WHAT IS CLAIMED IS

1. A method comprising:

inserting a non-lubricated stopper that includes a sealing rib into a placement region located at a proximal end of a vacuum chamber, the non-lubricated stopper being at least partially covered by a polymer layer;

creating a vacuum seal between the vacuum chamber and an end portion of the non-lubricated cartridge tube;

applying vacuum through a vacuum port fluidly connected to the non-lubricated cartridge tube to vacuum seal the vacuum chamber and sealing gasket of the non-lubricated cartridge tube to translate the non-lubricated stopper through the vacuum chamber from the placement region of the vacuum chamber to a proximal end of the non-lubricated cartridge tube, the vacuum port being located at a distal end of the vacuum chamber;

translating the non-lubricated stopper through the non-lubricated cartridge tube with an insertion rod until a desired headspace between a front edge of the sealing rib and a liquid solution located in the non-lubricated cartridge tube is achieved;

retracting the insertion rod away from the vacuum chamber; and

retracting the vacuum chamber away from the non-lubricated cartridge tube.

2. The method of claim 1, wherein the stopper comprises an elastomeric material having the polymer layer thereon.

3. The method of claim 1 or claim 2, wherein the polymer layer comprises an expanded fluoropolymer layer.

4. The method of claim 3, wherein the expanded fluoropolymer layer comprises an expanded polytetrafluoroethylene layer.

5. The method of any one of claims 1 to 4, comprising adding the liquid solution to the non-lubricated barrel prior to creating the vacuum seal between the sealing gasket and the end portion of the non-lubricated cartridge tube.

6. The method of any one of claims 1 to 5, wherein the liquid solution is a therapeutic substance.

7. The method of claim 6, wherein the therapeutic substance contains therein a biologic, a therapeutic compound, or a combination thereof.

8. The method of any one of claims 1 to 7, wherein the vacuum chamber has been electropolished, extrude honed, or a combination thereof.

9. The method of any one of claims 1 to 8, wherein at least the stopper, the vacuum chamber, the cartridge tube, the end portion of the cartridge tube, and the insertion pin are free or substantially free of lubricants.

10. The method of any one of claims 1 to 9, wherein the vacuum chamber comprises a transition zone having a taper angle for transitioning the non-lubricated stopper from the placement region of the vacuum chamber to the proximal end of the cartridge tube.

11. The method of any one of claims 1 to 10, wherein the taper angle is between about 0.1 degree and about 20 degrees.

12. The method of any one of claims 1 to 11, wherein the desired headspace is from about 1 mm to about 25 mm.

13. The method of any one of claims 1 to 12, wherein the insertion rod has a flat or substantially flat surface and the non-lubricated stopper is a solid stopper.

14. The method of any one of claims 1 to 13, wherein the vacuum chamber is positioned above and is aligned with the non-lubricated cartridge tube.

15. The method of any one of claims 1 to 14, comprising lowering the vacuum chamber to create the vacuum seal with the non-lubricated cartridge tube.

16. The method of any one of claims 1 to 15, wherein the insertion rod and vacuum chamber are retracted simultaneously.

17. The method of any one of claims 1 to 16, wherein the insertion rod is retracted prior to retracting the vacuum chamber.