CLAIMS

What is claimed is:

1. A method of installing a fluid flow component in an apparatus for controlling flow, the method comprising:

a) positioning a first seal into a first seal retainer to form a seal assembly;

b) installing the seal assembly onto the fluid flow component so that the first seal is aligned with a first seal cavity of the fluid flow component, thereby forming a component assembly;

c) positioning the component assembly atop a first substrate block of the apparatus for controlling flow so that the first seal is aligned with a first seal cavity of the first substrate block and a portion of the first seal retainer is positioned between the first substrate block and the fluid flow component;

d) partially fastening the component assembly to the apparatus for controlling flow so that the first seal is at least partially disposed within each of the first seal cavity of the first substrate block and the first seal cavity of the fluid flow component;

e) retracting the first seal retainer so that the first seal retainer is released from the fluid flow component and the portion of the first seal retainer is removed from between the first substrate block and the fluid flow component; and

f) completely fastening the component assembly to the apparatus for controlling flow.

2. The method of claim 1 wherein apparatus for controlling flow further comprises a base substrate and the fluid flow component assembly further comprises a first fastener, and in step c), the first substrate block is in contact with the base substrate.

~~3. The method of claim 2 wherein in step d), the first fastener engages the base substrate.~~

~~4. The method of claims 3 wherein in step d), the first fastener extends through the first substrate block.~~

3. ~~5.~~ The method of ~~any one of~~ claim~~s~~ 1 ~~to 4~~ wherein the apparatus for controlling flow comprises a first component mounting location, the first component mounting location comprising the first substrate block and a second substrate block, wherein the second substrate block comprises a first seal cavity, the fluid flow component comprises a second

seal cavity and a second fastener, further comprising steps a-1) and b-1), wherein step a-1) comprises installing a second seal into a second seal retainer to form a second seal assembly, wherein step b-1) comprises installing the second seal assembly onto the fluid flow component so that the second seal is aligned with the second seal cavity of the first component, and wherein step c) further comprises positioning the component assembly in the first mounting location so that the second seal is aligned with the first seal cavity of the second substrate block and wherein step e) further comprises retracting the second seal retainer so that the second seal retainer is released from the fluid flow component.

~~6. The method of claim 5 further comprising step a-1), wherein step a-1) comprises installing a second seal into a second seal retainer to form a second seal assembly.~~

~~7. The method of claim 6 further comprising step b-1), wherein step b-1) comprises installing the second seal assembly onto the fluid flow component so that the second seal is aligned with the second seal cavity of the first component.~~

~~8. The method of claim 7 wherein step c) further comprises positioning the component assembly in the first mounting location so that the second seal is aligned with the first seal cavity of the second substrate block and wherein step e) further comprises retracting the second seal retainer so that the second seal retainer is released from the fluid flow component.~~

~~9. The method of any one of claims 1 to 8 wherein the component assembly is fastened by a bolt.~~

~~10. The method of any one of claims 1 to 9 wherein the component assembly is fastened by a plurality of bolts.~~

4. ~~11.~~ The method of ~~any one of~~ claim~~s~~ 1 ~~to 10~~ wherein the first seal retainer comprises a seal aperture that receives the first seal.

~~12. The method of claim 11 wherein the seal aperture of the first seal retainer is a circular aperture.~~

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5. ~~13.~~ The method of ~~any one of~~ claim~~s~~ ~~11 to 12~~ wherein the first seal is an interference fit in the seal aperture and wherein the seal aperture engages an outer diameter of the first seal.

~~14. The method of any one of claims 11 to 13 wherein the seal aperture engages an outer diameter of the first seal.~~

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6. ~~15.~~ The method of ~~any one of~~ claim~~s~~ ~~11 to 14~~ wherein the first seal retainer comprises a frangible zone, the frangible zone comprising a slot extending from the seal aperture.

~~16. The method of claim 15 wherein the frangible zone of the first seal retainer facilitates rupture of the first seal retainer.~~

~~17. The method of any one of claims 15 to 16 wherein the frangible zone comprises a slot extending from the seal aperture~~.

7. ~~18.~~ The method of ~~any one of~~ claim~~s~~ 1 ~~to 17~~ wherein step e) further comprises rupturing the first seal retainer to release the first seal retainer.

~~19. The method of any one of claims 1 to 18 wherein the first seal retainer engages an alignment feature of the component assembly.~~

8. ~~20.~~ The method of ~~any one of~~ claim~~s~~ 1 ~~to 19~~ wherein the first seal retainer comprises a gripping feature.

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9. ~~21.~~ The method of claim ~~20~~ wherein the gripping feature is one of a plurality of circular apertures or a pair of elongate apertures spaced from one another.

~~22. The method of claim 20 wherein the gripping feature is formed as a pair of elongate apertures spaced from one another.~~

~~23. The method of any one of claims 1 to 22 wherein the first seal retainer is made of sheet material.~~

~~24. The method of any one of claims 1 to 23 wherein the first seal retainer is formed of one of polyethylene terephthalate, Mylar, perfluoroalkoxy alkane, polytetrafluoroethylene, polyether ether ketone, polyvinylidene fluoride, polyimide, polypropylene, or fluorinated ethylene propylene.~~

~~25. The method of any one of claims 1 to 24 wherein the seal retainer has a thickness of 0.013 mm.~~

~~26. The method of any one of claims 1 to 25 wherein, during step a), the seal retainer is folded along an axis.~~

~~27. The method of any one of claims 1 to 26 wherein the apparatus for controlling flow comprises a plurality of component mounting locations.~~

~~28. The method of any one of claims 1 to 27 wherein the fluid flow component is one of a valve, a flow controller, a pressure transducer, a flow measurement sensor, a pressure regulator, a flow restrictor, or an actuator.~~

10. ~~29.~~ The method of ~~any one of~~ claim~~s~~ 1 ~~to 28~~ wherein in step d), a mounting surface of the first substrate block and a mounting surface of the fluid flow component are separated by a first distance and wherein in step f) the mounting surface of the first substrate block and the mounting surface of the fluid flow component are separated by a second distance, wherein the first distance is greater than the second distance.

~~30. A method of manufacturing semiconductors or integrated circuits comprising:~~

~~installing a fluid flow component of an apparatus for controlling flow according to the method of any one of claims 1 to 29 to complete a fluid supply line that extends from a fluid source to a process chamber; and~~

~~flowing fluid from the fluid source to the process chamber to contact one or more semiconductor or integrated circuit wafers in the process chamber.~~

11. ~~31.~~ A seal retainer for retaining a seal, the seal retainer comprising:

a sheet body, the sheet body comprising:

a first axis;

a second axis perpendicular to the first axis;

a first portion, the first axis coplanar with the first portion, the first portion elongate in a direction of the first axis and extending from the second axis along the first axis;

a second portion, the second portion extending from the second axis and having a seal retaining feature.

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12. ~~32.~~ The seal retainer of claim ~~31~~ wherein the first portion comprises a first perimeter edge, a second perimeter edge opposite the first perimeter edge, a third perimeter edge, and a fourth edge opposite the third perimeter edge, the fourth edge being collinear with the second axis.

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13. ~~33.~~ The seal retainer of ~~any one of~~ claims ~~31 to 32~~ wherein the first portion comprises a plurality of circular apertures which form a gripping feature.

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14. ~~34.~~ The seal retainer of ~~any one of~~ claims ~~31 to 33~~ wherein the first portion comprises a plurality of elongate apertures separated by a tab portion, the tab portion having a distal edge connected to an internal edge of the first portion, wherein the distal edge of the tab portion is connected to the internal edge of the first portion by a frangible zone.

~~35. The seal retainer of claim 34 wherein the distal edge of the tab portion is connected to the internal edge of the first portion by a frangible zone.~~

~~36. The seal retainer of any one of claims 31 to 35 wherein the second portion is elongate along the second axis.~~

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15. ~~37.~~ The seal retainer of ~~any one of~~ claims ~~31 to 34~~ wherein the seal retaining feature of the second portion is a seal retaining aperture, wherein the second portion comprises a frangible zone adjacent the seal retaining aperture, the frangible zone located between the seal retaining feature and a perimeter edge of the sheet body.

~~38. The seal retainer of claim 37 wherein the seal retaining aperture is circular.~~

~~39. The seal retainer of any one of claims 37 to 38 wherein the second portion comprises a frangible zone adjacent the seal retaining aperture.~~

~~40. The seal retainer of any one of claims 31 to 39 wherein a frangible zone is located between the seal retaining feature and a perimeter edge of the sheet body.~~

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16. ~~41.~~ The seal retainer of ~~any one of~~ claim~~s 31 to 40~~ wherein the second portion comprises a frangible zone, the frangible zone comprising a slot.

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17. ~~42.~~ The seal retainer of claim ~~41~~ wherein the slot extends from the seal retaining feature.

~~43. The seal retainer of any one of claims 41 to 42 wherein the frangible zone comprises a plurality of slots.~~

~~44. The seal retainer of any one of claims 41 to 43 wherein seal retaining feature comprises a center point, the slot extending radially from the center point to a perimeter edge of the sheet body.~~

~~45. The seal retainer of any one of claims 31 to 44 wherein the second portion comprises a frangible zone and the sheet body comprises a perimeter edge, the frangible zone positioned at a location where a distance between the seal retaining feature and the perimeter edge is smallest.~~

~~46. The seal retainer of any one of claims 31 to 45 wherein the second portion comprises a fastener engagement feature.~~

~~47. The seal retainer of claim 46 wherein the fastener engagement feature is semicircular.~~

~~48. The seal retainer of any one of claims 46 to 47 wherein the fastener engagement feature forms a portion of a perimeter edge of the sheet body.~~

~~49. The seal retainer of any one of claims 46 to 48 wherein the fastener engagement feature comprises a frangible zone.~~

~~50. The seal retainer of any one of claims 31 to 49 wherein the sheet body is formed of one of polyethylene terephthalate, Mylar, perfluoroalkoxy alkane, polytetrafluoroethylene, polyether ether ketone, polyvinylidene fluoride, polyimide, polypropylene, or fluorinated ethylene propylene.~~

~~51. The seal retainer of any one of claims 31 to 50 wherein the sheet body has a thickness of 0.013 mm.~~

~~52. The seal retainer of any one of claims 31 to 51 wherein the first portion forms a first planar surface and the second portion forms a second planar surface.~~

~~53. The seal retainer of any one of claims 31 to 52 wherein, in a folded state, the second portion is angled with respect to the first axis.~~

~~54. The seal retainer of any one of claims 31 to 53 wherein, in a flat state, the second portion is coplanar with the first axis.~~

18. ~~55.~~ A fluid flow component assembly, the fluid flow component assembly comprising:
a fluid flow component comprising a first seal cavity;
an alignment feature in contact with the fluid flow component;
a first seal configured to engage the first seal cavity;
a first seal retainer configured to engage the first seal and the alignment feature of the fluid flow component;
wherein the first seal is assembled to the first seal retainer, the first seal in contact with the first seal cavity.

~~56. The component assembly of claim 55 wherein the fluid flow component is one of a valve, a flow controller, a pressure transducer, a flow measurement sensor, a pressure regulator, or an actuator.~~

~~57. The component assembly of any one of claims 55 to 56 wherein the first seal has a cylindrical outer surface.~~

~~58. The component assembly of any one of claims 55 to 57 wherein the first seal retainer has a circular seal retaining aperture configured to engage a cylindrical outer surface of the first seal.~~

~~59. The component assembly of claim 58 wherein the first seal retainer has a frangible zone located adjacent the seal retaining aperture.~~

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19. ~~60.~~ The component assembly of ~~any one of~~ claim~~s 55 to 59~~ wherein the first seal retainer has a fastener engagement feature.

~~61. The component assembly of claim 60 wherein the fastener engagement feature is semicircular.~~

~~62. The component assembly of any one of claims 60 to 61 wherein the fastener engagement feature forms a portion of a perimeter edge of the first seal retainer.~~

~~63. The component assembly of any one of claims 60 to 62 wherein the fastener engagement feature comprises a frangible zone.~~

~~64. The component assembly of any one of claims 55 to 63 wherein the first seal retainer is formed of a sheet material.~~

~~65. The component assembly of any one of claims 55 to 64 wherein the first seal retainer is non-planar.~~

~~66. The component assembly of any one of claims 55 to 65 wherein the first seal retainer engages the alignment feature.~~

~~67. The component assembly of any one of claims 55 to 66 wherein the fluid flow component further comprises a second seal cavity.~~

~~68. The component assembly of claim 67 further comprising a second seal, a second alignment feature, and a second seal retainer, the second seal configured to engage the second seal cavity and the second seal retainer configured to engage the second seal and the second alignment feature, wherein the second seal is assembled to the second seal retainer and in contact with the second seal cavity and the second alignment feature is in contact with the first component.~~

~~69. The component assembly of claim 68 wherein the second seal retainer engages the second alignment feature.~~

20. ~~70.~~ A method of installing a fluid flow component to an apparatus for controlling flow, the method comprising:

a) positioning a component assembly atop a first substrate block, the component assembly comprising a fluid flow component, a first seal retainer, and a first seal retained by the first seal retainer in alignment with a first seal cavity of the fluid flow component, the component assembly positioned atop the first substrate block so that the first seal is aligned with a first seal cavity of the first substrate block;

b) retracting the first seal retainer so that the first seal retainer is released from the fluid flow component while the first seal and the fluid flow component remain in position; and

c) fastening the fluid flow component to the apparatus for controlling flow so that the first seal hermetically seals a flow path of the first substrate block to a flow path of the fluid flow component.