
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: METHOD AND SYSTEM FOR PRESSURE CONTROL OF HYDROCARBON WELL FLUIDS

(57) Abstract: A method and a system are disclosed, arranged for pressure control of well fluid produced from wells in a hydrocarbon production field. The system comprises a first pump (6) in fluid communication with a first well (W 1,W 2) and a second pump (6) in fluid communication with a second well (W 3,W 4), the pumps arranged for receiving well fluid produced from the wells respectively and to deliver the fluid to downstream piping (P1-P5) or equipment. The first and second pumps each comprises a motor/generator unit operable as a generator as the pump is driven by well fluid in power generation mode, and wherein the pump is driven in power consumption mode by operation of the motor/generator unit as a motor, wherein the pumps are operatively interconnected via a power distribution unit (8) configured to distribute recovered power between the pumps or to other recipient.
METHOD AND SYSTEM FOR PRESSURE CONTROL OF HYDROCARBON
WELL FLUIDS

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a method and a system arranged for pressure control of well fluids produced in hydrocarbon production. The invention particularly relates to a system aiming for reduced power consumption and recovery of energy in rotating equipment used in the production and transportation of hydrocarbon fluid from wells to topside recipient.

BACKGROUND AND PRIOR ART

Hydrocarbon wells in a hydrocarbon production field typically produce at different pressure and flow rate at a given point in time. The individual oil or gas well also usually delivers at a flow rate and pressure that is decreasing over time. Changes in well fluid pressure and control of flow rate and pressure in produced well fluid is conventionally handled by choking or boosting the flow: i.e. if well fluid pressure is higher than desired in downstream equipment the flow is restricted by means of a choke valve arranged on the well head, and if well fluid pressure is lower than required for transport or downstream treatment the flow may be increased by means of a booster pump or compressor arranged downstream of the choke valve. Boosting and choking are processes that either consume energy or reduce the potential production rate from wells in a hydrocarbon production field.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide pressure control of well fluids produced from wells in a hydrocarbon production field.

It is another object of the present invention to provide a power saving method and system arranged for pressure control of well fluids produced from wells in a hydrocarbon production field.
It is still another object of the present invention to provide a method and a system arranged for pressure control and for optimization of production from wells in a hydrocarbon production field.

At least one of the above objects is met in a system arranged for pressure control of well fluid produced from wells in a hydrocarbon production field, the system comprising:

- a first pump in fluid communication with a first well and a second pump in fluid communication with a second well, the pumps arranged for receiving well fluid produced from the wells respectively and to deliver the fluid to downstream piping or equipment

- the first and second pumps each comprising a motor/generator unit operable as a generator as the pump is driven by well fluid in power generation mode, and wherein the pump is driven in power consumption mode by operation of the motor/generator unit as a motor, wherein the pumps are operatively interconnected via a power distribution unit configured to distribute recovered power between the pumps or to other recipient.

IN EMBODIMENTS OF THE INVENTION

The pump can be realized as a helicon axial pump adapted for pressure boosting of multiphase fluid.

The pumps are configured with a motor- and generator unit which has a motor that is integrated in a power and flow module.

The power and flow module is an electrically powered flow machine wherein permanent magnets are carried in the periphery of a rotor, whereas electromagnets and stator coils are supported on a casing that surrounds the rotor.
The rotor of the power and flow module comprises rotor vanes which are provided a pitch angle against the flow direction which is applied to generate a mainly axial flow through the power and flow module.

The pumps of the pressure control system may each comprise a set of integrated power and flow modules arranged in succession, wherein each power and flow module may be individually controlled via a dedicated variable speed drive (VSD).

The set of power and flow modules in a pump may comprise contra rotating rotors such that each clockwise rotating rotor follows upon an anti-clockwise rotating rotor.

In a set of power and flow modules each module may be arranged to follow directly upon a preceding module without inter-positioned stator vanes between the rotor vanes of successive power and flow modules.

When the motor/generator unit is operated as a motor, the rotor is brought in rotation as the permanent magnets move in the magnetic field which is generated when current is fed to the stator coils for energizing the electromagnets. In the motor mode the pump transfers energy to the fluid via the rotor vanes, raising the pressure in the well fluid.

When the motor/generator unit is operated as a generator the rotor is brought in rotation by the well fluid, the rotor magnets inducing current in the stator coils. In the generator mode, briefly speaking, the pump absorbs energy from the fluid via the rotor vanes, reducing the pressure in the well fluid.

The rotor vanes may be specifically designed, such as curved forward or backward relative to the rotational direction of the rotor, for transfer of energy to the well fluid or for absorbing energy from the well fluid.

In a pump comprising a set of stackable power and flow modules the modules may be alternatingly specified for the motor operation mode or the generator operation mode respectively. In other words, the pump can be equipped with power and flow modules which are alternatingly specified for transfer of energy to the well fluid or for absorbing energy from the well fluid by corresponding shaping of the rotor vanes.
The pressure control system of the present invention further comprises a central power distribution unit (SPDU) to which electrical power and control is supplied from a topside platform at sea or land. The SPDU supplies power to the pumps as required and well fluid pressures are monitored and reported to the SPDU from pressure transmitters arranged on each well. The SPDU contains control logic designed to determine if the subject pump is to be operated as pressure raiser or as pressure reducer, i.e. in power consumption mode or in power generation mode.

The SPDU is further equipped to receive electrical power from a pump operating in generator mode. Electrical power received in the SPDU can be shifted between pumps in the pressure control system, or be delivered to other equipment in the field, or can be supplied to topside platform. In this way, the energy that is tied into the well fluid pressures can be balanced between the wells that are connected to the pressure control system, while simultaneously the energy consumption for pressure control can be reduced.

Thus, in embodiments of the invention, current well fluid pressures can be monitored and reported to the power distribution unit from pressure transmitters arranged on wellheads.

Pumps may further be arranged on wellheads and operable for equalization of pressures in well fluid produced from wells producing at different well fluid pressures.

Embodiments of the invention comprise pumps which are arranged on a module that is connectible to a well head, a Christmas tree or surface tree.

In other embodiments pumps may be arranged on downstream piping and operable for equalization of pressures in fluid flows at different pressures in jumpers/pipings, manifolds, riser bases, PLEM or other flow lines installed on a hydrocarbon production site.

The present invention can be implemented as a method for controlling the pressures in well fluid produced from wells in a hydrocarbon production field, the method comprising:
arranging a pump respectively in fluid communication with each well to receive fluid produced from that well and to deliver the fluid to downstream piping, wherein each pump comprises a motor/generator unit,

and wherein flow/pressure in delivered fluid is increased by operating the pump as motor in power consumption mode, and wherein flow/pressure in delivered fluid is reduced by operating the pump as generator in power generation mode, wherein in power generation mode recovered power is distributed between the pumps or to other recipient via a power distribution unit operatively connected to the pumps.

Details on the different aspects of the invention will be further discussed below in the detailed description of preferred embodiments.

SHORT DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be further explained below with reference made to the accompanying schematic drawings. In the drawings,

Fig. 1 shows a general layout of a pressure control system according to the present invention,

Fig. 2 is a longitudinal sectional view through power and flow modules adapted for incorporation in a pump for the pressure control system of the present invention, and

Fig. 3 is a corresponding sectional view illustrating a booster pump comprising a set of power and flow modules.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Although explained and illustrated below with reference to a subsea implementation it should be pointed out that the teachings provided herein are likewise applicable in the process of hydrocarbon production from land based hydrocarbon wells.

The general layout of a system for pressure control of well fluid produced from seafloor wells in a subsea hydrocarbon production field shall now be explained with reference to Fig. 1. A number of seafloor wells W1-W5, distributed over the seafloor 1, are connected to deliver well fluid to a topside platform 2 or vessel at sea, or to land, via pipelines P1-P5, a manifold 3 and a riser 4. A wellhead 5 on top of each well Wi-
W₅ is arranged to carry the valves, connections and sensors which are required to produce fluid from the well.

According to the embodiment of the invention shown in Fig. 1, a pump and generator 6 is installed in the flow downstream of a choke or production valve 7. The pump/generator may however alternatively be installed upstream of the choke/production valve 7.

The pump 6 is an electrically powered flow machine wherein permanent magnets are carried in the periphery of a rotor, whereas electromagnets and stator coils are supported on a casing that surrounds the rotor, as will be further explained below.

Electrical power is supplied to the pump 6 from a subsea power distribution unit (SPDU) 8 via a variable speed drive (VSD) 9. Power and communication between the SPDU 8 and the platform 2 is transferred via an umbilical 10.

Electrical equipment that is conventionally applied to run subsea units in a hydrocarbon production field, such as transformers, rectifiers, converters etc., which are not required for the understanding of the present invention, are omitted from Fig. 1 for reason of clarity.

The SPDU 8 comprises control logic designed to process information on the current pressures in the well fluid delivered by the seafloor wells W₁-W₅. Well fluid pressures are monitored and reported to the SPDU 8 from pressure transmitters (PT) 11 located upstream of the production valves 7. The SPDU 8 uses the well fluid pressure to decide for each well whether the pump 6 is to be operated for raising the pressure, i.e. as motor in power consumption mode, or for reducing the pressure, i.e. as generator in power generation mode.

Example
If well W₁ produces at a pressure of 250 bar, the pump 6 may be operated in generator mode to reduce the pressure in fluid delivered from the pump down to 150 bar, e.g. Note that the pressure difference represents energy which would normally be wasted if the pressure is reduced by choking the flow.
If well \( W_2 \) simultaneously produces at a pressure of 100 bar the pump 6 is operated in motor mode to raise the pressure in fluid delivered from the pump to 150 bar.

The energy which is recovered by reducing the pressure 100 bar in well fluid from well \( W_i \) in this example can be in the order of 500 kW, whereas the energy required to raise the pressure 100 bar in well fluid produced from well \( W_2 \) can be in the same order of 500 kW. Balancing the pressures between the two wells as illustrated above can thus be accomplished with a considerable saving of energy.

The energy that is recovered from the pump 6 operating in generator mode is transferred to the SPDU 8 via electric power lines 12. The control logic installed in the SPDU 8 determines whether the recovered energy shall be routed to other pumps in the pressure control system, to other subsea power consumers or to the topside platform at sea or to land.

The structure of the pump and generator unit 6 will now be closer explained with reference to Fig. 2.

More precisely, the pump and generator unit 6 is an electrically powered machine which can be realized in different embodiments. Common to all embodiments is an integrated permanent magnet (PM) motor wherein permanent magnets are carried in the periphery of a motor rotor or impeller, whereas electromagnets and stator coils are supported on a stationary casing that surrounds the rotor/impeller.

Embodiments of the pump 6 comprises a power and flow module wherein the rotor is formed with radial blades or rotor vanes which attach to a central rotor shaft that is journalled for rotation. Other embodiments comprise a rotor with vanes that are journalled for rotation on the exterior of a stationary shaft.

With reference to Fig. 2 a set of power and flow modules 100 is shown in longitudinal sectional view. Each power and flow module 100 comprises a rotor 101 which is journalled for rotation on a rotor shaft 102. The rotor 101 can be journalled in radial/axial bearings 103 onto the exterior of a stationary rotor shaft for rotation thereabout separately from the other rotors in a set of power and flow modules. These bearings 103 can be of a kind which gets lubrication from the process fluid.
The rotors may alternatively be non-rotationally attached to a common rotor shaft which is journalled to rotate in bearings arranged on a bearing support (not shown).

Each rotor 101 comprises a set of rotor vanes 104 that extend mainly in radial direction from a rotor centre axis C. At least some of the rotor vanes 104 carry a permanent magnet 105 in the outer, peripheral end of the rotor vane. The permanent magnets 105 can be integrated in a ring member 106 interconnected to the rotor vanes in the rotor periphery 107.

The rotor 101 is surrounded by a casing 108 which has coupling means, such as flanges 109, for coupling to adjacent power and flow modules 100. Seals, not shown in the drawings, are arranged as required in the meeting interfaces between casings of coupled power and flow modules. Supported in the casing 108 is a set of electromagnets with associated stator coils, in the drawings commonly referred to by reference no. 110. The electromagnets 110 form an outer ring about the inner ring of permanent magnets, and the casing 108 can take the shape of a cylinder.

The rotor 101 is thus brought in rotation as the permanent magnets move in the magnetic field which is generated when current is fed to the stator coils for energizing the electromagnets.

In order to optimize operation each power and flow module 100 in a set of power and flow modules can be individually powered and separately controlled via dedicated variable speed drives as illustrated through the VSD boxes in Fig. 3.

If appropriate, the set of individually controlled power and flow modules can be arranged to comprise contra rotating rotors such that each clockwise rotating rotor follows upon an anti-clockwise rotating rotor as illustrated by arrows R which indicate the rotational directions in Fig. 3.

The power and flow modules 100 can be arranged to follow directly upon a preceding module without inter-positioned stator vanes between the rotor vanes of successive modules 100.

In rotation the power and flow module 100 generates an axial flow in the annular flow passage that is formed through the motor rotor, acting as impeller. The rotor vanes
104 are designed with an angle of attack or pitch angle $\alpha$ against the flow $F$ (see Fig. 3), and thus relative to the centre axis $C$. In a set of power and flow modules at least one of the rotors may have vanes with other pitch angle than the other rotors in the set. The pitch angle can be changed successively from the first to the last rotor in the set.

The rotor vanes 104 can be formed with an air-foil section to improve performance in the motor and power generation modes respectively. To illustrate that, the rotor vanes may be formed convexo-concave in sectional profile, and mounted with the concave side facing the rotational direction as illustrated in the power and flow module 100'. A convexo-concave rotor vane may alternatively be mounted with the convex side facing the rotational direction as illustrated in the power and flow module 100''. Thus, the motor rotor or impeller 101 can be designed to perform optimally in either boosting mode, wherein energy is transferred to the fluid via the rotor vanes, or in retarding mode wherein energy is absorbed from the fluid via the rotor vanes.

In practise the pump may have to be designed as a compromise, eventually losing some performance in one of its two modes of operation. However, due to its axial compactness resulting from a stackable design with no stationary guides inserted between the dynamic stages of the pump, the total length can still be maintained within limits even if additional motor stages are added in compensation.

In retarding mode, the power and flow module 100 operates as a dynamo inducing current in the stator coils by the rotating magnetic field which is produced by the permanent magnets, in rotation powered by the momentum of the well fluid that passes through the rotor.

A pressure control system is thus disclosed wherein pumps comprising the motor/generator unit can be arranged on wellheads and operated for equalization of pressures in well fluid produced from seafloor wells or produced from land based hydrocarbon wells that produce at different well fluid pressures. In this aspect the pumps can be arranged on an installation module that is connectible to a well head or to a Christmas tree or a surface tree. However, the pumps can also be operated in other positions of the hydrocarbon production field, such as on downstream piping wherein the pumps can be operated for equalization of pressures in fluid flows at
different pressures in jumpers/pipings, manifolds, riser bases, PLEM or other flow lines installed on a subsea hydrocarbon production site.

The pressure control system as disclosed provides for implementation of a pressure control method comprising:

arranging a respective pump in fluid communication with each well to receive fluid produced from that well and to deliver the fluid to downstream piping, wherein each pump comprises a motor/generator unit,

and wherein flow/pressure in delivered fluid is increased by operating the pump as a motor in power consumption mode, and wherein flow/pressure in delivered fluid is reduced by operating the pump as a generator in power generation mode, wherein in power generation mode recovered power is distributed between two or more pumps or to other recipient via a power distribution unit operatively connected to the pumps.

It has been explained above and illustrated in drawings of exemplifying embodiments, that a highly integrated, compact and power saving system for pressure control of well fluid produced from hydrocarbon wells can be achieved by implementation of the teachings presented herein.

Still, it will be appreciated that modifications of the disclosed embodiments are possible without leaving the scope and spirit of the invention as disclosed above and defined in the appended claims.
CLAIMS:

1. A system arranged for pressure control of well fluid produced from wells in a hydrocarbon production field, the system comprising:

   a first pump (6) in fluid communication with a first well (W1-W5) and a second pump (6) in fluid communication with a second well (W1-W5), the pumps arranged for receiving well fluid produced from the wells respectively and to deliver the fluid to downstream piping (P1-P5) or equipment,

   the first and second pumps each comprising a motor/generator unit (100, 100', 100") operable as a generator as the pump is driven by well fluid in power generation mode, and wherein the pump is driven in power consumption mode by operation of the motor/generator unit as a motor, wherein the pumps are operatively interconnected via a power distribution unit (8) configured to distribute recovered power between the pumps or to other recipient.

2. The pressure control system of claim 1, wherein the pump (6) is a helicon axial pump adapted for pressure boosting of multiphase fluid.

3. The pressure control system of claim 2, wherein the pump (6) comprises a motor and generator unit in which the motor is integrated in a power and flow module (100, 100', 100").

4. The pressure control system of claim 3, wherein the power and flow module (100, 100', 100") is an electrically powered flow machine wherein permanent magnets (105) are carried in the periphery of a rotor (101), whereas electromagnets and stator coils (110) are supported on a casing (109) that surrounds the rotor.

5. The pressure control system of claim 4, wherein the rotor of the power and flow module comprises rotor vanes (104) which are provided a pitch angle (α) against the flow direction (F).

6. The pressure control system of claim 5, wherein the pump comprises a set of integrated power and flow modules arranged in succession, wherein each power and flow module (100, 100', 100") is individually controlled via a dedicated variable speed drive (9).
7. The pressure control system of claim 6, wherein the set of power and flow modules in the pump comprises contra rotating rotors (101) such that each clockwise rotating rotor follows upon an anti-clockwise rotating rotor.

8. The pressure control system of claim 7, wherein in a set of power and flow modules each module is arranged to follow directly upon a preceding module without inter-positioned stationary guides between the rotors of successive power and flow modules.

9. The pressure control system of any of claims 4-8, wherein the rotor vanes (104) are designed, such as curved forward or backward relative to the rotational direction (R) of the rotor, for transfer of energy to the well fluid or for absorbing energy from the well fluid respectively.

10. The pressure control system of claim 9, wherein in a set of stackable power and flow modules the modules are alternatingly specified for transfer of energy to the well fluid or for absorbing energy from the well fluid by corresponding shaping of the rotor vanes (104).

11. The pressure control system of any previous claim, wherein the power distribution unit (8) contains control logic to determine if the pump is to be operated in power consumption mode or in power generation mode.

12. The pressure control system of claim 11, wherein current well fluid pressures are monitored and reported to the power distribution unit (8) from pressure transmitters (11) arranged on wellheads (5).

13. The pressure control system of any previous claim, wherein the pumps are arranged on wellheads (5) and operable for equalization of pressures in well fluid produced from wells (W1-W5) producing at different well fluid pressures.

14. The pressure control system of any previous claim, wherein the pumps are arranged on an installation module that is connectible to a well head, a Christmas tree or surface tree.
15. The pressure control system of any previous claim, wherein the pumps are arranged on downstream piping and operable for equalization of pressures in fluid flows at different pressures in jumpers, manifolds, riser bases, PLEM or other flow lines installed on a hydrocarbon production site.

16. A method for controlling the pressures in well fluid produced from wells (Wi-Wj) in a hydrocarbon production field, the method comprising:

   arranging a pump (6) respectively in fluid communication with each well to receive fluid produced from that well and to deliver the fluid to downstream piping (P1-P5), wherein each pump comprises a motor/generator unit (100, 100', 100")

   and wherein flow/pressure in delivered fluid is increased by operating the pump as a motor in power consumption mode, and wherein flow/pressure in delivered fluid is reduced by operating the pump as a generator in power generation mode, wherein in power generation mode recovered power is distributed between the pumps or to other recipient via a power distribution unit (8) operatively connected to the pumps.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B43/12 F04B47/02 F04D13/12 F04D15/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols):
F04B F04D F03B E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.  

[X] See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search
3 March 2016

Date of mailing of the international search report
11/03/2016

Name and mailing address of the ISA/
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Form PCT/ISA/210 (second sheet) (April 2005)
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<td>GONG HUA ET AL: &quot;Comparison of Multiphase Pumping Technologies for Subsea and Downhole Applications&quot;, OIL AND GAS FACILITIES, vol. 1, no. 01, 1 February 2012 (2012-02-01), pages 36-46, XP055254194, ISSN: 2224-4514, DOI: 10.2118/146784-PA</td>
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