CLAIMS

1. A threaded connection having a straight central axis, the connection comprising:

a pin having an external pin seal surface and an internal pin seal surface , the external and internal pin seal surfaces separated by a run-in pin thread portion, a perfect pin thread portion, and a run-out pin thread portion, each pin thread portion having a plurality of pin threads, each pin thread having a root, a crest, a stab flank, and a load flank, the depth of each pin thread determined by the distance between the root and the crest, and the width of each pin thread determined by the distance between the stab flank and the load flank, wherein each stab flank is angled between 9° and 20° relative to a plane perpendicular to the straight central axis and toward the external pin seal surface, wherein each load flank is angled between -4° and -9° relative to the plane perpendicular to the straight central axis and toward the external pin seal surface, and wherein for each pin thread an absolute value of the angle of the stab flank is greater than an absolute value of the angle of the load flank;

the roots of adjacent pin threads aligned along a pin taper plane that is angled relative to the central axis of the connection;

the crests of adjacent pin threads of the run-in pin thread portion aligned along a pin run-in plane that is angled relative to the central axis of the connection and the pin taper plane;

the crests of adjacent pin threads of the perfect pin thread portion aligned along a pin perfect plane that is substantially parallel to the pin taper plane; and

the crests of adjacent pin threads of the run-out pin thread portion aligned along a pin run-out plane that is substantially parallel to the central axis of the connection, and angled relative to the pin taper plane;

a box having an internal box seal surface and an external box seal surface, the external and internal box seal surfaces separated by a run-in box thread portion, a perfect box thread portion, and a run-out box thread portion, each box thread portion having a plurality of box threads, each box thread having a root, a crest, a stab flank, and a load flank, the depth of each box thread determined by the distance between the root and the crest, and the width between each box thread determined by the distance between the stab flank and the load flank of adjacent box threads;

the crests of adjacent box threads aligned along a box taper plane that is angled relative to the central axis of the connection;

the roots of adjacent box threads of the run-in box thread portion aligned along a box run-in plane that is parallel to the central axis of the connection and angled relative to the box taper plane;

the roots of adjacent box threads of the perfect box thread portion aligned along a box perfect plane that is substantially parallel to the box taper plane; and

the roots of adjacent box threads of the run-out box thread portion aligned along a box run-out plane that is angled relative to the central axis of the connection and the box taper plane;

the pin threads and the box threads arranged so that when the connection is fully made up, the threads of the run-in pin thread portion engage the threads of the run-out box thread portion, the threads of the perfect pin thread portion engage the threads of the perfect box thread portion, the threads of the run-out box thread portion engage the threads of the run-in pin thread portion, the external pin seal surface sealingly engages the external box seal surface, and the internal pin seal surface sealingly engages the internal box seal surface; and

the width of the pin threads is slightly greater than the width between corresponding box threads, so that as the pin threads engage with the box threads, an interference fit is created between the pin threads and the box threads to limit axial movement in the connection under tension and compression and reduce deformation of the seals during full compression.

2. The threaded connection of claim 1, wherein the pin further comprises:

a pin internal seal diameter; and

a pin internal seal thickness,

the ratio of the pin internal seal diameter to the pin internal seal thickness ranging from sixteen to sixty six.

3. The threaded connection of claim 1 or claim 2, wherein the crests of at least a portion of the box threads are curved so that when the pin threads are fully engaged with the box threads, there is a void between the roots of the pin threads and the corresponding curved crests of the box threads to reduce standoff caused by lubricant or other fluids becoming trapped between the threads as the connection is made up.

4. A threaded connection for connecting two pipes, each pipe having a substantially similar pipe outer diameter and pipe thickness, the threaded connection having a straight central axis, the connection comprising:

a pin comprising:

an external pin seal surface;

an internal pin seal surface;

a pin internal seal diameter; and

a pin internal seal thickness,

the external and internal pin seal surfaces separated by a run-in pin thread portion, a perfect pin thread portion, and a run-out pin thread portion, each pin thread portion having a plurality of pin threads, each pin thread having a root, a crest, a stab flank, and a load flank, wherein each stab flank is angled between 9° and 20° relative to a plane perpendicular to the straight central axis and toward the external pin seal surface, wherein each load flank is angled between -4° and -9° relative to the plane perpendicular to the straight central axis and toward the external pin seal surface, and wherein for each pin thread an absolute value of the angle of the stab flank is greater than an absolute value of the angle of the load flank; and

a box having an internal box seal surface and an external box seal surface, the external and internal box seal surfaces separated by a run-in box thread portion, a perfect box thread portion, and a run-out box thread portion, each box thread portion having a plurality of box threads, each box thread having a root, a crest, a stab flank, and a load flank;

the pin threads and the box threads arranged so that when the connection is fully made up, the threads of the run-in pin thread portion engage the threads of the run-out box thread portion, the threads of the perfect pin thread portion engage the threads of the perfect box thread portion, the threads of the run-out box thread portion engage the threads of the run-in pin thread portion, the external pin seal surface sealingly engages the external box seal surface, and the internal pin seal surface sealingly engages the internal box seal surface;

the ratio of the pin internal seal diameter to the pin internal seal thickness being 1.3 to 6.3 times as great as the ratio of the pipe outer diameter to the pipe thickness.

5. The threaded connection of claim 4, wherein,

the roots of adjacent pin threads align along a pin taper plane that is angled relative to the central axis of the connection,

the crests of adjacent pin threads of the run-in pin thread portion align along a pin run-in plane that is angled relative to the central axis of the connection and the pin taper plane,

the crests of adjacent threads of the perfect pin thread portion align along a pin perfect plane that is substantially parallel to the pin taper plane, and

the crests of adjacent pin threads of the run-out pin thread portion align along a pin run-out plane that is substantially parallel to the central axis of the connection, and angled relative to the pin taper plane.

6. The threaded connection of claim 5, wherein,

the crests of adjacent box threads align along a box taper plane that is angled relative to the central axis of the connection,

the roots of adjacent box threads of the run-in box thread portion align along a box run-in plane that is parallel to the central axis of the connection and angled relative to the box taper plane,

the roots of adjacent box threads of the perfect box thread portion align along a box perfect plane that is substantially parallel to the box taper plane, and

the roots of adjacent box threads of the run-out box thread portion align along a box run-out plane that is angled relative to the central axis of the connection and the box taper plane.

7. The threaded connection of claim 4 or claim 6, wherein the width of the pin threads is slightly greater than the width between adjacent box threads, so that as the pin threads engage with the box threads, an interference fit is created between the pin threads and the box threads to limit axial movement in the connection under tension and compression and reduce deformation of the seals during full compression.

8. The threaded connection of any of claims 4, 6, or 7, wherein the crests of at least a portion of the box threads are curved so that when the pin threads are fully engaged with the box threads, there is a void between the root of the pin threads and the corresponding curved crests of the box threads to reduce standoff caused by lubricant or other fluids becoming trapped between the threads as the connection is made up.

9. A threaded connection having a straight central axis, the connection comprising:

a pin having an external pin seal surface and an internal pin seal surface, the external and internal pin seal surfaces separated by a run-in pin thread portion, a perfect pin thread portion, and a run-out pin thread portion, each pin thread portion having a plurality of pin threads, each pin thread having a root, a crest, a stab flank, and a load flank, wherein each stab flank is angled between 9° and 20° relative to a plane perpendicular to the straight central axis and toward the external pin seal surface, wherein each load flank is angled between -4° and -9° relative to the plane perpendicular to the straight central axis and toward the external pin seal surface, and wherein for each pin thread an absolute value of the angle of the stab flank is greater than an absolute value of the angle of the load flank;

a box having an internal box seal surface and an external box seal surface, the external and internal box seal surfaces separated by a run-in box thread portion, a perfect box thread portion, and a run-out box thread portion, each box thread portion having a plurality of box threads, each box thread having a root, a crest, a stab flank, and a load flank;

the pin threads and the box threads arranged so that when the connection is fully made up, the threads of the run-in pin thread portion engage the threads of the run-out box thread portion, the threads of the perfect pin thread portion engage the threads of the perfect box thread portion, the threads of the run-out box thread portion engage the threads of the run-in pin thread portion, the external pin seal surface sealingly engages the external box seal surface, and the internal pin seal surface sealingly engages the internal box seal surface;

the crests of at least a portion of the box threads being curved so that when the pin threads are fully engaged with the box threads, there is a void between the roots of the pin threads and the corresponding curved crests of the box threads to reduce standoff caused by lubricant or other fluids becoming trapped between the threads as the connection is made up.

10. The threaded connection of claim 9, wherein,

the roots of adjacent pin threads align along a pin taper plane that is angled relative to the central axis of the connection,

the crests of adjacent pin threads of the run-in pin thread portion align along a pin run-in plane that is angled relative to the central axis of the connection and the pin taper plane,

the crests of adjacent pin threads of the perfect pin thread portion align along a pin perfect plane that is substantially parallel to the pin taper plane, and

the crests of adjacent pin threads of the run-out pin thread portion align along a pin run-out plane that is substantially parallel to the central axis of the connection, and angled relative to the pin taper plane.

11. The threaded connection of claim 10, wherein,

the crests of adjacent box threads align along a box taper plane that is angled relative to the central axis of the connection,

the roots of adjacent box threads of the run-in box thread portion align along a box run-in plane that is parallel to the central axis of the connection and angled relative to the box taper plane,

the roots of adjacent box threads of the perfect box thread portion align along a box perfect plane that is substantially parallel to the box taper plane, and

the roots of adjacent box threads of the run-out box thread portion align along a box run-out plane that is angled relative to the central axis of the connection and the box taper plane.

12. The threaded connection of claim 9 or claim 11, wherein the width of the pin threads is slightly greater than the width between adjacent box threads, so that as the pin threads engage with the box threads, an interference fit is created between the pin threads and the box threads to limit axial movement in the connection under tension and compression and reduce deformation of the seals during full compression.

13. The threaded connection of any of claims 9, 11, or 12, wherein the pin further comprises:

a pin internal seal diameter; and

a pin internal seal thickness,

the ratio of the pin internal seal diameter to the pin internal seal thickness ranging from sixteen to sixty six.

14. The threaded connection of claim 1, 4 or 9, wherein the external pin seal surface is bounded by a pin thread at a first external pin surface end and a pin shoulder at a second external pin surface end, the second external pin surface end positioned relatively farther from the internal pin seal surface than the first external pin surface end, and

wherein the pin shoulder extends away from the external pin seal surface and the straight central axis at an acute angle relative to the external pin seal surface.

15, The threaded connection of claim 1, 4 or 9, wherein the threaded connection has an unenergized state, in which the pin threads and the box threads are not full engaged, and an energized state, in which the pin threads and the box threads are fully engaged,

wherein when the threaded connection is in the unenergized state, the external pin seal surface is radially spaced from an innermost cylindrical surface of the pin and the external box seal surface is radially spaced from an outermost cylindrical surface of the box, and

wherein when the threaded connection is in the energized state the external pin seal surface comes into interfering contact with the external box seal surface so that at least one of the external pin seal surface and the external box seal surface deform to form a press fit that prevents fluid from passing between the external pin seal surface and the external box seal surface.