CLAIMS

What is claimed is:

1. A downhole shunt tube isolation system, comprising:

an isolation sleeve housing defining an isolation sleeve chamber;

an isolation sleeve moveable within the isolation sleeve chamber between an open position and a closed position, the isolation sleeve having a slurry pathway extending through at least a portion of the isolation sleeve, wherein the slurry pathway fluidically couples a first slurry tube segment to a second slurry tube segment with the isolation sleeve in the open position and fluidically decouples the first slurry tube segment from the second slurry tube segment in the closed position;

a fluid channel in communication with the isolation sleeve chamber, the channel initially closed to hydraulically lock the isolation sleeve in the open position; and

an actuation mechanism configured to open the fluid channel to hydraulically unlock the isolation sleeve, and wherein opening the fluid channel generates a pressure differential across the isolation sleeve that drives the isolation sleeve toward the closed position.

2. The system of claim 1, wherein the slurry pathway comprises a radial isolation sleeve inlet, a bore, and a radial isolation sleeve outlet, and wherein the radial isolation sleeve inlet and the radial isolation sleeve outlet pass through a radially outer surface of the isolation sleeve.

3. The system of claim 2, wherein the isolation sleeve inlet and the isolation sleeve outlet are angularly aligned about the circumference of the isolation sleeve.

4. The system of claim 1, further comprises a retention feature configured to restrain rotational and/or axial movement of the isolation sleeve with the isolation sleeve disposed in the open position.

5. The system of claim 1, wherein the isolation sleeve housing further defines a radial inlet, and a radial outlet, wherein the first tube segment is fluidly connected the radial inlet, and wherein the second tube segment is fluidly connected to the radial outlet.

6. The system of claim 5, further comprising an isolation inlet module and an isolation outlet module each secured the isolation sleeve housing, wherein the isolation inlet module fluidly couples the first tube segment with the radial inlet of the isolation sleeve housing, and wherein the isolation outlet module fluidly couples the second tube segment with the radial outlet of the isolation sleeve housing.

7. The system of claim 1, wherein the channel fluidly connects a high-pressure fluid source with a piston chamber, and wherein opening the channel permits fluid flow into the piston chamber, and wherein the piston chamber is in communication with the isolation sleeve chamber.

8. The system of claim 1, further comprising a plug positioned in the channel to close the channel, wherein the actuation mechanism comprises a mechanical device configured to displace a portion of the plug to open a fluid path through the plug and open the channel.

9. The system of claim 1, further comprising a plug positioned in the channel to close the channel, wherein the actuation mechanism comprises a hydraulic device configured to displace a portion of the plug to open a fluid path through the plug and open the channel.

10. The system of claim 1, further comprising a biasing member to bias the isolation sleeve toward the closed position.

11. A downhole shunt tube isolation system, comprising:

an isolation sleeve housing defining an isolation sleeve chamber having an open axial end a sealed axial end disposed opposite the open end, a radial inlet, and a radial outlet;

an isolation sleeve disposed within the isolation sleeve chamber, the isolation sleeve having a pathway extending through the isolation sleeve, wherein a gravel slurry is configured to flow through the pathway from a first tube segment, via the radial inlet, to a second tube segment, via the radial outlet, with the isolation sleeve disposed in an open position, and wherein the pathway is misaligned with respect to the radial inlet and the radial outlet to block flow of the gravel slurry

from the first tube segment to the second tube segment with the isolation sleeve disposed in a closed position;

a shifting sleeve housing defining a piston chamber, a central bore extending axially through the shifting sleeve housing, and a channel extending from the central bore to the piston chamber, wherein the piston chamber is in fluid communication with an open portion of the isolation chamber via the open axial end, and wherein the open portion is positioned between the open axial and the isolation sleeve;

a plug disposed within the channel to seal the piston chamber from the central bore, wherein sealing the channel hydraulically locks the isolation sleeve in the open position; and

an inner sleeve disposed within the central bore of the shifting sleeve, wherein the inner sleeve is configured to slide along the shifting sleeve housing to displace a portion of the plug and open a fluid path through the plug to the piston chamber, wherein opening the fluid path to the piston chamber hydraulically unlocks the isolation sleeve, and wherein a pressure differential between the open portion of the isolation chamber and a sealed portion of the isolation chamber, positioned between the isolation sleeve and the sealed axial end, drives the isolation sleeve to the closed position with the isolation sleeve hydraulically unlocked.

12. The system of claim 11, further comprising a piston disposed within the piston chamber, wherein the piston is configured to slide along the piston chamber in a direction away from the channel in response to opening the fluid path through the plug.

13. The system of claim 12, further comprising a hydraulic coupling configured to fluidly couple the piston chamber with the isolation sleeve chamber, wherein a hydraulic oil fills a space in the piston chamber, the hydraulic coupling, and the open portion of the isolation chamber, between the piston and the isolation sleeve, with the isolation sleeve in the open position.

14. The system of claim 11, further comprising a hydraulic coupling configured to fluidly couple the piston chamber with the isolation sleeve chamber, wherein the hydraulic coupling comprises passageway having a diameter between 0.5-0.01 of the diameter of the piston chamber to choke flow of the hydraulic oil from the piston chamber to the open portion of the isolation sleeve chamber.

15. The system of claim 11, further comprising an isolation inlet module and an isolation outlet module each secured the isolation sleeve housing, wherein the isolation inlet module fluidly couples the first tube segment with the radial inlet of the isolation sleeve housing, and wherein the isolation outlet module fluidly couples the second tube segment with the radial outlet of the isolation sleeve housing.

16. The system of claim 15, wherein the isolation inlet module is configured receive the gravel slurry at an axial end of the isolation inlet module and output the gravel slurry at a radial portion of the isolation inlet module.

17. The system of claim 11, wherein the sealed portion of the isolation sleeve chamber is filled with air comprising a pressure between 0.0-1.0 atmosphere (atm) in the open position of the isolation sleeve.

18. The system of claim 11, wherein the isolation sleeve comprises at least one radial seal configured to seal the sealed portion of the isolation sleeve chamber from the radial outlet, the radial inlet, and the open portion of the isolation sleeve chamber.

19. A method for actuating a downhole shunt tube isolation system, comprising:

sealing a piston chamber disposed within a shifting sleeve housing, via a plug, to hydraulically lock an isolation sleeve in an open position, wherein a gravel slurry is configured to flow from a first tube segment to a second tube segment, via the isolation sleeve, in the open position, wherein the isolation sleeve is disposed within an isolation sleeve chamber, and wherein the piston chamber and the isolation sleeve chamber are in fluid communication;

actuating an inner sleeve disposed within a shifting sleeve housing to displace a portion of the plug and open a fluid path through the plug to the piston chamber, wherein opening the fluid path to the piston chamber hydraulically unlocks the isolation sleeve; and

shifting the isolation sleeve to a closed position, via a biasing force on the isolation sleeve, to block flow of the gravel slurry from the first tube segment to the second tube segment, wherein

the biasing force is generated by a pressure differential across the isolation sleeve with the fluid path opened.

20. The method of claim 19, wherein sealing the sleeve chamber comprises inserting a plug into a slot in the shifting sleeve housing at a surface of a well completion operation to seal the piston chamber at a pressure between 0.0-1.0 atmosphere (atm).

21. The method of claim 19, comprising coupling the isolation sleeve to an inner surface of the isolation sleeve housing with the isolation sleeve in the closed position via a snap ring secured proximate a sealed axial end of the sealed portion of the isolation sleeve chamber.