- determining a real value of said at least one operating parameter, when the pump is in said active state,
- based on said real value of said at least one operating parameter, determining if an externally applied force is acting on the motor to such an extent that an operating condition detrimental to the pump arrangement is initiated, which is true when the load factor of the motor exceeds a level detrimental to the pump arrangement,
- effecting a state shift from the active state of the pump to an inactive state of the pump if an operating condition detrimental to the pump arrangement is initiated, said state shift comprising the step of the control unit, immediately after it is determined that an operating condition detrimental to the pump arrangement is initiated, abruptly breaking the driving of the motor in said first direction by the nominal rotational speed of the motor being set equal to zero.

Thus, embodiments of the present invention are based on the understanding that by carrying out different types of measures depending on the load factor of the motor, the pump arrangement is spared and the number of emergency service turn-outs can more or less be entirely eliminated.

According to a preferred embodiment of the present invention, the method also comprises the steps of:
- based on said real value of said at least one operating parameter, determining if an external force is acting on the motor to such an extent that an operating condition straining the pump arrangement is initiated, which is true when the load factor of the motor exceeds a level straining the pump arrangement, and
- effecting a state shift from the active state of the pump to a cleaning state of the pump if an operating condition straining the pump arrangement is initiated.

In this way, the pump arrangement will be differently controlled depending on if the character of clogging corresponds to a detrimental operating condition and a strained operating condition, respectively.

According to a preferred embodiment of the present invention, the method also comprises the step of:

Claims

1. Method for controlling a pump arrangement comprising a pump ~~(2)~~ and a control unit ~~(6)~~, the pump ~~(2)~~ comprising a motor ~~(7)~~ and the control unit ~~(6)~~ being arranged to drive said motor ~~(7)~~,

said motor ~~(7)~~, at each individual instant of time, when the pump ~~(2)~~ is in an active state and the motor ~~(7)~~ is driven in a first direction, being associated with a load factor that corresponds to an operating condition of the pump arrangement,

the pump arrangement furthermore comprising means for monitoring at least one operating parameter from which the load factor of the motor ~~(7)~~ can be derived,

the method comprising the steps of:

- determining a real value of said at least one operating parameter, when the pump ~~(2)~~ is in said active state,
- based on said real value of said at least one operating parameter, determining if an externally applied force is acting on the motor ~~(7)~~ to such an extent that an operating condition detrimental to the pump arrangement is initiated, which is true when the load factor of the motor ~~(7)~~ exceeds a level detrimental to the pump arrangement,
- effecting a state shift from the active state of the pump ~~(2)~~ to an inactive state of the pump ~~(2)~~ if an operating condition detrimental to the pump arrangement is initiated, said state shift comprising the step of the control unit ~~(6)~~, immediately after it is determined that an operating condition detrimental to the pump arrangement is initiated, abruptly breaking the driving of the motor ~~(7)~~ in said first direction by the nominal rotational speed of the motor being set equal to zero.

2. Method according to claim 1, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition detrimental to the pump arrangement is initiated comprises the step of:

- determining if said real value of said at least one operating parameter is equal to or exceeds a predetermined detrimental threshold value (G_S).

3. Method according to claim 1, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition detrimental to the pump arrangement is initiated comprises the step of:
- determining if said real value of said at least one operating parameter is outside a predetermined detrimental interval (R_S).

4. Method according to claim 1, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition detrimental to the pump arrangement is initiated comprises the step of:
- determining if a difference between said real value and a predetermined nominal value, when the pump ~~(2)~~ is in an active state, is equal to or exceeds a predetermined detrimental difference threshold value (D_S).

5. Method according to any one of claims 1-4, which furthermore comprises the steps of:
- based on said real value of said at least one operating parameter, determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition straining the pump arrangement is initiated, which is true when the load factor of the motor ~~(7)~~ exceeds a level straining the pump arrangement, and
- effecting a state shift from the active state of the pump ~~(2)~~ to a cleaning state of the pump ~~(2)~~ if an operating condition straining the pump arrangement is initiated.

6. Method according to claim 5, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition straining the pump arrangement is initiated comprises the step of:
- determining if said real value of said at least one operating parameter is equal to or exceeds a predetermined straining threshold value (G_A) during a predetermined first period of time (T_1).

7. Method according to claim 5, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition straining the pump arrangement is initiated comprises the step of:

- determining if said real value of said at least one operating parameter is outside a predetermined straining interval (R_A) during a predetermined first period of time (T_1).

8. Method according to claim 5, wherein the step of determining if an external force is acting on the motor ~~(7)~~ to such an extent that an operating condition straining the pump arrangement is initiated comprises the step of:

- determining if a difference between said real value and a predetermined nominal value, when the pump ~~(2)~~ is in an active state, is equal to or exceeds a predetermined straining difference threshold value (D_A) during a predetermined first period of time (T_1).

9. Method according to claim 6 depending on claim 5 in turn depending on claim 2, wherein the threshold value (G_S) detrimental to said at least one operating parameter is at least 20 % greater than the threshold value (G_A) straining said at least one operating parameter.

10. Method according to claim 7 depending on claim 5 in turn depending on claim 3, wherein the interval (R_S) detrimental to said at least one operating parameter is greater than and includes the interval (R_A) straining said at least one operating parameter.

11. Method according to claim 8 depending on claim 5 in turn depending on claim 4, wherein the difference threshold value (D_S) detrimental to said at least one operating parameter is at least two times greater than the difference threshold value (D_A) straining said at least one operating parameter.

12. Method according to any one of the preceding claims, which furthermore comprises the step of:

- effecting a state shift from the active state of the pump ~~(2)~~ to a cleaning state of the pump ~~(2)~~ if the motor ~~(7)~~ continually has been driven in said first direction during a predetermined second period of time (T_2).

13. Method according to any one of claims 5-12, wherein said state shift from the active state of the pump ~~(2)~~ to the cleaning state of the pump ~~(2)~~ comprises the step of:
- decreasing the rotational speed of the motor ~~(7)~~ in said first direction according to a predetermined down-ramping of the rotational speed of the motor ~~(7)~~.

14. Method according to claim 13, which furthermore comprises the steps of:
- stopping the motor ~~(7)~~, and
- keeping the motor ~~(7)~~ stopped during a predetermined third period of time (T_3).

15. Method according to claim 14, which furthermore comprises the steps of:
- increasing the rotational speed of the motor ~~(7)~~ in a second direction opposite the first direction according to a predetermined up-ramping of the rotational speed of the motor ~~(7)~~,
- driving the motor ~~(7)~~ in said second direction during a predetermined fourth period of time (T_4),
- decreasing the rotational speed of the motor ~~(7)~~ in said second direction according to said down-ramping of the rotational speed of the motor ~~(7)~~, and
- stopping the motor ~~(7)~~.