SUMMARY

An aspect of the disclosure provides a cargo tank comprising an interior volume having one or more electrostatic separator sections connected to an inlet of the cargo tank and isolated from other interior volumes of the cargo tank, the inlet configured to receive a produced stream containing oil and water. At least one of the electrostatic separator sections houses at least one electrostatic separator vessel.

Another aspect of the disclosure provides a storage tank comprising an interior volume having one or more electrostatic separator sections connected to an inlet of the storage tank and isolated from other interior volumes of the storage tank, the inlet configured to receive a produced stream containing oil and water. A treatment flow path of at least one of the electrostatic separator sections houses at least one electrostatic separator vessel.

A crude oil storage tank for use in a floating production storage and offloading ("FPSO") installation is also disclosed. The crude oil storage tank includes a tank having an inlet section that receives an oil-and-water mixture, an oil outlet section that receives a dehydrated crude oil, and an electrostatic separator section located between the inlet and outlet sections. The inlet section provides an oil-and-water mixture to the electrostatic separator section and the electrostatic separator section provides a dehydrated oil product to the oil outlet section and a water product to a water outlet section of the tank.

The electrostatic separator section of the tank houses at least one set of electrostatic (high velocity) internals, preferably of the type disclosed in US 8591714 B2 and US 9095790 B2 to Sams et al., both incorporated by reference herein. Because the electrostatic internals are housed within the crude oil storage tank, the weight of this equipment is removed from the topside and becomes part of the boat's structure.

Each set of the electrostatic internals can be made up of a first and a second elongated leg connected one to the other and oriented at an incline or oblique angle relative to a longitudinal centerline of the crude oil storage tank, each leg providing a defined

treatment flow path for treating the incoming oil-and-water mixture, with the first leg having a closed upper end, the second leg having an open upper end, and each leg having open bottom ends located in a water outlet section of the tank. The legs are inclined so the lower end of each lies closer to the inlet section side of the tank and the upper end lies closer to the oil outlet section side of the tank. The flow path itself is confined to the legs where the oil-and-water mixture is subjected to an electric field.

The inlet to the first leg is in communication with the inlet section of the crude oil storage tank. The oil outlet of the first leg is the inlet to the second leg. The oil outlet of the second leg is in communication with the outlet section of the crude oil storage tank.

Dehydrated oil exits the oil outlet located along the upflow end of the second leg and separated water exits the water outlet at the downflow ends of the first and second legs.

Employing one or more sets of the electrostatic internals within the crude oil storage tank permits the allowable inlet water content of stream to increase above 30% and up to 80%, significantly reducing the required topside processing equipment. Additionally, no pre-treater is required.

Because the crude oil storage tank when equipped with the electrostatic internals can handle large volumes of water, the first and second separator vessels arranged upstream of the tank can be vertically oriented vessels smaller in size than the typical horizontal separator vessel used in FPSO process trains. The same is true of the other vessels used in the system. A flash vessel is arranged downstream of the first and second vertical separator vessels, a degasser vessel is arranged downstream of the flash vessel, and the crude oil storage tank equipped with the electrostatic internals is arranged downstream of the degasser vessel.

An electrostatic treater is then arranged downstream of the crude oil storage tank. Employing DUAL FREQUENCY® technology (Cameron Solutions, Inc., Houston, TX) within the treater is viable for water cuts approaching 50%.

A process for removing water from a produced oil-and-water stream is also disclosed. The process includes the step of routing the produced oil-and-water stream to the electrostatic separator section of the crude oil storage tank, with the produced oil-and-water stream being treated upstream of the tank by the first and second separator vessels, a flash vessel, and a degasser vessel.

Embodiments can provide a system and process design that reduces the size and weight requirements of prior art FPSO process trains yet still achieves the final BS&W and salt requirements while accommodating streams with higher volumes of water flowing into the crude oil storage tank.

WHAT IS CLAIMED

1. A cargo tank comprising:

an interior volume having one or more electrostatic separator sections connected to an inlet of the cargo tank and isolated from other interior volumes of the cargo tank, the inlet configured to receive a produced stream containing oil and water;

wherein at least one of the electrostatic separator sections houses at least one electrostatic separator vessel.

2. A cargo tank according to claim 1, wherein the at least one electrostatic separator vessel is oriented oblique to a longitudinal centerline of the cargo tank.

3. A cargo tank according to claim 1, wherein at least one of the electrostatic separator sections includes at least two legs containing electrostatic internals, the at least two legs in fluid communication with one another.

4. A cargo tank according to claim 1, wherein the at least one electrostatic separator vessel is cylindrical shaped.

5. A cargo tank according to claim 1, further comprising the inlet including a portion of the interior volume housing the produced stream.

6. A cargo tank according to claim 1, further comprising a portion of the interior volume housing oil separated from the produced stream.

7. A cargo tank according to claim 6, wherein an oil outlet of at least one of the electrostatic separator sections is in fluid communication with the portion of the interior volume housing oil separated from the produced stream.

8. A cargo tank according to claim 1, further comprising a portion of the interior volume housing water separated from the produced stream.

9. A cargo tank according to claim 8, wherein a water outlet of at least one of the electrostatic separator vessels is in fluid communication with the portion of the interior volume housing water separated from the produced stream.

10. A storage tank comprising:

an interior volume having one or more electrostatic separator sections connected to an inlet of the storage tank and isolated from other interior volumes of the storage tank, the inlet configured to receive a produced stream containing oil and water;

wherein a treatment flow path of at least one of the electrostatic separator sections houses at least one electrostatic separator vessel.

11. A storage tank according to claim 10, wherein the at least one of the electrostatic separator vessel is oriented oblique to a longitudinal centerline of the storage tank.

12. A storage tank according to claim 10, wherein at least one of the electrostatic separator sections includes at least two legs containing electrostatic internals, the at least two legs in fluid communication with one another.

13. A storage tank according to claim 10, wherein the at least one electrostatic separator vessel is cylindrical shaped.

14. A storage tank according to claim 10, further comprising the inlet including a portion of the interior volume housing the produced stream.

15. A storage tank according to claim 1, further comprising a portion of the interior volume housing oil separated from the produced stream.

16. A storage tank according to claim 15, wherein an oil outlet of at least one of the electrostatic separator sections is in fluid communication with the portion of the interior volume housing oil separated from the produced stream.

17. A storage tank according to claim 10, further comprising a portion of the interior volume housing water separated from the produced stream.

18. A storage tank according to claim 17, wherein a water outlet of at least one of the electrostatic separator sections is in fluid communication with the portion of the interior volume housing water separated from the produced stream.