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SPOLANA
NERATOVICE

901212 MN/LR

DEMINERALIZATION STATION

MANUAL: BACKWASH OF RESIN

Content:

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901212 MN/LR
Backw. 1

DEMINERALIZATION STATION

MANUAL: BACKWASH OF RESIN

1. GENERAL

1.1 Suspended solids are accumulated in the lower part of the resin compartment, especially in the cation filter.
Resin fines are accumulated at the top of the bed in all filters.
Therefore, from time to time, the resins have to be backwashed to get rid of the suspended solids and the fines.

For this purpose, there is a backwash tank to which 25 - 50 % of the resin volume from a compartment is transrerred.
During transferring both the resin in the compartment and the resin in the backwash tank are backwashed.

NOTE ! IT IS ESSENTIAL NOT TO MIX DIFFERENT KINDS OF RESINS.

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2. BACKWASH INTERVALS

2.1 All new resins should be backwashed before taken into service.

2.2 The cation resin in filter F 1701 should be backwashed twice a year and the outher resins at least once a year.

2.3 If the pressure drop over a filter increases too much the resin has to be backwashed. Note that the pressure drop increases a little towards the end of the cycle.

The pressure drop skall not exceed
1,3 - 1,5 bar over the cation filters or
1,5 - 1,8 bar over the anion filter at a flow of 60 - 80 m^3/h.

3. BACKWASH OF RESIN

3.1 SITUATION BEFORE START

Backwashing resin from one comparment takes 2 - 4 hours, so make sure there is enough demin water in the storage tanks.

Transferring and backwashing should be supervised all the time.

The resins have their minimum volyme while exchausted (except for the weak anion resin) and should be backwash in that condition.

3.2 TRANSFER TO BACKWASH TANK

Push RESIN TRANSFER, S7, in the control panel. All valves close.

In the front of the CCC there is one pushbutton for cach filter versel, F 1701, F 1702, F 1703.
Push the button representing the filter from which you want to transfer resin.
The pushbutton flashes and inlet valve(-s) is (are) opened.

Connect the hose to the resin compartment and to the top connection of the backwash tank.

Connect the water supply hose to the ejector.

Open the resin transfer valve of the compartment partly. The water-resin flow to the backwash tank is controlled by this valve.

Continue resin transfer/backwash at least for 40 minutes or until the backwash effluent is transparent and control the flow to avoid that resin is discharged with the effluent water.

It is possible to increase the backwash flow by opening the water inlet valve at the ejector.

3.3 TRANSFER FROM BACKWASH TANK TO FILTER COMPARTMENT

After having finished backwashing close the filter resin transfer valve.

Push the button for backwashed filter (placed in CCC).

Connect the resin transfer hose to the ejector.

Open the vent valve of the filer.

Open the valves for ejector transfer between the backwash tank and the filter compartment.

It is possible to increase the flow by opening the drain valve of the filter.

When all resin has been transferred, close the valves.

Rinse the backwash tank and the hose carefully.

Push the stop button in the CCC.

Push the stop button, S6, in the control panel.

Vent all filters.

Start regeneraton of the line.

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DEMINERALIZATION STATION

MANUAL: R E G E N E R A T I O N

Content:

APPENDIX:

REG 1: Automatic regeneration, drawing 4F-5938.

REG 2: Manual regeneration. Manual regeneration of the cation filters or the anion filter, drawing 3F-5937.

REG 3: Basic time schedule for regeneration steps, drawing 4F-5949.

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Reg. 1

DEMINERALIZATION STATION

MANUAL: REGENERATION

1. GENERAL

1.1 The line shall be regenerated if:

- The conductivity after the line exceeds preset value and the alarm for high conductivity for the line is set.

- The silica (SiO_2) concentration after the line is too high (alarm).

1.2 Automatic or manual execution of regeneration is possible.

Level contacts on the measuring vessels and preset timers determine the change of sequence steps during automatic regeneration.

The sequence steps during manual regeneration are changed by pushing the regeneration buttons in a predetermined order.

1.3 Regeneration can always be interrupted by pushing the STOP button. The line then goes to STEP 0 position with all the valves in the line and in the mixing station closed.

1.4 Automatic regeneration has to be manually started.

1.5 It is possible to extend a regeneration step by going over from AUTO REG to MAN REG. When the extension is sufficient, go back to AUTO REG.

1.6 Enough water must be available in the demin water tanks H1706 A and B for the regeneration, which consumes about 44 m^3 for dilution of the chemicals and for rinsing.

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2. SITUATION BEFORE START

2.1 The station is supplied with inlet water, electricity and compressed air.

2.2 The line is in OFF position.

2.3 There is enough water in the demin water storage tanks H1706 A/B.

2.4 The manual valves are in position in accordance with basic position list.

2.5 The instruments are tested and in function.

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Reg. 4

3. AUTOMATIC REGENERATION
See:

- Service and regeneration diagram, drawing 3F-5950.

- Push buttons and signal lamps, drawing 4F-5951.

- Appendix REG 1 and REG 3.

- Alarm list.

3.1 Start of automatic regeneration

3.1.1 Push AUTO REG, S5.

Automatic regeneration starts and proceeds according to appendix REG 1.

Preset timers or level contacts determine when next sequence step shall start.

3.2 Manual stop of regeneration

3.2.1 It is always possible to stop the regeneration:

Push STOP, S6.

The line goes to STEP 0 position.

See 4.1.2.

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Reg. 5

3.3. End of regeneration

When the time for CIRCULATION, S11, is out, the conductivity after the polishing cation filter is controlled:

- If it is over preset H1 limit value:
  See 3.3.1.

- If it is under preset H1 limit value:
  See 3.3.2.

3.3.1 CIRCULATION, S11, continues until the conductivity comes below preset value. Alarm LONG RINSE PERIOD is set.

To stop CIRCULATION, see 3.2.

3.3.2 CIRCULATION, S11, stops.

If MAN is lit, the line goes to MAN and OFF position.

If AUTO is lit, production in AUTO position starts.

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Reg. 6

4. MANUAL REGENERATION
MANUAL REGENERATION OF THE CATION FILTERS OR THE ANION FILTERS

See:
- Service and regeneration diagram, drawing 3F-5950.

- Push buttons and signal lamps, drawing 4F-5951.

- Appendix REG 2 and REG 3.

- Alarm list.

4.1 Start of manual regeneration of the line

4.1.1. Push MAN REG, S4.

The line goes to STEP 0 position, from which three different kinds of manual regenerations can be chosen:

1. Regeneration of the line: See 4.1.3.

2. Regeneration of the cation filters: See 4.2.

3. Regeneration of the anion filter: See 4.3.

4.1.2. Execute regeneration steps S9-S13, according to appendix REG 2, instruction 1.

Change of step is done by pushing buttons S9-S13 or by low level contact signals from chemical measuring vessels.

Basic time schedule for the regeneration steps is schown in appendix REG 3.

4.2. Start of manual regeneration of the cation filters

4.2.1 Continue regeneration from STEP 0 (see 4.1) by pushing regeneration buttons S9, S10, S22 according to appendix REG 2, instruction 2.

If normal amount of acid is wanted, change of steg from acid injection to acis rinse is automatically executed by signal from acid vessel contact.

Basic time schedule for the regeneration steps is shown in appendix REG 3.

4.3 Start of manual regeneration of the anion filter

4.3.1 Continue regeneration from STEP 0 (see 4.1) by pushing regeneration buttons S12, S13 and S11 according to appendix REG 2, instruction 3.

If normal amount of caustic is wanted, change of step from caustic unjection to caustic rinse is automatically executed by signal from caustic vessel contact.

Basic time schedule for the regeneration steps is shown in appendix REG 3.

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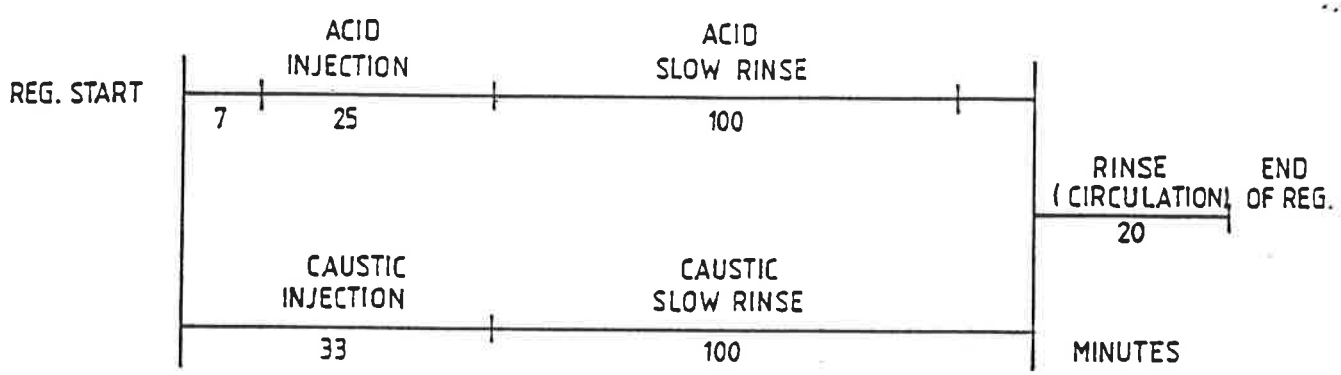
Reg. 8

4.4. Stop/End of manual regeneration

Manual regeneration can be stopped at any time:

4.4.1 Push STOP, S6.

The line goes to STEP 0 position.



REMARKS:

RINSE (CIRCULATION) STARTS WHEN TIMERS FOR ACID AND CAUSTIC SLOW RINSE ARE OUT.

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DEMINERALIZATION STATION

BASIC TIME SCHEDULE FOR REGENERATION STEPS

DATE	DR'N	CH'D			OBJ. NO	DRWG NO	ISSUE
90 12 12	SE				9006	4F-5949	

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MANUAL: S E R V I C E

Content:

APPENDIX: Push buttons for service and regeneration, drawing 4F-5951. See under 5.

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Service 1

DEMINERALIZATION STATION

MANUAL: SERVICE

1. GENERAL

1.1 There are three push buttons for start and stop of service:

MAN, AUTO and OFF.

MAN: The line produces demineralized water even if the conductivity is higher than the second alarm level.

AUTO: The line produces demineralized water but stops if the conductivity exceeds the second alarm level.

OFF: No production when lit. If alarm for high conductivity is set, the line must be regenerated.

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Service 2

2. SITUATION BEFORE START

2.1 The system is filled with water.

2.2 The manual valves are in position according to basic position list.

2.3 The unit is supplied with inlet water, electricity and compressed air.

2.4 The instruments are tested and in function.

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3. SERVICE

See:

- Service and regeneration diagram, drawing 3F-5950.
- Push buttons and signal lamps, drawing 4F-5951.
- Alarm list

3.1 Manual start of service

The line is regenerated and in MAN or AUTO and OFF position.

Production can be started by pushing AUTO, S2 (see 3.1.1. - 3.1.4) or MAN, S1 (see 3.1.5). Production in AUTO demands acceptable conductivity while production in MAN overrides the alarm for high conductivity.

3.1.1 Service in AUTO position

Push AUTO, S2.

The line starts to rinse (circulation) for 3 minutes.

CIRCULATION, S11, is lit.

3.1.2 After 3 minutes of rinsing:

- If the conductivity after the polishing cation filter, CIS 1702, is lower (better) than preset H1 value: See 3.1.4.

- If the conductivity is higher than preset H1 value: See 3.1.3.

3.1.3 CIRCULATION, S11, continues. If the conductivity CIS 1702 goes under preset H1 value: See 3.1.4.

Alarm LONG START RINSE PERIOD is set if acceptable value is not reached within preset time (15 min). CIRCULATION, S11, continues.

To stop CIRCULATION, S11, see: 3.3.

3.1.4 Start of service

With acceptable conductivity the line starts production.

CIRCULATION, S11, stops and AUTO, S2, is lit.

3.1.5 Service in MAN position

Push MAN, S1.

Production starts.

3.2 Automatic start of service

The line is in AUTO and OFF position.

Automatic regeneration is in its last step, CIRCULATION.

3.2.1 The timer for circulation has gone out and the conductivity after the polishing cation filter is automatically controlled:

- If it is over preset H1 value: See 3.2.2.

- If it is below preset H1 value: See 3.2.3.

3.2.2 CIRCULATION, S11, continues until the conductivity comes below preset H1 value. Alarm LONG RINSE PERIOD is set.

To stop CIRCULATION, S11, see 3.3.

3.2.3 CIRCULATION, S11, stops and the line starts production.

NOTE: During the first hour of production, the control system accepts high conductivity after the anion filter.

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3.3 Interruption of start rinse (CIRCULATION)

CIRCULATION, S11, can always be stopped:

3.3.1 Push STOP/RESET, S6.

Circulation stops and the line goes back to OFF position.

3.3.2 To start rinse again, push AUTO, S2.

3.4 Manual stop of service

To stop service, push OFF, S3.

The line goes to MAN or AUTO and OFF position.

3.5 Automatic stop of service

If the line is in service in AUTO position and conductivity after anion or polishing cation filter exceeds preset H1 value, alarm HIGH CONDUCTIVITY is set. If the conductivity exceeds preset H2 value, production stops.

See note under 3.2.3.

3.6 Flow Control

The flow during service is possible to control by twisting a potentiometer placed in the control panel front. The potentiometer determines the position of the outlet valve V 1732 after the line.

By closing the valve, the flow goes down. The flow through the line is showed on the indicator FI 1701.

3.6.1 Minimum Flow

For best performance of the line during service, a minimum flow of about 15 m^3/h is required.

The limit value sensor automatically starts re-circulation if the flow descends below 20 m^3/h.

3.6.2 Normal Flow and Maximum Flow

Normal flow during service is between 20-80 m^3/h.

Maximum flow is 100 m^3/h.

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DEMINERALIZATION STATION

GENERAL FUNCTION DESCRIPTION

CONTENT:

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DEMINERALIZATION STATION

1. INTRODUCTION

1.1 General

The demineralization unit shall satisfy the need of deionized water. The produced water is highly purified to meet the demands for process water in the production.

The method used to demineralize the water is called ion exchange technique.

1.2 Capacity, quality of treated water

The station is designed to produce 50 m^3/h net and consists of one line of filters. Since regeneration takes about 2.5 hours and consumes about 45 m^3 of demineralized water, the flow capacity is 70 m^3/h.

With the quality of the inlet water the line has been designed for, it is possible to treat 680 m^3 during each cycle.

The calculated concentration of salts in the inlet water is 5.9 meqv/l cations and 5.96 meqv/l anions.

The average conductivity in the water after the anion filter is 3 µS/cm or better and after the polishing cation filter 0.3 µS/cm.

2. MAIN PARTS

2.1 Demineralization line

The demineralization line consists of a cation filter followed by a two-chamber anion filter and after that another cation filter.

The cation filters contain strong cation exchange resin and the anion filter contains weak and strong anion exchange resins, separated in the two chambers.

The treated water goes to two storage tanks for demineralized water.

2.2 Regeneration equipment

When the demineralization line is exhausted it needs to be regenerated with acid and caustic with help of measuring tanks and a mixing station where the concentrated chemicals are diluted to an appropriate concentration level.

There are two storage tanks installed, one for hydrochloric acid and one for caustic soda.

2.3 Pumps

There is one pump for recirculation of water over the filter line, two pumps for regeneration dilution water and three pumps for distribution to users.

2.4 Control panel, instruments, valves

The demineralization unit is controlled by programmable PLC equipment and is manoeuvered with push buttons in the front of the control panel. There are instruments showing the flow through the line and the conductivity after the anion filter and the polishing cation filter.

A Silica meter indicates the concentration of SiO_2 in the treated water.

The valves necessary for service and regeneration have pneumatic double-acting actuators and the process is automated. Regeneration is manually started from the control panel.

3. FUNCTION

3.1 During service

The filters operate according to the Amberpack system. During service the water flows upwards through the filters, while the chemicals flow downwards during the regeneration.

Thus regeneration is performed in counter-current, which means high water quality during service and low consumption of chemicals.

The filters are almost filled with resin, thus the ion exchange capacity per total filter volume is high, almost double that of conventional filters.

The inlet water first passes through the cation filter, after that the anion filter and, finally the polishing cation filter.

The cation filters contain cation resin loaded with H^+ ions. When passing through, the filter bed absorbs positive ions, cations, from the water in exchange of H^+ ions. Typical cations are Ca, Mg and Na. A small leakage of sodium from the cation filter is inevitable.

The pH value after the cation filter is about 3.

The anion filter contains anion resin loaded with OH^- ions, which are exchanged to negative ions, anions, in the water, such as acids, formed in the cation filter. The resin also takes up silica.

The polishing cation filter most of the remaining sodium is absorbed.

In case of low flow during service the recirculation pump starts in order to maintain a minimum flow through the filter line.

3.2 End of service period

The resin ions are consumed during the service period, and in the end of the period a small leakage of the Na-ions from the cation filter and/or of silica from the anion filter starts.

In case of Na leakage the conductivity will rise in proportion to the leakage. When the anion filter is exhausted the conductivity will not rise until most of the silica has left the filter.

Therefore, it is essential that the anion resin is not too old, because the exchange capacity decreases with time. The anion resin loses capacity faster than the cation resin. The supplier of resins recommends exchange of anion resin every 5-10 years and cation resin every 10-15 years.

3.3 Regeneration

When the resins have been exhausted they have to be regenerated.

The cation filters are regenerated with hydrochloric acid. The acid is stored in a tank with a volume corresponding to 14 days of nominal operation.

Before regeneration, part of the acid is transferred to a measuring tank. The tank is pressurized with air and the acid is diluted with demineralized water. The diluted acid is fed to the polishing cation filter and continues to and through the leading cation filter. Thus the polisher is regenerated with a very large excess of acid.

The caustic soda for anion filter regeneration is stored in a tank designed for 14 days nominal production. During regeneration the caustic soda flows from a pressurized measuring tank and is diluted with demineralized water berfore entering the top of the anion filter. The chemical first passes the upper compartment, containing strong type anion resin and then the lower compartment with weak type anion resin. The strong type resin is thus regenerated with a large excess of caustic soda, whereby very good silica removal is obtained.

After injection the chemicals are displaced (slow rinse) with demineralized water.

Finally the resins are rinsed by circulation of water through the filter line. The total regeneration time is about 2.5 hours, max. 3 hours.

The regeneration is automated but has to be started manually.

3.4 Normal start and stop of service

When the conductivity in the end of the regeneration gets acceptable, the line automatically starts production if it stands in AUTO position.

At the end of the production period, conductivity will normally increase. The conductivity meters have two limit contacts each. When the first limit is reached, an alarm is activated but the production continues.

Normally the production should be stopped and regeneration started at this point.

If the production continues and the second limit is reached, the production automatically stops if the line stands in AUTO position. In MAN position production continues.

If the line stands in OFF position and is started by pushing the AUTO button, the water is recirculated over the line to get a lower,

acceptable, conductivity value. If/when this is reached the production starts automatically.

If the MAN button is pushed in OFF position, production starts immediately and alarm is set if conductivity is too high.

3.5 Stop after regeneration

If the line stands in MAN position at the end of the regeneration period, the line will go to OFF position after finished regeneration.

3.6 Controls during process

(See Alarm Signals too)

During service and regeneration several functions are engaged to control the performance of the station.

During the service period the conductivities and silica concentration are continuously controlled. If the time for the start rinse period is too long, alarm is set.

Dilution flows during chemical injection and slow rinse and the quality of the water after regeneration are controlled.

Motor overload, tripped MCB and unnormal level in the demin. tanks are indicated by alarms.

4. ALARM SIGNALS

1. High conductivity after anion filter
2. High conductivity after polishing filter
3. High SiO_2 content
4. Silicometer failure
5. Condition for reg.start/long filling time
6. Long chemical injection time
7. Low dilution flow HCl/NaOH
8. Long rinse period
9. Long start rinse period
10. Deviating valve position
11. Low level demin. tank
12. Tripped MCB
13. Motor overload
14. Low battery capacity PLC
15. Spare
16. Spare

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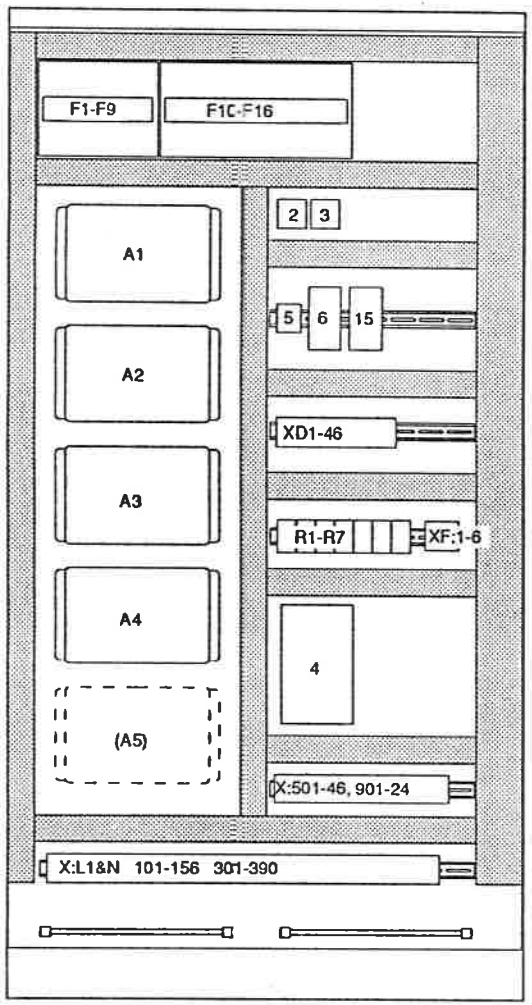
4. ALARM SIGNALS

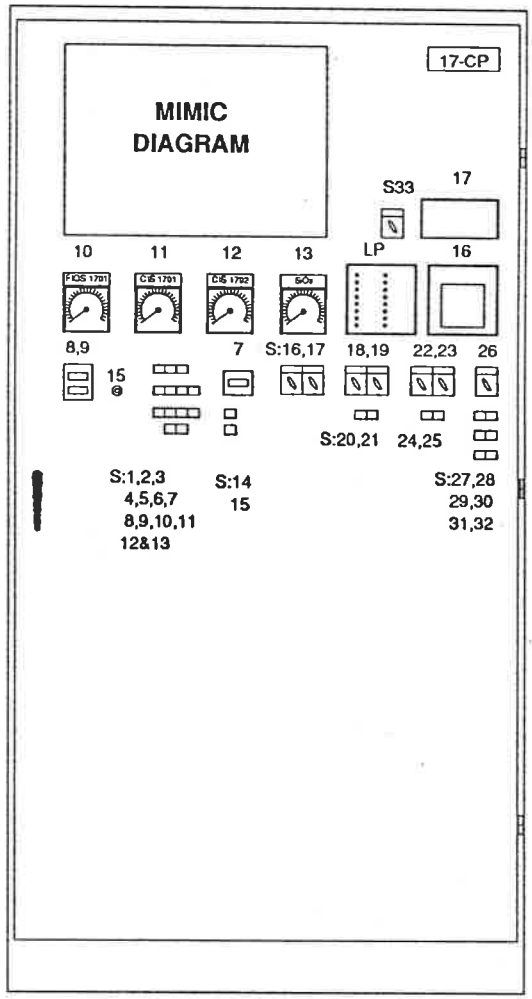
1. High conductivity after anion filter
   VYSOKÁ VODIVOST ZA F 1702
2. High conductivity after polishing filter
   VYSOKÁ VODIVOST ZA F 1703
3. High SiO_2 content
   VYSOKÝ OBSAH SiO_2
4. Silicometer failure
   PORUCHA SILIKOMETRU
5. Condition for reg.start/long filling time
   PODMÍNKA PRO REGENERACI
   NENAPLNĚNÁ ODMĚRKA
6. Long chemical injection time
   DÁVKOVÁNÍ
7. Low dilution flow HCl/NaOH
   ŘEDICÍ VODA
8. Long rinse period
   DOBA PROMÝVÁNÍ
9. Long start rinse period
   ZAHÁJENÍ PROMÝVÁNÍ
10. Deviating valve position
    NASTAVENÍ VENTILŮ
11. Low level demin. tank
    BLOKOVACÍ HLADINA H 1705 A, B
12. Tripped MCB
    NAPÁJENÍ PANELU
13. Motor overload
    PŘETÍŽENÍ ELMOTORŮ
14. Low battery capacity PLC
    NÍZKÉ NAPĚTÍ BATERIE PLC
15. Spare
16. Spare

SPOLANA NERATOVICE
DEMINERALIZATION STATION
OPERATION MANUAL

1	GENERAL FUNCTION DESCRIPTION
2	MANUAL: SERVICE
3	MANUAL: REGENERATION
4	MANUAL: BACKWASH OF RESIN
5	SERVICE AND REGENERATION DIAGRAM PUSHBUTTON LAY OUT
6	ALARM LIST ALARM INSTRUCTION
7	BASIC POSITION LIST FOR MANUAL VALVES
8	INSTRUMENT SETPOINT LIST
9	
10	P&I DIAGRAM, DRAWING 1A-5608

USE 206 108 50





Rev A 91.02.05

AKVAPUR		TECHNOEXPORT-SPOLANA	
		DEMINERALIZATION LINE CONTROL PANEL LAY OUT 17-CP	
RITAD: UEH	DATUM: 90-12-17		
GRANSKAD:	ANL. NR:	SKALA: 1:10	RITN. NR: 3D-5813A 1/2 — REV. A