Claims

What is claimed is:

1. A wellhead assembly comprising:

a wellhead housing mounted on a wellbore;

a production tree connected on top of the wellhead housing;

a production flow path formed through the wellhead housing and production tree and in fluid communication with the wellbore;

an annulus defined between concentric tubulars that are registered with the wellbore; and

a bleed line having an end in fluid communication with the annulus and having a portion routed in thermal communication with the production flow path, so that when production fluid from the wellbore flows through the production flow path and annulus fluid is in the bleed line, thermal energy from the production fluid transferred to bleed line heats the annulus fluid in the bleed line.

2. The wellhead assembly of claim 1, further comprising a cross over line for selectively providing fluid communication between the annulus and the production flow path, wherein the bleed line has an end connected to the cross over line.

3. The wellhead assembly of claim 1, wherein the portion of the production tree having the production flow path defines a production wing block, and wherein the bleed line is provided in the production wing block.

4. The wellhead assembly of claim 1, wherein a portion of the bleed line is adjacent a portion of the production flow path.

5. The wellhead assembly of claim 1, wherein a portion of the bleed line contacts a portion of the production flow path.

6. The wellhead assembly of claim 1, wherein a portion of the bleed line circumscribes a portion of the production flow path.

7. The wellhead assembly of claim 6, wherein the portion of the bleed line circumscribing the portion of the production flow path comprises a member selected from the group consisting of a helical line and a jacket.

8. The wellhead assembly of claim 1, wherein the wellbore is subsea.

9. A method of preventing hydrate formation in fluid produced from a wellbore, the method comprising:

a. providing a wellhead assembly comprising a wellhead housing mounted on the wellbore, a production tree connected on top of the wellhead housing, a production flow path formed through the wellhead housing and production tree and in fluid communication with the wellbore, an annulus defined between concentric tubulars that are registered with the wellbore, and a bleed line having an end in fluid communication with the annulus and having a portion routed in thermal communication with the production flow path;

b. flowing production fluid from the wellbore through the production flow path;

c. flowing annulus fluid from the annulus through the bleed line; and

d. heating the annulus fluid by transferring heat from the production fluid to the annulus fluid so that the annulus fluid is at a temperature above that which hydrates are formed.

10. The method of claim 9, after heating the annulus fluid, the annulus fluid is transferred to above sea surface while retaining sufficient thermal energy to remain above a hydrate forming temperature.

11. The method of claim 9, further comprising flowing the annulus fluid through a throttling valve in the bleed thereby reducing pressure of the annulus fluid, wherein the annulus fluid temperature drops to a reduced temperature that is above a hydrate formation temperature.

CLAIMS

What is claimed is:

1. A wellhead assembly comprising:
a wellhead housing mounted on a wellbore;

a production tree connected on top of the wellhead housing;

a production flow path formed through the wellhead housing and production tree and in fluid communication with the wellbore;

an annulus defined between concentric tubulars that are registered with the wellbore; and

a bleed line having an end in fluid communication with the annulus and having a portion routed in thermal communication with the production flow path, so that when production fluid from the wellbore flows through the production flow path and annulus fluid is in the bleed line, thermal energy from the production fluid transferred to the bleed line heats the annulus fluid in the bleed line.

2. The wellhead assembly of claim 1, further comprising a cross over line for selectively providing fluid communication between the annulus and the production flow path, wherein the bleed line has an end connected to the cross over line.

3. The wellhead assembly of claim 1, wherein the portion of the production tree having the production flow path defines a production wing block, and wherein the bleed line is provided in the production wing block.

4. The wellhead assembly of claim 1, wherein the production flow path defines a production flow line, and wherein a portion of the bleed line is adjacent a portion of the production flow line.

5. The wellhead assembly of claim 1, wherein a portion of the bleed line contacts a portion of the production flow path.

6. The wellhead assembly of claim 1, wherein a portion of the bleed line circumscribes a portion of the production flow path.

7. The wellhead assembly of claim 6, wherein the portion of the bleed line circumscribing the portion of the production flow path comprises a member selected from the group consisting of a helical line and a jacket.

8. The wellhead assembly of claim 1, wherein the wellbore is subsea.

9. The wellhead assembly of claim 1, wherein a portion of the production flow path extends through a main bore that extends axially through the wellhead housing and production tree, and another portion of the production flow path extends through a production line that has an end in communication with the main bore and projects through the production tree, and wherein a portion of the bleed line distal from the annulus runs adjacent to the production line so that the thermal energy conducts from the production line, through the production tree, and to the portion of the bleed line in the production tree.

10. A method of preventing hydrate formation in fluid produced from a wellbore, the method comprising:

a. providing a wellhead assembly comprising a wellhead housing mounted on the wellbore, a production tree connected on top of the wellhead housing, a production flow path formed through the wellhead housing and production tree and in fluid communication with the wellbore, an annulus defined between concentric tubulars that are registered with the wellbore, and a bleed line having an end in fluid communication with the annulus and having a portion routed in thermal communication with the production flow path;

b. flowing production fluid from the wellbore through the production flow path;

c. flowing annulus fluid from the annulus through the bleed line; and

d. heating the annulus fluid by transferring heat from the production fluid to the annulus fluid so that the annulus fluid is at a temperature above that which hydrates are formed.

11. The method of claim 10, after heating the annulus fluid, the annulus fluid is transferred to above sea surface while retaining sufficient thermal energy to remain above a hydrate forming temperature.

12. The method of claim 10, further comprising flowing the annulus fluid through a throttling valve in the bleed line thereby reducing pressure of the annulus fluid, wherein the annulus fluid temperature drops to a reduced temperature that is above a hydrate formation temperature.

13. The method of claim 10, wherein the heat transferred from the production fluid to the annulus fluid is conducted through the production tree.