CLAIMS

1. A liquid delivery system comprising:

a substrate block including a first substrate port and a second substrate port formed in an upper surface and a first liquid passageway that extends in a first direction and fluidly connects the first substrate port to the second substrate port;

a first active component having a lower surface with an active component port fluidly connected to the first substrate port; and

a removable seal assembly surrounding the fluidly connected first substrate and active component ports and sized to fit inside corresponding channels formed in the upper surface of the substrate block and the lower surface of the first active component and around the fluidly connected first substrate and active component ports for sealing the fluid connection between the substrate block and the first active component, the seal assembly including:

(a) a cylindrical inner sleeve having conically shaped upper and lower portions surrounding an interior liquid pathway and sized to fit within the corresponding channels in the surfaces of the substrate block and active component so that liquid flowing between the first substrate and active component ports passes through the interior liquid pathway, said inner sleeve being tapered toward a top and a bottom of the inner sleeve by having a sloped outer portion that is sloped away from the interior pathway at an angle relative to a vertical axis of the inner sleeve at both the top and bottom of the inner sleeve; and

(b) an annular outer ring connected to the outer portion of the inner sleeve and having a larger diameter than the inner sleeve, the outer ring extending in a vertical direction toward both a top and a bottom of the outer ring;

wherein the inner sleeve has a first height extending from the top of the inner sleeve to the bottom of the inner sleeve and the outer ring has a second height extending from the top of the outer ring to the bottom of the outer ring, the first height being greater than the second height; and

wherein the inner sleeve further comprises a sloped inner portion that slopes away from the sloped outer portion and toward the interior liquid pathway at an angle relative to the vertical axis of the inner sleeve at both the top and bottom

of the inner sleeve, wherein the slope of the sloped inner portion is at a greater angle relative to the vertical axis than the slope of the sloped outer portion.

2. The liquid delivery system of claim 1 in which the corresponding channels formed around the substrate and active component ports comprise a port opening having a sloped surface that will mate with the sloped outer portion of the inner sleeve when the seal assembly is installed.

3. The liquid delivery system of claim 2 in which the corresponding channels formed around the first substrate and active component ports further comprise a circular groove having a larger diameter than the port opening into which the circular outer ring of the seal assembly will be inserted when the seal assembly is installed.

4. The liquid delivery system of claim 3 in which the outer ring has a width that is larger than a width of the corresponding circular groove formed around the fluidly connected substrate and active component ports.

5. The liquid delivery system of claim 4 in which the outer ring, when installed, is compressed in the horizontal direction but not in the vertical direction, wherein the sloped outer portion of the inner sleeve is compressed in the vertical direction when the seal assembly is installed.

6. The liquid delivery system of claim 1 in which the outer ring has a height defined as the distance the outer ring extends in a vertical direction toward both the top and bottom of the seal assembly from a central horizontal axis and in which the height of the outer ring is less than the depth of the corresponding channels formed around the substrate and active component ports.

7. The liquid delivery system of claim 1 in which the sloped outer portion of the inner sleeve is compressed in the vertical direction when the seal assembly is installed.

8. The liquid delivery system of claim 1 in which the inner sleeve has an axial height from the horizontal axis of the seal assembly to the upper or lower edge of the inner sleeve

and in which the ratio of the axial height to the thickness of the inner sleeve wall is in the range from 0.5 to 2.5.

9. The liquid delivery system of claim 1 in which the removable seal assembly is symmetrical above and below a central horizontal plane.

10. The liquid delivery system of claim 1 in which the removable seal assembly is symmetrical about a central vertical plane.

11. The liquid delivery system of claim 1 in which the removable seal assembly comprises a polymer or fluoropolymer.

12. The liquid delivery system of claim 1 in which the removable seal assembly comprises a compressible material.

13. A removable seal assembly for sealing around a fluid connection formed when two substrates, each having a fluid flow pathway open to a first substrate face, are connected via a face-to-face interface, the removable seal assembly comprising:

a cylindrical inner sleeve having conically shaped upper and lower portions surrounding an interior fluid pathway and sized to fit within corresponding channels in the substrate faces so that fluid flowing between the fluidly connected substrates passes through the interior fluid pathway, said inner sleeve being tapered toward a top and a bottom of the inner sleeve by having a sloped outer portion that is sloped away from the interior pathway at an angle relative to the vertical axis of the inner sleeve at both the top and bottom of the inner sleeve; and

an annular outer ring connected to the outer portion of the inner sleeve and having a larger diameter than the inner sleeve, the outer ring extending in a vertical direction toward both a top and a bottom of the outer ring and sized to fit within corresponding cylindrical grooves formed in the substrate faces and surrounding the fluid connection between the substrates;

wherein the inner sleeve has a first height extending from the top of the inner sleeve to the bottom of the inner sleeve and the outer ring has a second height extending

from the top of the outer ring to the bottom of the outer ring, the first height being greater than the second height; and

wherein the inner sleeve further comprises a sloped inner portion that slopes away from the sloped outer portion and toward the interior liquid pathway at an angle relative to the vertical axis of the inner sleeve at both the top and bottom of the inner sleeve, wherein the slope of the sloped inner portion is at a greater angle relative to the vertical axis than the slope of the sloped outer portion.

14. The removable seal assembly of claim 13 in which the inner sleeve has an axial height from the horizontal axis of the seal assembly to the upper or lower edge of the inner sleeve and in which the ratio of the axial height to the thickness of the inner sleeve wall is in the range from 0.5 to 2.5.

15. The removable seal assembly of claim 13 in which the removable seal assembly is symmetrical above and below a central horizontal plane.

16. The removable seal assembly of claim 13 in which the removable seal assembly is symmetrical about a central vertical plane.

17. The removable seal assembly of claim 13 in which the removable seal assembly comprises a polymer or fluoropolymer.

18. The removable seal assembly of claim 13 in which the removable seal assembly comprises a compressible material.