NIRO ATOMIZER (A'ASIA) PTY. LTD.

OPERATION INSTRUCTION FOR

WIEGAND

GRAVITY-FLOW-EVAPORATING-PLANT

VI/ 1364

C O N T E N T S

WIEGAND Karlsruhe GmbH D 7505 Ettlingen	WORKING INSTRUCTIONS FOR WIEGAND GRAVITY FLOW EVAPORATOR	V 1/1364

Order no.:	V 1/1364 NIRO ATOMIZER MELBOURNE FOR EIPPS-LAND CONSOLIDATED MILK MAFFRA
Plant:	ONE THREE-STAGE CONTINUOUSLY WORKING TYPE WIEGAND vacuum gravity-flow evaporating plant with finisher and thermo-compressor of special design for the milk industry.
Flow Diagram:	V 2-4/961
Erection Drawing:	V 4/855
Description:	see working manual

Operational Data:

Product:	skim milk
Feed:	18.2oo kg/h, 9 % TS, 5 °C
Evaporating Capacity:	14.79o kg/h, water
Concentrate:	3.41o kg/h, 48 % TS, 42 °C

Temperatures

Preheating:	from 5 °C to 72 °C			
Heating:	from 72 °C to 9o °C			
Evaporation Boiling Temperature	1st stage 7o °C	2nd stage 61 °C	3rd stage 42 °C	4th stage 42 °C

Steam consumption:	(8.4 atmg) 12o psig
9o °C heating and evaporation:	3.62o kg/h
Vacuum unit	17o kg/h
Water consumption:	92 cbm/h 0/2o °C
Power:	415 Volt, 3 phases, 5o cycles installed 36,4 kW effective 3o,o kW
Condensate discharge:	appr. 15 cbm/h, 6o °C

Special features:

-Noise and heat insulation calandria ol and thermo-compressor
-Cleaning-In-Place-System
-Later possible extension: switchable spiral tube high heater system up to 12o °C.

Datum: 11.1o.1971 Bearbeiter: Fernbacher/Schm gesehen:

Wiegand Apparatebau GmbH. Karlsruhe	Operating instructions for WIEGAND-Gravity-Flow-Evaporating-Plant	

You will find general remarks about evaporating plants in the evaporator prospectus on pages 8 and 16.

I. Prerequisites

a) Instruct boiler operating personnel that steam is required.

b) Open main steam valve to the steam header, then drain water from the steam header.

c) Close all openings (air cocks, manholes etc.) through which air could enter the plant.

d) Turn on sealing water for the pumps (max. pressure at the pump inlet: 2 m W.C.).

e) Check up whether condensation tank contains condensate resp. water.

f) Switch on air-compressor (min. 6 kg/cm^2; max. 1o kg/cm^2).

g) Open discharge valve at the air distributor in the panel until air coming out is dry and free of oil.

h) Turn on main switch.

II. Producing the vacuum

a) Turn on all the product pumps successively, but always wait as long as liquid appears within the first separator, then turn on this feed pump etc. (thus avoiding that the pump runs dry and makes a noise).

b) At maximum load, open flow valve for appr. 1/4 of the flow (check up that the separator does not fill up), and give back into the float balance tank the liquid coming out of the finisher.

c) Open steam valves to the air ejectors and to the pre-evacuator after first having opened the valve within the suction line to the latter.

d) Adjust nominal value to desired steam pressure at the steam pressure governor. The pneumatic steam valve has slowly to be opened by turning the manual remote control of the steam pressure governor, and switch to automatic operation.

e) At operation with cooling tower: close fully the pneumatic cooling water valve by turning the manual remote control of the vacuum controller.

f) Start hot water pump and open slowly half the way pneumatic cooling water valve at the manual remote control.

III. Starting up the plant

a) When vacuum has reached appr. 8 m W.C., open slowly steam valve to the vapour compressor to half of the nominal value.

b) Start condensate pumps.

c) When vacuum has reached appr. 8,5 m W.C. resp. appr. 14o Torr, close valve within the suction line to the pre-evacuator and then steam valve to the pre-evacuator.

d) Switch the vacuum controller to "Automatic"-set-point to get the desired boiling temperature within the finisher.

e) When the vacuum has reached 9,5 m W.C. resp. 62 Torr, adjust pressure for the vapour compressor to the nominal value resp. to that pressure which has given the correct density the last time.

f) Adjust flow to theoretical quantity.

g) Adjust nominal value at the temperature controller to the desired value. Open slowly the pneumatic steam valve by turning the manual remote control of the temperature controller.

IV. Changing over to product

a) Convey the discharge from the finisher to the channel.

b) When the plant is operating steadily and the separators have a minimum water level, open the product valve.

c) When the product appears in the separator of the finisher, convey the discharge back into the float balance tank.

d) When the concentrate has reached appr. 2o % less than the rated concentration (i.e., for instance, at skim milk rated concentration 5o % solids - 2o % (1o % solids) = 4o % solids), give concentrate into the concentrate tank.

Note: During the following minutes, checks of the solid content must be made every 3o seconds, because when feeding back the concentrate with a concentration higher than [illegible]d above, then there is the risk of burn-on.

e) During the next 3o minutes, check regularly the operating conditio[illegible] and readjust to attain the rated conditions.

V. Observations during the operation

a) Because of the steadily increasing heat transfer resistance during the operation, the final concentration tends to drop; therefore, adjust the steam pressure to the vapour compressor delicate sensitively.

b) Check and record the operating conditions every 3o minutes.

c) Check the sealing water flow at the pumps.

VI. Changing over to condensate (water)

a) Close the product valve. Condensate float valve will open automatically.

b) Check the final concentration; if it falls below the value mentioned under IV.d), convey liquid to the channel.

c) When all the product remainders have been pumped off the plant, give back liquid into float balance tank; turn the swing pipe in that way that liquid runs through the strainer.

VII. Cleaning with l[illegible]

a) Reduce the st[illegible] pressure at the vapour compressor to appr. 3/4 of the pressure during operation.

b) Convey condensate into the float balance tank.

c) Switch temperature controller to "hand" and close control valve.

d) Within 5 minutes, continuously pour in caustic soda flakes (NaOH) into the strainer of the float balance tank until 2 %o in kg, referred to the flow rate, have been dissolved (if, for example, the flow rate amounts to 1o.ooo kg/h, then appr. 2o kg flakes have to be used).

e) Open the valves to the chamber spray system at each separator.

f) Increase flow rate by 1o - 2o %, but take care that the separators do not get too full.

g) After a cleaning time of 2o - 3o minutes, convey liquid to the channel resp. to a lye collecting tank.

VIII. Cleaning with acid

a) After rinsing with condensate and after all the lye has been removed from the plant, turn swing pipe again over the strainer within the float balance tank.

b) Within 5 minutes, continuously pour acid (HNO_3) into the float balance tank until the solution has a concentration of appr. 2 % (content of liquid during the clenaingis appr. 1o % of the flow rate).

c) Cleaning with acid for a period of appr. 15 minutes.

d) After the chemical cleaning, convey liquid to the channel resp. to an acid collecting tank.

e) Rinsing with condensate until all acid has been removed from the plant.

f) Close the valves of the chamber spray system at each separator.

g) The plant now is ready for shutting down or for starting up anew.

IX. Shutting down the plant

a) Turn off the steam valve for vapour compressor.

b) Reduce flow rate to 1/4 of the quantity at maximum load.

c) Wait until the plant is cooled down, then stop feed pumps. When all the separators have been emptied by pumps, then stop all the pumps - even the cooling water pumps.

d) Switch steam pressure governor and vacuum roller to "hand" and close the valves at the manual remote controls.

e) Turn off the air compressor.

f) Close the valve at the sealing water tank.

g) Open air cock.

X. Mechanical cleaning

At certain intervals (in some cases daily), the plant has to be checked as to whether the chemical cleaning has removed all the deposits. For this purpose, open top and bottom of the evaporating bodies and of the separators. All the dirt traps have as well to be cleaned.

Heating tubes, distributor system etc. have to be brushed - if required.

It is also necessary to open the plant because the oxygen from the air helps in preserving the surface of the steel.

XI. Chemical cleansing agents

The cleansing agents must be free of chlorine and its compounds (attention: do not use HYDROCHLORIC ACID!); otherwise, pitting of the stainless steel would be caused.

a) Alkaline cleansing agents:

caustic soda NaOH 2 % (2 kg scales or 6 litres 33 % lye in 100 kg water) or other alkaline cleansing agents, too, may be used if suitable, tested and permitted.

b) Acid cleansing agents:

2 % nitric acid HNO_3 (4 litres acid at 36° Bé or 53 %) or other acid cleansing agents if suitable, tested and permitted.

XII. Difficulties during operation

a) Vacuum too low resp. temperatures too high

probably due to:

1. leaks on the lids or manholes,
   the screw joints,
   the pump seals or
   the pump covers

   because of defective gaskets or screws being not tightened enough;
2. cooling water shortage or cooling water being too warm;
3. steam pressure too low;
4. air ejector nozzles too large after lengthy working time.

b) Built up of liquid in the separators

probably due to:

1. leak on the pump seal;
2. loose screw joints on the pump;
3. If the built up occurs in the first time after installation, then t orifice disks of the following stage have to be opened by appr. 1o % of the cross section, a.s.o.

c) Built up of condensate in the heating body

probably due to:

1. leak on the pump seal;
2. loose screw joints on the pump;
3. blockage of the condensate orifice disk.

d) Final concentration too low

probably due to:

1. working conditions being other than indicated;
2. deposits on the heating surfaces;
3. inadequate de-aerating or draining of the heating bodies.

   If a de-aerating pipe is "cold", then there is a leak or the orifice disk is blocked.

e) Deposits on or blockage of individual tubes

in varying order may be due to incomplete removal of all the impurities out of the plant.
Thorough removal of all the impurities mostly cures this trouble.
Deposits may also form if the flow is too low or if the final concentration is too high.

f) If a pump makes a noise then the following orifice disk has to be diminished by appr. 1o % of the cross section, a.s.o.

XIII. In case of emergency

a) In case of power failure the steam supply is shut down, i.e. the solenoid valve closes the air supply to the pneumatic controlling valve so that this valve is shut. After power is reconnected, pump out all the product and clena the plant.

b) In case of steam failure, shut off product supply.

c) In case of cooling water supply failure, shut off valves to the vapour compressors and to the heaters.

Remarks

1. General

In case of plants with steam jet thermo-compressors the evaporating capacity can only be varied in small limits, i.e. by increasing or reducing the steam pressure before the thermo compressor. In case of an increase of the steam pressure at the same time possible the cooling water quantity and thus the total temperature difference of the plant has to be slightly increased. In general the variation from the nominal steam pressure shall not exceed ± 1 atmg. for a modification of the capacity, since otherwise there might be disturbances.

As all external values, the steam pressure, too should be constant if possible. If variations cannot be avoided, care has to be taken that these variations will be temporally constant, i.e. that there are no sudden changes and above all no plu-minus variations.

Changes of the mentioned type influence the whole plant and can make the operation unstable.

The regulation of the vacuum resp. of the temperature in the condenser is effected by the cooling water valve.
Note: The more cooling water, the higher the vacuum -
- and vice versa.

Above all the feed quantity is influencing the required final concentration. A coarse adjustment can be obtained with hand regulating valve after the balance tank. The more product with a constant initial concentration will be fed in, the lower the final concentration will become at constant external consitions - and vice versa.

Besides the feed quantity also an initial concentration which temporally varying, is influencing the final concentration. If the plant is operated by hand these concentration changes can be compensated with the feed quantity at constant external conditions. In case of automatic operation care to be taken that there is a constant initial concentration. With regard to possible variations the same applies as explained as above for the steam pressure. A sufficient help in this connection is that the evaporator will only be fed from tanks of a size of at least 3o.ooo l, having a sufficient intermixing; and that in case of changing-over to another tank care is taken and the evaporator is exactly being observed.

2. If the plant shall for any reason be operated with a capacity lower than the nominal capacity, attention has to be paid that this reduction does not exceed appr. minus 15 %. If the feed quantity is further reduced, the product side liquid content of the plant is so drastically reduced that there is the danger of dposits, incrustations and burning. An operating time

of 2o hours can possibly not be reached any more with the described capacity reduction, and a manual mechanical cleaning might become necessary.

3. Capacity measurements

In case of correct adjusting of the working conditions the evaporating capacity has to coincide with the value indicated under I. - operational data -. The evaporating capacity can be calculated by measuring the initial and final concentration and the feed resp. concentrate quantities, as follows

$$A = B + K \quad \text{(kg/h)}$$

$$K = A/e \quad \text{(kg/h)}$$

$$B = K\ (e - 1) \quad \text{(kg/h)}$$

The symbols have the following meaning:

A = feed quantity (kg/h)
B = evaporating capacity (kg/h)
K = concentrate quantity (kg/h)

c_A = initial concentration (% TS)
c_K = final concentration (%TS)
$e = c_K/c_A$ = evaporating ratio (-)

Initial and final concentrations can be determined roughly with the refractometer. Certain recalculations and corrections have to be taken into consideration . A WIEGAND measuring value sheet is to be found in the annec. To be able to apply the quick refractometer measuring suitably WIEGAND recommend to check thse conversion values under the milk conditions at site with laboratory solids determinations. For exact concentration measurements always a laboratory solids determination has to be applied.

For the exact measuring of the feed quantity and of the concentrate quantity WIEGAND recommend a measuring during a certain period in suitable containers (tank level measurement) with stop watch. For the continuous operation the indication at the flow meter is in most cases sufficient. But for exact capacity control this value can only be used as rough control for the feed quantity.

If there is no possibility to measure the feed quantity exactly via an additional tank or similar, one can do without.
In this case the total condensate quantity should, however, be determined with a tank level measurement. This can be done very exactly.

The following values can thus be determined exactly and in a simple way at the plant in operation:

- initial concentration (% TS)
- final concentration (% TS)
- concentrate quantity (kg/h)

With the above-indicated equations feed quantity and evaporating capacity can be calculated.

Control:

- feed quantity
  compare the calculated value with the value of a suitable tank level measurement;
- evaporating capacity:
  compare the calculated value with the measured value of the whole condensate quantity.
  (Evaporating capacity and total condensate quantity are directly proportional. The nominal evaporating capacity is identical to the total condensate quantity. If lower condensate quantities are determined the evaporating capacity is proportionally in the same ratio lower or higher.

For each measuring point of the explained concentration and quantity measurements, temperature measurements have to be effected in parallel-

WIEGAND suggest to effect at least 5 measurements in particular for the quantity and concentration at each measuring point to get a mean value. In case of concentrate measurements attention has to be paid to the conversion of l/h into kg/h.

During the measurement of capacity the plant has to work absolutely stable.

4. Minutes on Capacity Measurement

The capacity measurement has to be recorded. The model of such an operation record is to be found in the annex. Measured and calculated values have to be entered in a suitable form. In case of measurements of quantity and concentration the measurement place and method have to be described briefly, in °Th, % lactic acid, SH and pH-value of the milk as well as the intake temperature.