CLAIMS

1. Control method for the electric motors of a pump unit of a fire protection system,

which fire protection system comprises spray nozzles (112), a pump unit, a control system with pressure-measuring means, and piping (105) for conducting extinguishing medium from the pump unit to the spray nozzles,

which pump unit comprises pump drives, each of which comprises a pump (101) and an AC electric motor (102, 203a-203f) rotating it, which motor can be connected to an AC electricity network via a contactor device (206a-f),

in which pump unit the AC electric motors are controlled on the basis of the pressure to be measured in the piping,

characterized in that

one of the electric motors (102, 203a-203f) at a time is controlled by means of a frequency converter (108, 204) such that the motor to be controlled with the frequency converter operates as a motor that under the control of the frequency converter steplessly adjusts pressure and the others are started up into the network as steplessly adjusting motors.

2. Method according to claim 1, **characterized** in that the frequency converter can be connected to a motor by means of a first contactor device (205), or otherwise the motor is supplied directly from the network via a second contactor device (206a), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

3. Method according to claim 1, **characterized** in that the frequency converter is connected by means of a contactor device to one of the electric motors.

4. Method according to claim 1, **characterized** in that the frequency converter can be connected by means of contactor devices to any whatsoever of the motors of the pump drive.

5. Method according to claim 2 or 4, **characterized** in that there are two contactor devices (305a-f and 306a-f) for each motor, such that the frequency converter can be connected to each of the motors by means of the first contactor device (205), or otherwise each motor can be supplied directly from the network via the second contactor device (206a-206f), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

6. Method according to claim 4 or 5, **characterized** in that the motors are synchronized to the frequency and phase of the main network, in which case they can be connected to it without significant current peaks.

7. Method according to claim 4, 5 or 6, **characterized** in that an instrument transformer (308) is connected to the analog input of the frequency converter, and the frequency converter measures its own output voltage and the voltage of a phase of the main network and communicates the synchronization moment to the control electronics.

8. Method according to any of the preceding claims, **characterized** in that the fire protection system is a water mist extinguishing system, more particularly a high-pressure water mist extinguishing system.

9. Method according to any of the preceding claims, **characterized** in that the pump unit is controlled with a separate control unit, common to the motors and to the frequency converter, which control unit comprises a control unit (PUC) 402 for the pump unit, connection boards (MCI) 403 for the motor control, a connection board (FCI) 404 for the frequency converter control, and input/output cards (IOC) 405.

10. Method according to any of the preceding claims, **characterized** in that the control cards communicate along a redundant bidirectional CAN bus (406).

11. Method according to any of the preceding claims, **characterized** in that time-critical commands, which are a synchronization command, open KF, close KD, are generated locally in the FCI and in the MCI.

12. Method according to any of the preceding claims, **characterized** in that the FCIs and the MCIs are connected galvanically with conductors (501 – 504) to

each other via the synchronization connectors that they contain for giving synchronization commands from an FCI to one MCI and from it onwards to the other MCIs.

13. Control apparatus of the electric motors of a pump unit of a fire protection system,

which fire protection system comprises spray nozzles (112), a pump unit, a control system with pressure-measuring means, and piping (105) for conducting extinguishing medium from the pump unit to the spray nozzles,

which pump unit comprises pump drives, each of which comprises a pump (101) and an AC electric motor (102, 203a-203f) rotating it, which motor can be connected to an AC electricity network via a contactor device (206a-f), and also a control unit,

in which pump unit the AC electric motors are arranged to be controlled on the basis of the pressure to be measured in the piping,

characterized in that

the apparatus comprises a frequency converter controlling one or more electric motors, and

the control unit is arranged to control one of the electric motors (102, 203a-203f) at a time by means of a frequency converter (108, 204) such that the motor to be controlled with the frequency converter operates as a motor that under the control of the frequency converter steplessly adjusts pressure and the others are started up into the network as steplessly adjusting motors.

14. Apparatus according to claim 13, **characterized** in that the frequency converter can be connected to the motor by means of a first contactor device (205), or otherwise the motor is supplied directly from the network via a second contactor device (206a), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

15. Apparatus according to claim 13, **characterized** in that the frequency converter is connected by means of a contactor device to one of the electric motors.

16. Apparatus according to claim 13, **characterized** in that the frequency converter can be connected by means of contactor devices to any whatsoever of the motors of the pump drive.

17. Apparatus according to claim 14 or 16, **characterized** in that there are two contactor devices (305a-f and 306a-f) for each motor, such that the frequency converter can be connected to each of the motors by means of the first contactor device (205), or otherwise each motor can be supplied directly from the network via the second contactor device (206a-206f), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

18. Apparatus according to claim 16 or 17, **characterized** in that the motors can, by means of the control unit, be synchronized to the frequency and phase of the main network, in which case they can be connected to it without significant current peaks.

19. Apparatus according to any of claims 16 - 18, **characterized** in that an instrument transformer (308) is connected to the analog input of the frequency converter, and the frequency converter measures its own output voltage and the voltage of a phase of the main network and communicates the synchronization moment to the control electronics.

20. Apparatus according to any of the preceding claims 13 - 19, **characterized** in that the fire protection system is a water mist extinguishing system, more particularly a high-pressure water mist extinguishing system.

21. Apparatus according to any of the preceding claims 13 - 20, **characterized** in that the pump unit comprises a separate control unit, common to the motors and to the frequency converter, which control unit comprises a control unit (PUC) 402 for the pump unit, connection boards (MCI) 403 for the motor control, a connection board (FCI) 404 for the frequency converter control and input/output cards (IOC) 405.

22. Apparatus according to any of the preceding claims 13 - 21, **characterized** in that the control cards communicate along a redundant bidirectional CAN bus (406).

23. Apparatus according to any of the preceding claims 13 - 22, **characterized** in that the control unit is fitted such that time-critical commands, which are a synchronization command, open KF, close KD, are generated locally in the FCI and in the MCI.

24. Apparatus according to any of the preceding claims 13 - 23, **characterized** in that the FCIs and the MCIs are connected galvanically with conductors (501 – 504) to each other via the synchronization connectors that they contain for giving synchronization commands from an FCI to one MCI and from it onwards to the other MCIs.

25. Apparatus according to any of the preceding claims 13 - 24, **characterized** in that the apparatus comprises two frequency converters, connected in parallel, which are arranged to operate such that the first frequency converter operates in a normal operating situation, and the second frequency converter is fitted to operate when the first frequency converter fails.

CLAIMS

1. Control method for the electric motors of a pump unit of a fire protection system,

which fire protection system comprises spray nozzles (112), a pump unit, a control system with pressure-measuring means, and piping (105) for conducting extinguishing medium from the pump unit to the spray nozzles,

which pump unit comprises pump drives, each of which comprises a pump (101) and an AC electric motor (102, 203a-203f) rotating it, which motor can be connected to an AC electricity network via a contactor device (206a-f),

in which pump unit the AC electric motors are controlled on the basis of the pressure to be measured in the piping,

characterized in that

one of the electric motors (102, 203a-203f) at a time is controlled by means of a frequency converter (108, 204) such that the motor to be controlled with the frequency converter operates as a motor that under the control of the frequency converter steplessly adjusts pressure and the others are started up into the network as steplessly adjusting motors,

and in that the frequency converter can be connected:

a) to a motor by means of a first contactor device (205), or otherwise the motor is supplied directly from the network via a second contactor device (206a), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF); or

b) by means of contactor devices to any whatsoever of the motors of the pump drive;

and there are two contactor devices (305a-f and 306a-f) for each motor, such that the frequency converter can be connected to each of the motors by means of the first contactor device (205), or otherwise each motor can be supplied directly from the network via the second contactor device (206a-206f), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

2. Method according to claim 1, characterized in that the frequency converter is connected by means of a contactor device to one of the electric motors.

3. Method according to claim 1, characterized in that the motors are synchronized to the frequency

and phase of the main network, in which case they can be connected to it without significant current peaks.

4. Method according to claim 1 or 3, characterized in that an instrument transformer (308) is connected to the analog input of the frequency converter, and the frequency converter measures its own output voltage and the voltage of a phase of the main network and communicates the synchronization moment to the control electronics.

5. Method according to any of the preceding claims, characterized in that the fire protection system is a water mist extinguishing system, more particularly a high-pressure water mist extinguishing system.

6. Method according to any of the preceding claims, characterized in that the pump unit is controlled with a separate control unit, common to the motors and to the frequency converter, which control unit comprises a control unit (PUC) 402 for the pump unit, connection boards (MCI) 403 for the motor control, a connection board (FCI) 404 for the frequency converter control, and input/output cards (IOC) 405.

7. Method according to any of the preceding claims, characterized in that the control cards communicate along a redundant bidirectional CAN bus (406).

8. Method according to any of the preceding claims, characterized in that time-critical commands, which are a synchronization command, open KF, close KD, are generated locally in the FCI and in the MCI.

9. Method according to any of the preceding claims, characterized in that the FCIs and the MCIs are connected galvanically with conductors (501 - 504) to each other via the synchronization connectors that they contain for giving synchronization commands from an FCI to one MCI and from it onwards to the other MCIs.

10. Control apparatus of the electric motors of a pump unit of a fire protection system,

which fire protection system comprises spray nozzles (112), a pump unit, a control system with pressure-measuring means, and piping (105) for conducting extinguishing medium from the pump unit to the spray nozzles,

which pump unit comprises pump drives, each of which comprises a pump (101) and an AC electric motor (102, 203a-203f) rotating it, which motor can be connected to an AC electricity network via a contactor device (206a-f), and also a control unit,

in which pump unit the AC electric motors are arranged to be controlled on the basis of the pressure

to be measured in the piping,

characterized in that

the apparatus comprises a frequency converter controlling one or more electric motors, and

the control unit is arranged to control one of the electric motors (102, 203a-203f) at a time by means of a frequency converter (108, 204) such that the motor to be controlled with the frequency converter operates as a motor that under the control of the frequency converter steplessly adjusts pressure and the others are started up into the network as steplessly adjusting motors.

and in that

the frequency converter can be connected:

a) to the motor by means of a first contactor device (205), or otherwise the motor is supplied directly from the network via a second contactor device (206a), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF); or

b) by means of contactor devices to any whatsoever of the motors of the pump drive;

and there are two contactor devices (305a-f and 306a-f) for each motor, such that the frequency converter can be connected to each of the motors by means of the first contactor device (205), or otherwise each motor can be supplied directly from the network via the second contactor device (206a-206f), such that the motor can be connected to the network directly (KD) or via a frequency converter (KF).

11. Apparatus according to claim 10, characterized in that the frequency converter is connected by means of a contactor device to one of the electric motors.

12. Apparatus according to claim 13, characterized in that the motors can, by means of the control unit, be synchronized to the frequency and phase of the main network, in which case they can be connected to it without significant current peaks.

13. Apparatus according to any of claims 10 - 12, characterized in that an instrument transformer (308) is connected to the analog input of the frequency converter, and the frequency converter measures its own output voltage and the voltage of a phase of the main network and communicates the synchronization moment to the control electronics.

14. Apparatus according to any of the preceding claims 10 - 13, characterized in that the fire

protection system is a water mist extinguishing system, more particularly a high-pressure water mist extinguishing system.

15. Apparatus according to any of the preceding claims 10 - 14, characterized in that the pump unit comprises a separate control unit, common to the motors and to the frequency converter, which control unit comprises a control unit (PUC) 402 for the pump unit, connection boards (MCI) 403 for the motor control, a connection board (FCI) 404 for the frequency converter control and input/output cards (IOC) 405.

16. Apparatus according to any of the preceding claims 10 - 15, characterized in that the control cards communicate along a redundant bidirectional CAN bus (406).

17. Apparatus according to any of the preceding claims 10 - 16, characterized in that the control unit is fitted such that time-critical commands, which are a synchronization command, open KF, close KD, are generated locally in the FCI and in the MCI.

18. Apparatus according to any of the preceding claims 10 - 17, characterized in that the FCIs and the MCIs are connected galvanically with conductors (501 -504) to each other via the synchronization connectors that they contain for giving synchronization commands from an FCI to one MCI and from it onwards to the other MCIs.

19. Apparatus according to any of the preceding claims 10 - 18, characterized in that the apparatus comprises two frequency converters, connected in parallel, which are arranged to operate such that the first frequency converter operates in a normal operating situation, and the second frequency converter is fitted to operate when the first frequency converter fails.