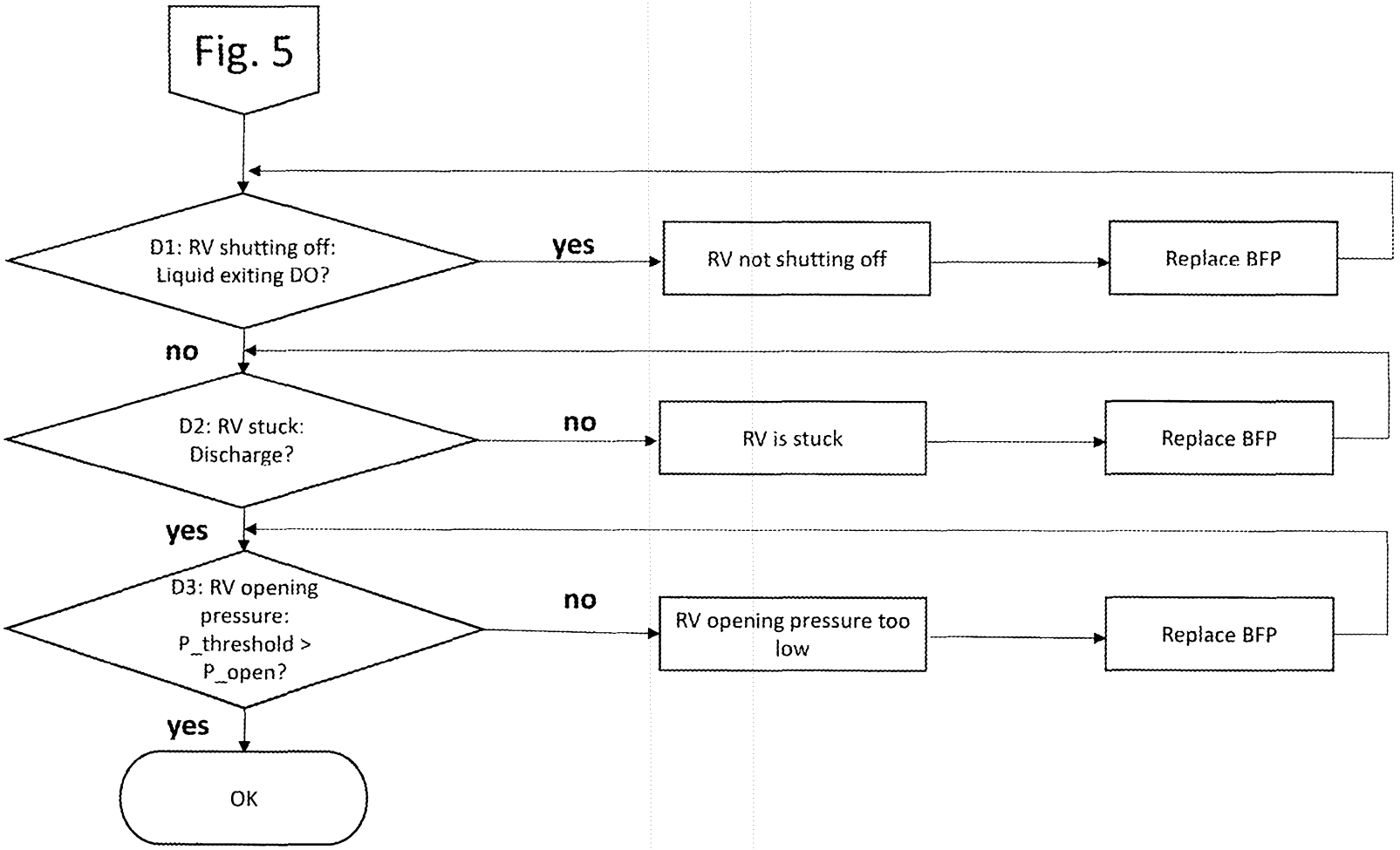

Fig. 5
D1: RV shutting off: Liquid exiting DO?
yes
RV not shutting off
Replace BFP
no
D2: RV stuck: Discharge?
no
RV is stuck
Replace BFP
yes
D3: RV opening pressure: P_threshold > P_open?
no
RV opening pressure too low
Replace BFP
yes
OK

FIG. 6

ABSTRACT

The present invention relates to a method of testing a backflow preventer assembly (1), the backflow preventer assembly comprising at least a backflow preventer (2), an upstream test cock (16) positioned upstream of an upstream check valve, a downstream test cock (18) positioned downstream of the downstream check valve, wherein both test cocks are configured to be attached to a liquid pressure measurement device (17), an upstream shut off valve (21) positioned upstream of the upstream test cock, wherein an upstream zone (18) is defined between the upstream check valve assembly and the upstream shut off valve, a downstream shut off valve (22) positioned downstream of the downstream test cock, wherein a downstream zone (20) is defined between the downstream check valve assembly and the downstream shut off valve. The method of testing the backflow preventer assembly comprises testing the downstream shut off valve and the downstream check valve assembly by measuring a first pressure (23) development over time in the downstream zone at the downstream test cock. It furthermore comprises testing an opening pressure (24) of a relief valve by closing the upstream shut off valve, gradually lowering the pressure in the upstream zone by tapping off liquid from the upstream zone via the upstream test cock and by measuring a second absolute pressure (25) at the upstream test cock at which fluid starts to discharge via the discharge opening and comparing said absolute pressure to a required threshold pressure for the relief valve.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P32977NL00/WHA2
Nederlands aanvraag nr. **2019334**	Indieningsdatum **24-07-2017**
	Ingeroepen voorrangsdatum

Aanvrager (Naam)

H.S.F. Samenwerkende Fabrieken B.V.

Datum van het verzoek voor een onderzoek van internationaal type	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.
11-11-2017	**SN69974**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

E03B7/07;E03C1/10;F16K37/00

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**E03B;E03C;F16K**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2019334

A. CLASSIFICATIE VAN HET ONDERWERP
INV. E03B7/07 E03C1/10 F16K37/00
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
E03B E03C F16K

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 5 404 905 A (LAURIA THOMAS J [US]) 11 april 1995 (1995-04-11)	12
A	* kolom 3, regel 6 - kolom 4, regel 29 * * kolom 5, regel 48 - kolom 7, regel 27 * * kolom 8, regel 30 - kolom 10, regel 10 * * kolom 11, regel 15 - kolom 12, regel 61; figuren 1,3,5,7 *	1-11

X	US 2004/035467 A1 (HECKING WILLI [DE]) 26 februari 2004 (2004-02-26)	12,13
A	* bladzijde 2, alinea 27 * * bladzijde 3, alinea 42 - bladzijde 5, alinea 54; figuren 5-7, 10 *	1,2

A	EP 1 741 843 A2 (SASSERATH & CO KG H [DE]) 10 januari 2007 (2007-01-10) * kolom 5, alinea 23 - kolom 8, alinea 38; figuren 1-3 *	1,2,12, 13

☐ Verdere documenten worden vermeld in het vervolg van vak C.

☒ Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
12 maart 2018	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fajarnés Jessen, A

Formulier PCT/ISA/201 (tweede blad) (januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2019334

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 5404905 A	11-04-1995	GEEN	
US 2004035467 A1	26-02-2004	PL 359448 A1	06-10-2003
		US 2004035467 A1	26-02-2004
EP 1741843 A2	10-01-2007	AT 431466 T	15-05-2009
		AU 2006202799 A1	18-01-2007
		DE 102005031422 B3	21-12-2006
		EP 1741843 A2	10-01-2007
		ES 2326235 T3	05-10-2009
		US 2007000543 A1	04-01-2007
		ZA 200605480 B	26-09-2007

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN69974	24.07.2017		NL2019334

International Patent Classification (IPC)
INV. E03B7/07 E03C1/10 F16K37/00

Applicant
H.S.F. Samenwerkende Fabrieken B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

Examiner
Fajarnés Jessen, A

Application number

WRITTEN OPINION

NL2019334

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-13
	No:	Claims	
Inventive step	Yes:	Claims	1-11
	No:	Claims	12, 13
Industrial applicability	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VII Certain defects in the application

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re Item VIII

Certain observations on the application

1 Claim **1** lacks clarity for the following reasons:

1.1 The expression "an upstream test cock is positioned upstream of the upstream check valve" is not clear, as no "upstream check valve" has been defined before (but an upstream check valve assembly).

The same applies to the expression "a downstream test cock positioned downstream of the downstream check valve", as no "downstream check valve" has been defined before (but a downstream check valve assembly).

1.2 Moreover, the expression "second absolute pressure" is not clear, as no "first absolute pressure" is defined before. In fact, what is defined before is a "first pressure development".

2 Claims **4 to 6, 9** and **10** lack clarity. In fact, all these claims seem to widen out the steps **(a) to (d)** defined in claim **3**, but as they depend on "any one of the preceding claims", they contradict each other or do not make sense:

2.1 Claim **4** depends on claims **1 to 3** and refers to the preceding method, wherein "testing of the backflow preventer assembly for external leakage comprises" several steps. However, no reference to such testing of the backflow preventer assembly for external leakage has been made before in claims **1 or 2**.

2.2 Claim **5** lacks clarity when it depends on claims **1**, **2** and **4**, as it refers back to "testing of the upstream shut-off valve", but no reference to such testing has been made before.

2.3 Claim **6** lacks clarity when it depends on claims **1**, **2**, **4** and **5**, as it refers back to "testing of the upstream check valve assembly", but no reference to such testing has been made before. In fact, in "the preceding claim", the testing was for the upstream shut-off valve.

2.4 Claim **9** lacks clarity when it depends on claims **1**, **2** and **4 to 8**, as it refers back to "testing of the relief valve for shutdown", but no reference to such testing has been made before. In fact, in claim **1** the step concerning to the relief valve reads "testing an opening pressure of the relief valve".

2.5 Claim **10** lacks clarity when it depends on claims **1**, **2** and **4 to 9**, as it refers back to "testing of the functioning of the relief valve", but no reference to such testing has been made before. In fact, in claim **1** the step concerning to the relief valve reads "testing an opening pressure of the relief valve".

3 Claims **6 to 11** lack clarity. These claims depend on claim **1**, which defines a "method of testing a backflow preventer assembly, the backflow preventer assembly comprising at least a backflow preventer", which backflow preventer comprises several features. In all claims **6 to 11** one of the steps consist in "repairing or replacing" the backflow preventer. If the backflow preventer is repaired or replaced, then the methods would be testing a different backflow preventer as the one defined before, i.e. a second backflow preventer.

4 Claim **12** lacks clarity.

4.1 The expression "an upstream test cock is positioned upstream of the upstream check valve" is not clear, as no "upstream check valve" has been defined before (but an upstream check valve assembly).

The same applies to the expression "a downstream test cock positioned downstream of the downstream check valve", as no "downstream check valve" has been defined before (but a downstream check valve assembly).

4.2 It defines first "an upstream zone is defined between the upstream check valve assembly and the upstream shut-off valve" and "a downstream zone is defined between the downstream check valve assembly and the downstream shut off valve", but afterwards defines "an upstream shut-off valve positioned upstream of the upstream control valve" and "a downstream shut-off valve positioned downstream of the downstream control valve".

5 The subject-matter shown in figures 1 and 2 does not fall within the scope of independent claim **12**. In fact, according to claim **12**, "the backflow preventer assembly is free of a third test cock at the intermediate chamber". However, there is a test cock 33 at the intermediate chamber in figures 1 and 2.

This inconsistency between the claim and the figures leads to doubt concerning the matter for which protection is sought, thereby rendering the claim unclear.

6 There seems to be a contradiction in the description on page 11, lines 25 to 27 ("shut off valve 22 is closed" (?) - but it was already closed (see page 11, line 12)).

7 The vague and imprecise statement in the description on page 15, lines 22-23 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity when used to interpret them.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

8 The following documents are referred to in the search report:

D1	US 5 404 905 A
D2	US 2004/035467 A1
D3	EP 1 741 843 A2

CLAIMS 1 TO 11

9 As far as the application could be understood (see above under Item VIII), the subject-matter of independent claim **1** seems to be novel and inventive.

9.1 Document **D1**, which appears to represent the most relevant state of the art, discloses (cf. figure 7):

a)- a method of testing a backflow preventer assembly,

the backflow preventer assembly comprising at least:

b)- a backflow preventer comprising:

c)- a housing comprising an inlet and an outlet,

d)- an upstream check valve assembly 720 positioned in the housing downstream of the inlet and being biased to a closed position,

e)- a downstream check valve assembly 754 positioned in the housing downstream of the upstream check valve and being biased to a closed position,

f)- an intermediate chamber positioned between the upstream check valve assembly and the downstream check valve assembly,

g)- the intermediate chamber comprising a discharge opening at a bottom side thereof for emptying the intermediate chamber,

h)- a relief valve 744 located in the housing,

i)- the relief valve 744 being positioned upstream of the downstream check valve assembly 754 and being configured to move between a closed position in which it closes off the discharge opening and an open position in which the discharge opening is open (see column 12, lines 45 to 48),

j)- an upstream test cock 728,

k)- wherein the upstream test cock 728 is configured to be attached to a liquid pressure measurement device 732,

l)- a downstream test cock 762,

m)- positioned downstream of the downstream check valve,

n)- wherein the downstream test cock 762 is configured to be attached to a liquid pressure measurement device 766,

o)- an upstream shut off valve 710 positioned upstream of the upstream test cock 728,

p)- wherein an upstream zone is defined between the upstream check valve assembly 720 and the upstream shut off valve 710,

q)- a downstream shut off valve 772 positioned downstream of the downstream test cock 762,

r)- wherein a downstream zone is defined between the downstream check valve assembly 754 and the downstream shut off valve 772,

wherein the method of testing the backflow preventer assembly comprises:

s)- testing the downstream shut off valve 772 and the downstream check valve assembly 754 by measuring a first pressure development over time in the downstream zone at the downstream test cock 762 (see column 12, lines 31 to 44).

Therefore document **D1** discloses a method of testing a backflow preventer assembly from which the subject-matter of claim **1** differs in that:

t)- the upstream test cock is positioned upstream of the upstream check valve,

the method of testing the backflow preventer assembly further comprising

u)- testing an opening pressure of the relief valve by closing the upstream shut off valve, gradually lowering the pressure in the upstream zone by tapping off liquid from the upstream zone via the upstream test cock and by measuring a *second* absolute pressure at the upstream test cock at which fluid starts to discharge via the discharge opening and comparing said absolute pressure to a required threshold pressure for the relief valve.

The subject-matter of claim **1** is thus novel.

9.2 The problem to be solved by the present invention may be regarded as to provide a simpler and more cost-effective testing method for backflow preventer assemblies.

9.3 The solution to this problem as defined in claim **1** consist in features **(t)** and **(u)**.

9.4 This combination of the features of independent claim **1** is neither known nor rendered obvious by the documents cited in the search report.

With this solution, a backflow preventer can be tested without using any differential pressure meter. This is a substantial advantage, because an absolute pressure can be measured with a simpler device, which does not require a user to remember a specific and complex order of attachment, which is required in case a differential pressure meter is used.

Document **D1** defines a device with a built-in test method, providing a degree of assurance that backflow will be prevented. In fact, in this document the functional state of a backflow preventer is determined simply, easily and reliably. But the steps followed in the method of this document are different ones as in the present application and it would not be straight forward for the skilled person to change them in order to get to the method of claim **1**.

An advantage of the testing method of the present application is that only a simple manometer is needed to be able to perform all steps.

10 Claims **2 to 11** are dependent on claim **1** and as such also meet the requirements of novelty and inventive step.

CLAIMS 12 AND 13

11 The present application does not meet the criteria of patentability, because the subject-matter of claims **12** and **13** does not involve an inventive step.

11.1 Document **D1**, which appears to represent the most relevant state of the art, discloses (cf. figure 7):

a)- a backflow preventer assembly, comprising:

b)- a backflow preventer comprising:

c)- a housing comprising an inlet and an outlet,

d)- an upstream check valve assembly 720 positioned in the housing downstream of the inlet and being biased to a first closed position,

e)- a downstream check valve assembly 754 positioned in the housing downstream of the upstream check valve and being biased to a second closed position,

f)- an intermediate chamber positioned between the upstream check valve assembly and the downstream check valve assembly,

g)- the intermediate chamber comprising a discharge opening at a bottom side thereof for emptying the intermediate chamber,

h)- a relief valve 744 located in the housing,

i)- the relief valve 744 being positioned upstream of the downstream check valve assembly 754 and being configured to move between a closed position in which it closes off the discharge opening and an open position in which the discharge opening is open (see column 12, lines 45 to 48),

j)- an upstream test cock 728,

k)- wherein the upstream test cock 728 is configured to be attached to a liquid pressure measurement device 732,

l)- wherein an upstream zone is defined between the upstream check valve assembly 720 and the upstream shut off valve 710,

m)- a downstream test cock 762,

n)- positioned downstream of the downstream check valve,

o)- wherein the downstream test cock 762 is configured to be attached to a liquid pressure measurement device 766,

p)- wherein a downstream zone is defined between the downstream check valve assembly 754 and the downstream shut off valve 772,

q)- an upstream shut off valve 710 positioned upstream of the upstream test cock 728,

r)- a downstream shut off valve 772 positioned downstream of the downstream test cock 762,

s)- the backflow preventer assembly being free of a third test cock at the intermediate chamber.

Therefore document **D1** discloses a backflow preventer assembly from which the subject-matter of claim **12** differs in that:

u)- the upstream test cock is positioned upstream of the upstream check valve.

REMARK to **(s)**: even if 728 would be considered as a test cock being at the intermediate chamber, not second, and even less a third test cock are at this chamber, but at the most one.

The subject-matter of claim **12** is thus novel.

11.2 Starting from document **D2** as closest prior art, this document discloses a backflow preventer from which the subject-matter of claim **12** differs in that it comprises:

z)- a downstream shut off valve positioned downstream of the downstream test cock, wherein a downstream zone is defined between the downstream check valve assembly and the downstream shut off valve.

REMARK to **(s)**: in this case, the backflow preventer assembly would be free of a third test cock at the intermediate chamber the same way as can be seen in figures 1 and 2 of the present application.

11.3 The problem to be solved by the present invention may be regarded as to be able to measure the pressure also in the upstream zone.

11.4 The solution proposed in claim **12** of the present application cannot be considered as involving an inventive step. In fact, in the same document **D1**, the pressure can be measured in the upstream zone in the embodiment of figure 5. As stated in document **D1**, column 5, lines 6 to 10, the backflow preventer with failure indicator can take many forms and in would depend on what is needed. Therefore, feature **(u)** is merely one of several straight-forward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed.

11.5 The feature of dependent claim claim **13** has already been employed for the same purpose in the backflow preventer of document **D2** - see figure 10).

Hence the subject-matter of claim **13** does also not involve an inventive step.

Re Item VII

Certain defects in the application

12 The relevant background art disclosed in documents **D1** and **D2** is not mentioned in the description, nor are these documents identified therein.

13 The features of claims **3 to 13** are not provided with reference signs placed in parentheses.

14 The same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in view of the use of "stroomafwaartse controlekraan (18)" and "stroomopwaartse zone (18)" in claim **1**.