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2 Description and technical data

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2.1 General

2.1.1 Description and construction of machine

Basically the unit consists of

- distillation vessel
- condensor
- oil-expansion tank with built-in thermostats and float-switch
- electric switch-cabinet
- accessories (upon request)

Distillation vessel

The distillation vessel is heated by heat-transfer oil (oil bath) which is warmed up in the heating chamber beneath the distillation vessel.

For cleaning purposes the unit is equipped with a lid.

The thermometer fitted underneath the condensor indicates the temperature and the manometer the current pressure of the internal vessel during distillation.

The distillation unit operates at atmospheric pressure. A 0.5 bar safety pressure control valve is fitted as a precaution against any unintentional rise in pressure.

The whole vessel is surrounded by a rectangular sheet metal casing in welded construction. The area between the sheet metal casing and the vessel is filled in with insulating material.

Condensor

The vapors are condensed by a water-cooled condensor. The pipes containing the solvent vapors which are to be condensed are surrounded by the cooling water.

Oil Expansion tank

Because thermal oil expands on heating, an oil expansion tank is mounted on the reverse side of the distillation unit above the heating chamber. A float switch is located in the oil expansion tank, which switches off the heating if the oil falls below the required level (protection against drying out). Three thermostats are fitted on the oil expansion tank for temperature

control and monitoring. The temperature sensing units of the thermostats are located in the distillate discharge pipe, in the distillation vessel and in the heating chamber. If momentary overheating occurs, the immersion heaters are switched off.

Electrical Switch Cabinet

The distillation unit is completely wired up to the electrical switch cabinet and they are connected together by a 30 feet long electrical cable.

2.1.2 Application

The distiller M20 has been developed for the regeneration of flammable and inflammable solvents.

Characteristically the unit can be used in the paint and lacquer industry as well as in other fields of general industry.

All solvents with a solids content of up to 5 % are to be distilled, the unit may only be partially filled.

For example, if the solids content is 10 % the unit may only be filled with approximately 60 % of the regular filling capacity. Higher concentrates may only be mixed with small amounts of thin-bodied solvents.

2.1.3 Operation

This unit operates on a regular distillation principle, i.e. the liquid is being warmed up until it reaches its boiling point. The resulting vapors are then again liquefied on a cooling surface, the condenser. The solids diluted in the solvent, however, do not evaporate and remain as residue.

Important

Heat sensitive materials	(PVC)
Decomposing materials	(Nitrocellulose)
Teroxide forming materials	(Tetrahydrofuran)

Can only be processed under specific safety conditions.

I.E. Reduced temperatures, Liquid Residue.

In cases of uncertainty, Please contact lacquer or distillation equipment manufacturer.

2.2 Technical data

Distillation output	:	15 - 20 gal/h
Vessel capacity	:	max. 225 l = 60 gal
Heat requirement	:	9 kW
Power input	:	220 / 23,6 380 / 13,6 415 / 12,5 500 / 10,4
Heat up time at filled vessel approx.	:	ca. 1/2 - 1 h
Oilfilling capacity	:	ca. 30 l thermal oil, temperature range -10 Grad C - ca. 320 Grad C e.g. Shell Thermia B 27
Dimensions	:	see enclosed drawing
Weights:	:	Distillation unit empty ca. 300 kg = 660 lbs. Distillation unit full ca. 500 kg = 1.100 lbs.
Cooling water consumption (inlet temp. 15 Grad C, return temp. 35 Grad C)	:	ca. 1 cbm/h = 260 gal./h without cooling water thermostate ca. 0,5 cbm/h = 40 gal./h with cooling water thermostate

2.3. Safety measures

2.3.1 Explosion-proof protection and earthing

The washing machine operates with solvents. For this reason it is necessary to observe the appropriate safety regulations governing the use of flammable solvents.

These requirements include the following:

- It is only permitted to use electrical equipment of explosion-proof construction.
- It is not permitted to use electrical tools (drilling machines, grinding machines) which are not of explosion-proof construction.
- It is not permitted to operate with open windows or (naked) lights in the vicinity of flammable solvents.
- It is required to provide earth potential equalisation between the various plant parts.
- Cans and containers must be earthed for filling.
- The operators must wear shoes with electrically conducting soles, to prevent any static charging.
- Fire extinguishers are to be provided in adequate numbers and size.
- Adequate ventilation of the working area is required. There should be an air change of approx. 10 to 20 times per hour in the working area in which solvents are used.

The motors and similar electrical fitted to the machine are of explosion-proof construction. The control cabinets of the machine is not of explosion-proof construction.

The area (room) in which the machine is erected is rated as a hazardous area. The control cabinet must be installed outside the hazardous area.

To prevent electrostatic charges it is necessary to ensure satisfactory potential equalisation between all the plant parts.

Important! It must be ensured by the customer that all the machines have an electrically conducting connection to earth. For this purpose, the manufacturer provides earthing screws on the machines to which the earth cables should be connected.

2.3.2 Safeguards

Explosion-preventive features of electric devices are based on the assumption that the ignition of an explosive mixture must either be prevented or remain ineffective due to a sufficiently thick walling of its surrounding case.

With electric devices intrinsically safe means that sparks that do not exceed a certain energy level are not apply to trigger an explosion.

Therefore the thermostats and the float-switch are controlled by intrinsically safe relays. These relays reduce current as well as voltage to a level where, even in case of a direct short-circuit, sparks can no longer develop.

Because of those intrinsically safe relays regular electric devices can be used in explosive areas, as long as their supply with the above mentioned low levels of voltage and current is warranted. FM Certification is attached to this manual.

In order to identify intrinsically safe electrical circuits in a flameproof area, blue cables and terminals must be used, so as to distinguish these cables by colour from other cables carrying electrical current.

The cables for the intrinsically safe control circuits must also be laid separately from other cables carrying electrical current.

Flameproof Regulations: VDE 0170/0171 plus 0165. Details can be requested from VDE Verlag GmbH, 1000 Berlin 12, West Germany.

2.4 Accessories

2.4.1 Vacuum unit

The vacuum unit consists of

- vacuum pump
- driving motor
- container with cooling coil
- vacuum gauge
- air valve

and can be used for the following distillation units:

DW 50 - DW 100 - DW 200	without changing the unit
M20 N - K 1 - K 2	only if unit is equipped with reinforced vacuum chamber.

A so called liquid ring pump is used as a vacuum pump.

The distilled solvent itself is used as the propellant liquid for the vacuum pump.

The maximum vacuum level that can be reached (in mbar) corresponds to the physical value of the steam pressure of the propellant liquid, i.e. the solvent.

These values can be looked up in tables.

	water	ethyl acetate	toluole	petroleum
Grad C	15/40	15/40	15/40	15/40
mbar	20/100	90/250	25/100	2/5

Constant vacuum

High boiling solvents have to be distilled by vacuum. The start of the vacuum pump lowers the boiling temperature of the solvent. The vacuum must be applied to the vessel from the beginning of the distillation process.

End vacuum

By low boiling solvents, to the end of the process the flow rate will slow down. To speed the process up and achieve dryer residue, vacuum is applied. We recommend introducing false air by adjusting the throttle valve (small brass valve on top of piping) to a certain position, i.e. 0.3 bar, on the next step 0.4 bar, finally to 0.6 bar or 1.0 bar. The distillation process is complete if none or very little solvent will extract. To determine this, observe sightglass or pipe outlet on receiving tank.

Start & stop procedure

Start

1. Open red handle ballvalve on intake line of vacuum pump slightly (approximately 2:00 o'clock position).
2. Make sure throttle valve is in "open" position.
3. Put three-way valve in "vacuum distillation" position.
4. Press start button for "vacuum pumpe".
5. Adjust throttle valve as described above, and observe vacuum gauge.

Stop

1. Open throttle valve slowly to equalize vacuum pressure in vessel to zero.
2. Put three-way valve to "normal distillation" position.
3. Press "stop" button for vacuum pump.

Operating Instructions

Switching on the vacuum unit in case of

- a. continuous vacuum operation from the beginning (i.e. it is switched on together with the heating unit)
- b. temporary vacuum
e.g. towards the end of the distillation unit to further dry up the residue.
In this case gradually but slowly raise vacuum to avoid boiling over.

If vacuum is in operation for a longer time cooling system must be switched on

Filling the distillation unit through vacuum

With this filling method it is necessary to evacuate the closed distillation-chamber of the unit through the vacuum pump. After having reached an effective vacuum level the sucking pipe on the sucking hose is dipped into the container filled with contaminated solvent. Then the bolt valve is opened in order to establish the connection with the evacuated tank.

The contaminated solvent is then sucked into the distillation unit.

Process:

- close container opening
- switch on vacuum pump
- at a vacuum of approx. 0.5 bar dip sucking pipe into the container filled with contaminated solvent
- open bolt valve
- close bolt valve when unit is filled properly.

Cause of faults and remedy

<u>fault</u> -----	<u>cause</u> -----	<u>remedy</u> -----
- required vacuum can not be reached	- solvent is too warm	- use cooling system
	- vapor tension of solvent is too high	
	- leakiness of system	
- boiling over during- vacuum operation	- vacuum raised too fast	- rinse container start new

Maintenance of vakuu unit is limited to normal care and occasional replacement of pump gasket.

2.4.2 NC safety provisions

A decomposition occurring as a result of faulty operation can be avoided by applying NC safety steps NC 1 and NC 2. These features can be installed optionally as an additional safety measure.

Description of NC safety package Step NC 1

A relief pressure valve, preset by the manufacturer at 0,5 bar, is attached to the distillation tank. The customer has to connect this valve with a 2" pipe leading to the outside. Therefore, gases resulting from the decomposition can be channeled to the outside. In addition a water connection is attached to the container as quickly as possible. For this purpose an easily accessible and distinctly marked valve in the water line must be opened.

Description of NC safety package step NC 2.

A.) This safety step also includes, NC safety step NC 1, a pressure relief valve and a water shower. In addition, this system is equipped with an electronic measuring gauge, which is located at the control panel and is connected to the unit via a sensor.

B.) Components

- 1 Measuring spot at the distillation tank
- 2-4 Electronic measuring gauge (microprocessor controlled)
- 5 Zener barrier
- 6 Pressure relief valve
- 7 Solenoid valve for water
- 8 Solenoid valve for steam
- 11 Signal

C.) Function (see diagram)

1. Display NC 2 indicates boiling temperature (e.g. 85 degrees).
2. The first safety temperature is set a display NC 4 (MIN. e.g. 105 degrees).
As soon as the first safety temperature is reached:

- Heating system shuts off (solenoid valve in steam pipe closes)
 - Trouble lamp step NC 1 at control panel is lighted
 - Unit shuts off completely. If distillation unit is connected to washing machine, the latter shuts off too.
3. A second safety temperature is set at display NC 3 (Max. e.g. 120 degrees)
When the first safety temperature is exceeded and the second safety temperature is reached:
- Water shower ON (solenoid valve in water pipe opens und water quenches the unit's contents. After temperature has dropped, the valve will close again)
 - All functions of safety step NC 1 remain unchanged
 - Trouble lamp safety step NC 2 is lighted.

Both steps can be extinguished via key switch.

NOTE: The temperature quoted serve only as an example und have to be determined by the customer based on the various types of solvents used.

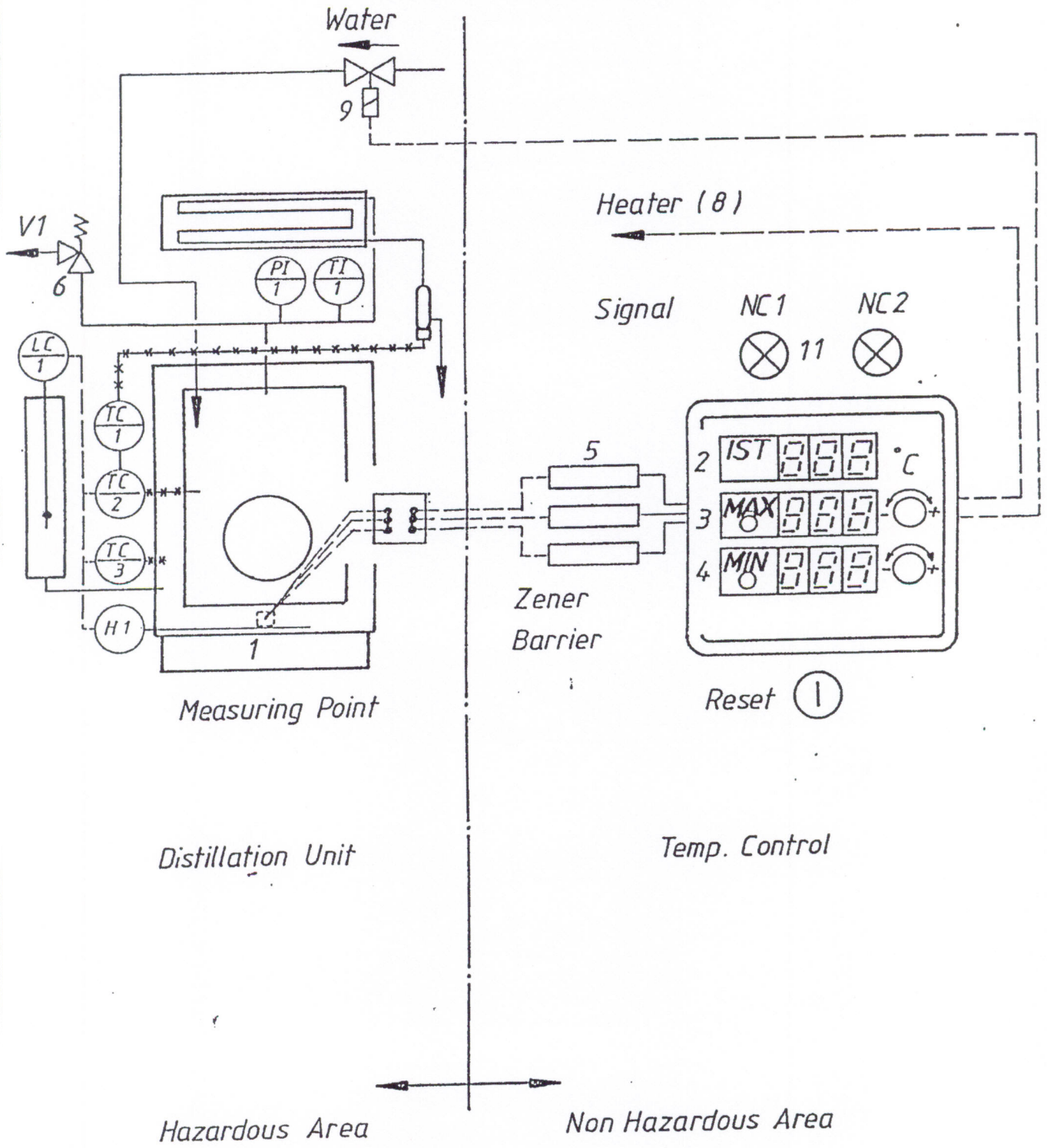
D.) Safety

In case of open-phase boiling temperature indicator rises to 150 degrees simulating safety step NC 2. The unit shuts down.

Automatic Temperatur Control
 NC 2 Equipment
 for Dist. Unit M 20

D.W. RENZMANN
 GmbH

JAN. 89



2.4.3 Cooling water-thermostat valve

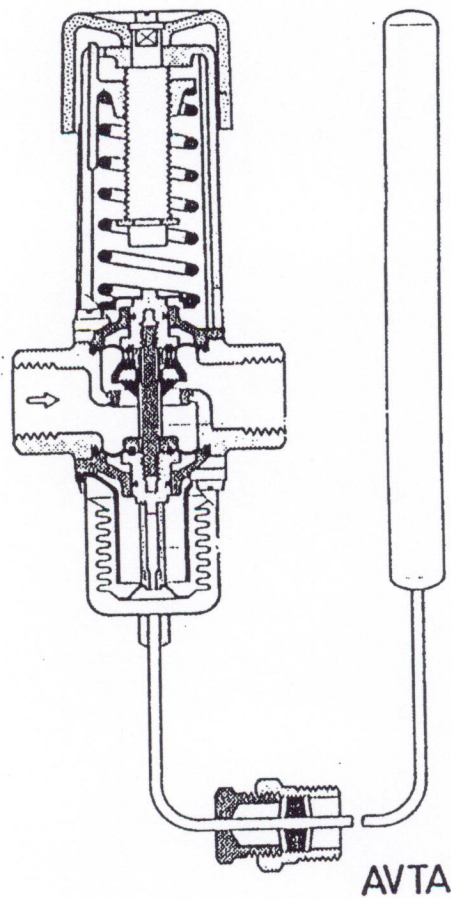
Cooling water flow should be set in a way so that the cooling water leaves the unit with a temperature of approx. 35 degrees.

Handwheel turned to the left

- Higher temperature in the return flow.

Handwheel turned to the right

- lower temperature in the return flow.



**D.W.
RENZMANN**

GmbH

Because the distillation unit operates at atmospheric pressure, it does not fall under the inspection regulations - UVV 7i.

Details can be requested from: Principal Employers' Liability Insurance Association, Central Office for Accident Prevention, (Hauptverband der gewerblichen Berufsgenossenschaften, Zentralstelle für Unfallverhütung), Langwortweg 103, 5300 Bonn 1, West Germany.

3 Connections for supplies and energy requirement

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3.1 Contaminated solvent

The M20 N EX distillation unit can be filled with dirty solvent from buckets by means of a filling device (if contained in the supply schedule). However, it can also be directly connected to a washing machine.

The supply is connected via a 3/4" line of galvanized steel piping. The gate valve provided should be opened only when filling and must be closed during the distillation process.

3.2 Clean solvent

The clean solvent (distillate) flows from the condenser in an open outlet, either into a collecting tank on hand or a tank installed elsewhere.

Important:

Under no circumstances should the outlet (distillate pipeline) be closed by a shut-off device, because the pressure resulting from the heating up and cooling down of the unit is equalized via this pipeline.

3.3 Cooling water

The cooling water must be connected to the connections provided on the condenser (outfeed-return). This can be done by means of a fixed 1/2" B.S.P. galvanized pipe.

3.4 Electrical connection

Flameproof protection of the unit can only be guaranteed if the switch cabinet and distillation unit are separated from each other by at least five meters or installed in separate rooms.

The location in which the unit stands is a flameproof area, where as that in which the switch cabinet is mounted is non-flameproof. Where electrical apparatus mounted on to the distillation unit is flameproof, the PTB test certificates are enclosed (see attached).

4 Transport and erection

4.1 Notes for transport

The equipment should be transported with the utmost care.

Any damage visible on the outside on the arrival of the consignment should be advised to the haulier immediately and notified in writing.

If there is a transport insurance, the insurance company should be notified at once and its instructions should be awaited.

4.2. Notes for unpacking

The equipment should be unpacked with care. Any damage suffered by the equipment during unpacking is not covered by any existing transport insurance.

Please check the consignment carefully for any loose items of supply.

Please check whether such items may possibly have been packed separately in wood wool or paper.

Any later complaints about missing or wrongly supplied parts can only be considered in exceptional cases.

4.3 Notes for erection

The machine should be erected in accordance with the enclosed drawing. The machine should be piped in accordance with the valid piping diagram.

5 Operation

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5.1 Instructions for the initial start-up

Functional tests

Before the initial start-up it is necessary to check the following points:

- that all electric motors run in the correct direction
- that all pipe lines and pipe couplings are tight
- that the pumps (if provided) are filled with solvent
(see pump manual)

5.1.1 Adjusting thermostates

Thermostat 1

Thermostat 1 serves as safety thermostat against lack of cooling-water.

In case of lacking cooling-water the temperature of the out-flowing distillate temperature will rise above the thermostat settings and will cut of the heater.

Thermostat 2

Thermostat 2 is a double thermostat A & B.

Thermostat A (dial for regulating temperature)

Is adjustable from outside. Set dial at highest boiling point of solvent plus 20 C.

Towards the end of the distillation, the amount of contaminated solvent in the boiler will have been reduced. Therefore less heat will be absorbed and the temperature will rise. If the temperature reaches the setting of the dial, the heater will automatically shut-off.

Thermostat B (Safety temperature)

Only adjustable after removing the cover. Set thermostat with a screwdriver 10 degrees C above the setting on thermostat A. This thermostat assures shut off of the heaters should thermostat A fail to do so.

If various solvents are used, we recommend a setting at 200 C. To reset thermostat press button.

Thermostat 3

Thermostat 3 is a double thermostat A & B.

Thermostat A (dial for oil temperature)

Adjustable from outside. Set dial at highest boiling point of solvent plus 30 - 60 C higher.

Thermostat A regulates oil temperature continuously.

Thermostat B (safety temperature)

Only adjustable after removing cover.

Set thermostat with screwdriver at 195 C.

This setting assures heater shut off should thermostat A fail. To reset thermostat press button.

5.1.2 Functional check

Before first commissioning, check

- direction of pump rotation
- all connections for tightness
- function of electrical connections

After connecting unit, check

- function of float switch in oil expansion tank
- current consumption of heating
- function of thermostates

5.1.3 Distillation characteristics

Pure liquids

Pure liquids have a fixed boiling point which remains unchanged throughout the distilling process.

e.g. alcohol 78 C (172 F)
water 100 C (212 F)

Mixtures

The combination of several liquids with different boiling points results in a mixture of liquids.

No general formula exists according to which the boiling point of a mixture can be predicted on the basis of the boiling points of its individual components.

IN most cases it can be assumed that the boiling process starts at the lowest boiling point and then rises gradually. At the end of the distillation the boiling temperature of the solvent with the highest boiling point will be reached.

If all the components of the boiling mixture are collected in a container after completion of the distilling process, the original composition can be obtained.

Breaking up the mixtur (fraction) into its individual components is not possible with a simple distilling unit.

Azeotropic Mixtures

Various liquids combine into so-called azeotropic mixtures, e.g. toluene water.

Boiling point - water: 100 C 212 F

Boiling point - toluene: 110 C 230 F

Boiling point - mixture: 86 C 187 F

5.1.4 Operation Experience

Individual experience is an important factor regarding the performance of the unit.

Diffrent solvents with a diffrent degree of contamination will require diffrent settings.

We recommend one person to be in charge of operating the unit.

Smells and vapors developing during initial operations may result from either the coating of the unit or some oil spilled at the fill-up and will disappear after several operations.

5.2 Distillation

If distillation takes place with a solvent mix or undefined solvent of which the boiling point (distillate temperature) is not known when first commissioning, the double thermostats are set at 195 Grad C.

After a fixed period of operation, it may be found that the temperature of 195 Grad C set on the thermostats is not being reached; in other words, the unit is distilling at a lower temperature.

If the temperature continues to remain constant after a longer period of operation, the thermostats should be set approximately 20 or 30 Grad C higher (see the previous instructions on the setting of the double thermostat).

When first filling the unit for test purposes, it is advisable to use clean solvent.

If any overhauling is then found to be necessary, there will be not difficulty in cleaning the unit if clean solvent has been used.

5.3 Cause of faults and remedy

<u>fault</u> -----	<u>cause</u> -----	<u>remedy</u> -----
- tank pump does not work	- pump is empty	- fill pump with liquid for start
	- trouble in electrical connection	- check electrical
- contaminated solvent in the distillate	- unit has been filled too high a level	- fill unit not higher the max. level, clean condenser eventually
- no distillation although unit heating is on	- trouble in cooling water system	- check cooling water system
	- dirty heating surfaces	- clean heating surfaces after each distillation
	- condenser outflow is blocked	- clean condenser outflow

6 Maintenance

6.1 Maintenance and care

6.1.1 After every distillation

- Visual inspection of all external parts.
- Check all pipe lines for leakage.
- Clean heating surfaces
- Lubricate lid gasket

6.1.2 From time to time

- Renew lid gasket
- Check all safety appliances (thermostates, float switches)
- Change thermal oil in the unit (e.g. SHELL THERMIA B27, 30 l) approx. every two years after analysis by a mineral oil company

Warning: The stuffing boxes must only be tightened lightly. If they are tightened too hard, the shaft runs hot, causing rapid wear of packing and shaft. It must be possible to rotate the pump by hand.

6.1.3 Bearings and gearings

The gearings and bearings of the electric motors are filled with grase for life.