WINTEK CORPORATION

WINTEK FEED OIL DEHYDRATION SYSTEM
SN: 120924 SYSTEM SUMMARY

Customer: Milligan

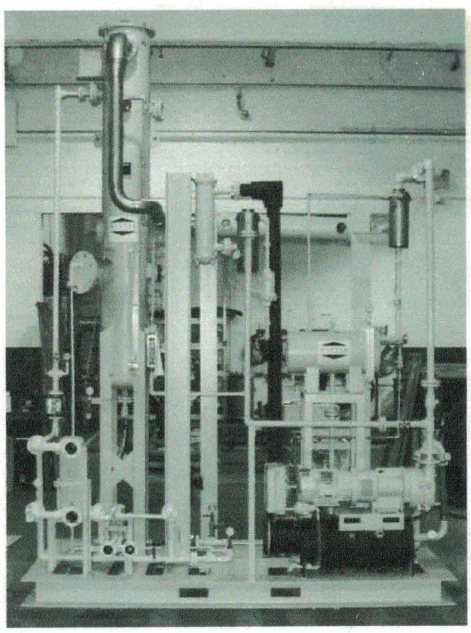
Process Parameters

Feed Content (based on Soy Oil modeled as Triacylgycerol)	**12.1 - 21 gpm total Feed Oil w/ 0.25wt% water (*rates shown are for 12.1 gpm)** 5,492 #/hr Feed Oil 13.8 #/hr water
Feed Temperature (by customer)	80F assumed
Objective:	Reduce water to 0.02-0.03 wt%
Construction	CS
Electrical Classification	NEMA 4 3/60/600V (system configured for 3/60/460V) Step down transformer (supplied loose): 600V - 460V

Heating by 100psig steam	166,000 BTU/hr*
Cooling Required based on 45°F water	20,500 BTU/hr* (cooling water can run in series from after condenser to precondenser)
N_2 purge rate required	Start-up only, use recycled gas
Vacuum Pump HP	10HP
Liquid Feed Line Size @ 60 psig (required)	1.5"
Oil discharge temp.	~140°F

Process Notes:

- Equipment offered is a Flash tower with Condenser/Receiver and vacuum system.
- Recovered water will contain ~50% oil mix
- Solids must be filtered prior to reaching Wintek system.
- For operation of this system you will require 100 psig steam and cooling fluid at 45°F



Feed Oil Dehydration Unit FOD-21.003(.0002)

- FT1- Recoup Heat Exchanger, SS Plate
  - Manual startup Valves (V-1,V-2)
  - TI, PI
  - Check valve on product discharge
- FT1- Feed Heat Exchanger, SS plate. Requires 100 psig steam, 166,000 BTU/hr*
  - TI , PI
  - Feed flow meter, local indication (FM-1)
  - 1.5" Globe Valve (V-31)
- 1st Stage Flash Tower, 16"dia, CS, FV – non-code, w/ 8"clean-out flange,

removable top
- 304SS demister
- Spray nozzle, SS
- Packing, SS
- (3) level switches, float type, (2 in sump, 1 at spray)
- Level control float valve
  - Isolation ball valve for float (V-6)
  - Globe valve for float (V-32)
  - Vacuum Gauge
  - Insulation on separator tank, discharge piping, and after-condenser
- Protected level glass, full metal jacket protection on 3 sides, lexan front protection, CS
- Absolute Digital Pressure Gauge
- Ball valve at bottom of flash tower (V-3)
- 4" CS vapor discharge piping
- Flash Tower Drain Valve (V-4)
- Nitrogen flow meter, w/ globe adjusting valve(V-9) and ball valves (V-7, V-8)

- Transfer pump –2 HP XP, low NPSHr, EDPM elastomers, ~100' TDH
  - Discharge pressure gauge
  - Discharge Globe adjusting valve, full port (V-5)
  - Pressure gauge
  - Check valve
- Piping, CS, threaded
- Condenser, copper tubes, CS shell, non-ASME, requires ~25 gpm 50°F coolant (run in series with after condenser)
  - Condensate Receiver, 20 gallon, CS, non-ASME FV/14 psig
    - Demister Pot, CS
    - Drip Glass
    - Temperature Gauge
    - Receiver Isolation Valve (V-17)
    - (2) level switches, float type, SS
    - Equalizer Line and Valve 1/2"(V-18)
    - Manual Vent Valve (V-19)
    - Vacuum Gauge
    - Manual Drain Valve (V-20)
    - Protected level glass, full metal jacket protection on 3 sides, lexan front protection
    - Transfer pump, CI/EPDM, 1 HP XP close coupled
    - Globe adjusting valve on discharge of pump (V-22)
    - (2x) Discharge check valves, and pressure gauge

Vacuum Pump
- Manual anti-cavitation vacuum adjustment (V-24)
- Inlet isolation valve (V-23)
- Inlet Check Valve
- Vacuum Gauge
- Liquid ring vacuum pump, CI/SS impeller/viton, oil sealant
  - 10HP, XP motor 1750 rpm
  - Oil sealant reservoir w/ integral oil mist coalescing system DX5
    - Temperature Gauge
    - Low oil level switch

        - Backpressure gauge
        - Level gauge
        - Drain Valve (V-27)
        - Y-Strainer
    - Air-cooled heat exchanger, integral with vacuum pump, aluminum core
        - Temperature control valve
        - Temperature switch
- Set, CS threaded piping 2"
- After-condenser, CU tubes, CS shell, non-ASME, requires ~25 gpm 45°F coolant (run in series with precondenser)
        - Demister pot, CS, 304SS demister, non-code
        - TI mount on demister pot
        - Return valve, CI
            - Condensate return isolation valve (V-34)
- CS threaded piping
- Common CS base
- Local Nema 7 Junction Box (no local logics or start/stop)
- Local motor disconnects (XP) not included
- Nema 4 Starter Control Panel
- Step down transformer (supplied loose)

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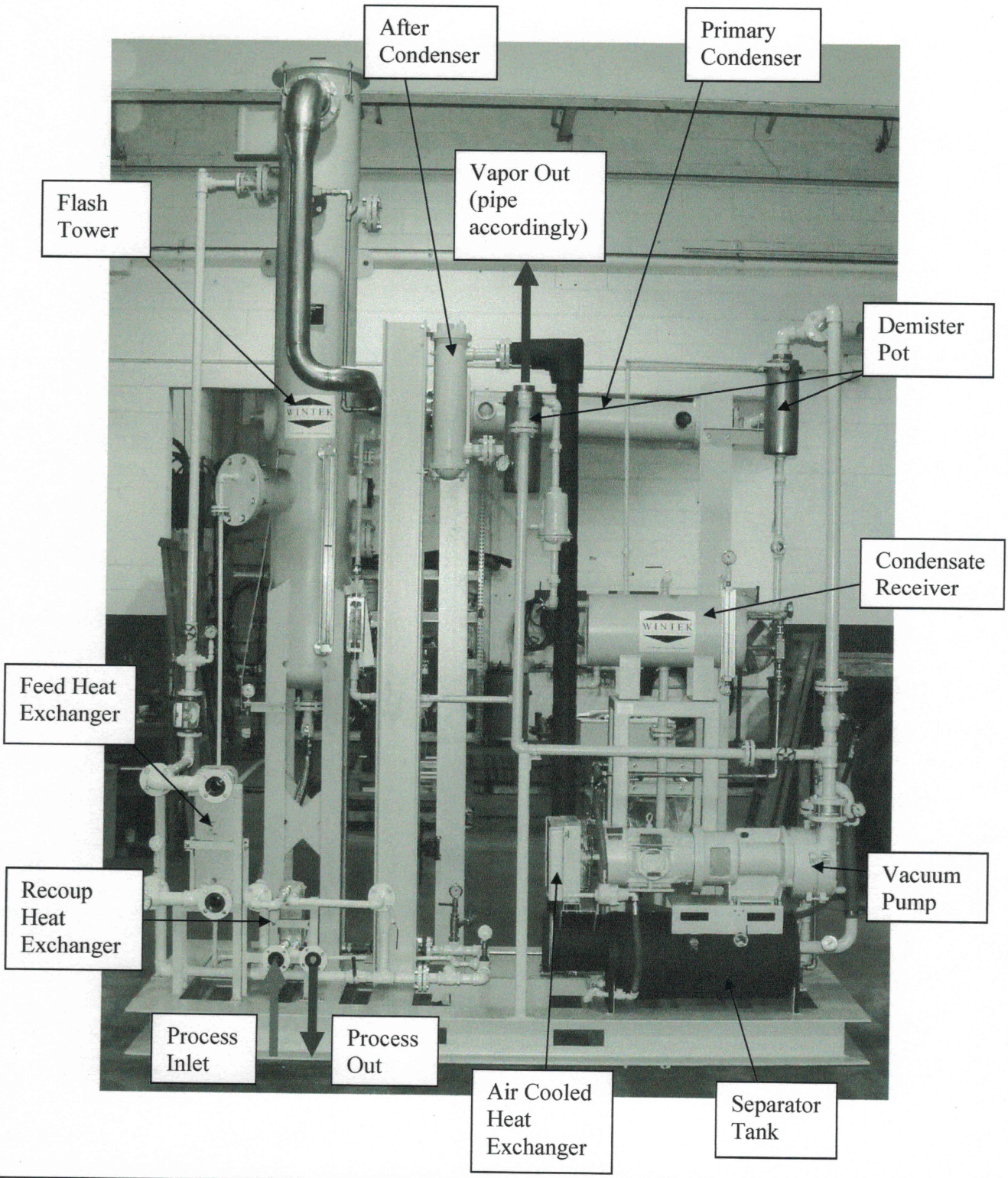
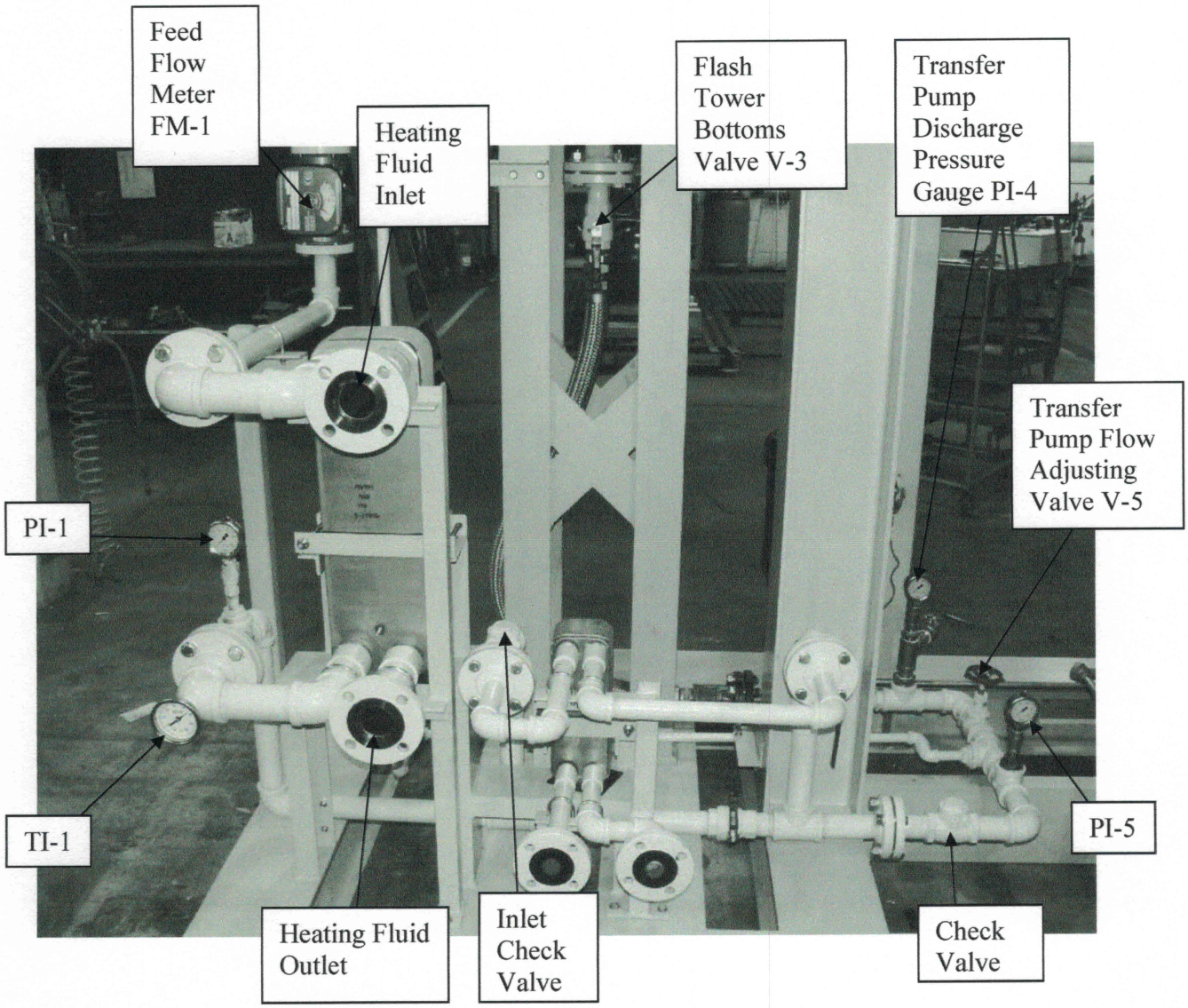


Wintek Corporation: Vacuum System Reliability
230 US Hwy 206, STE 401, Flanders, NJ 07836
Ph: (973) 252-8200 Fax: (973) 252-8233 Website: www.wintek-corp.com



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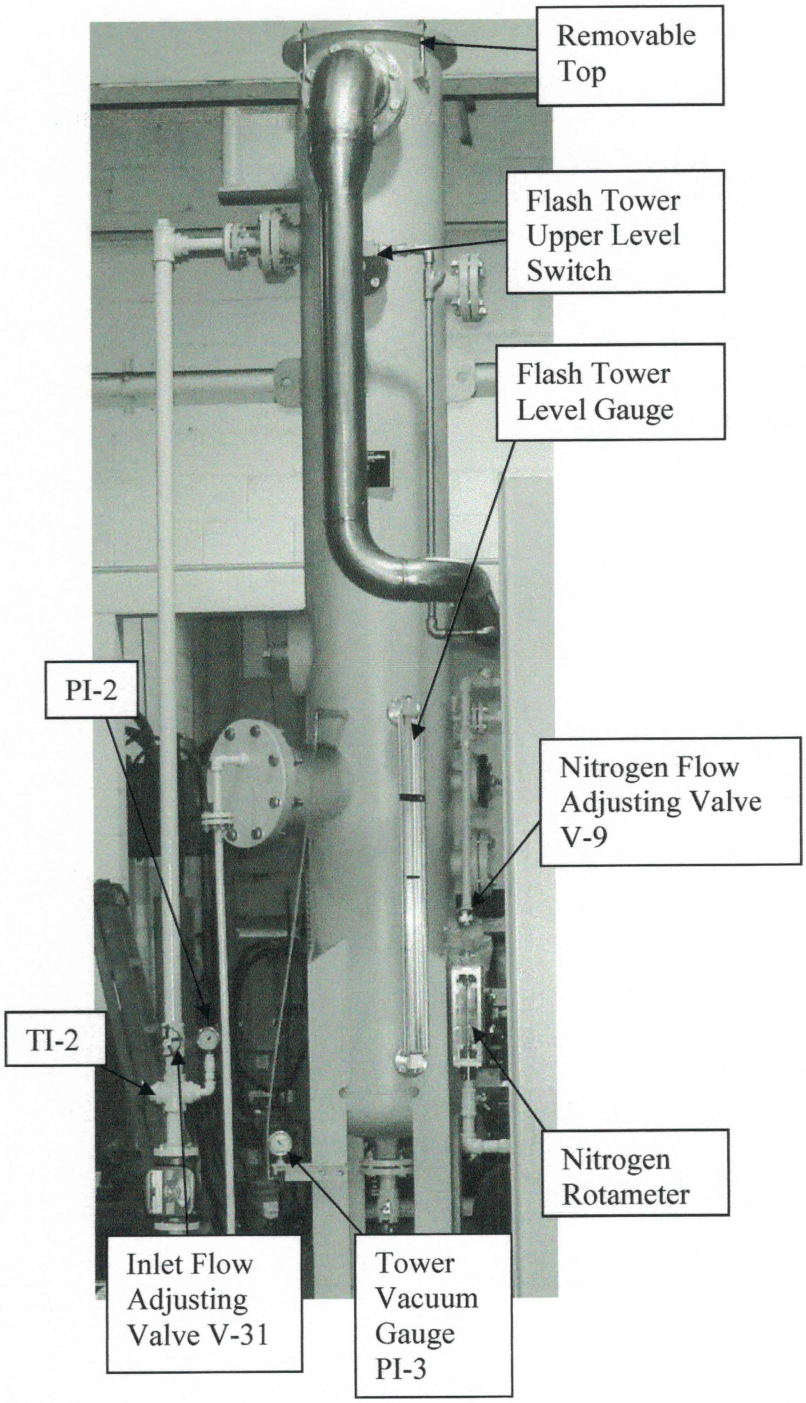

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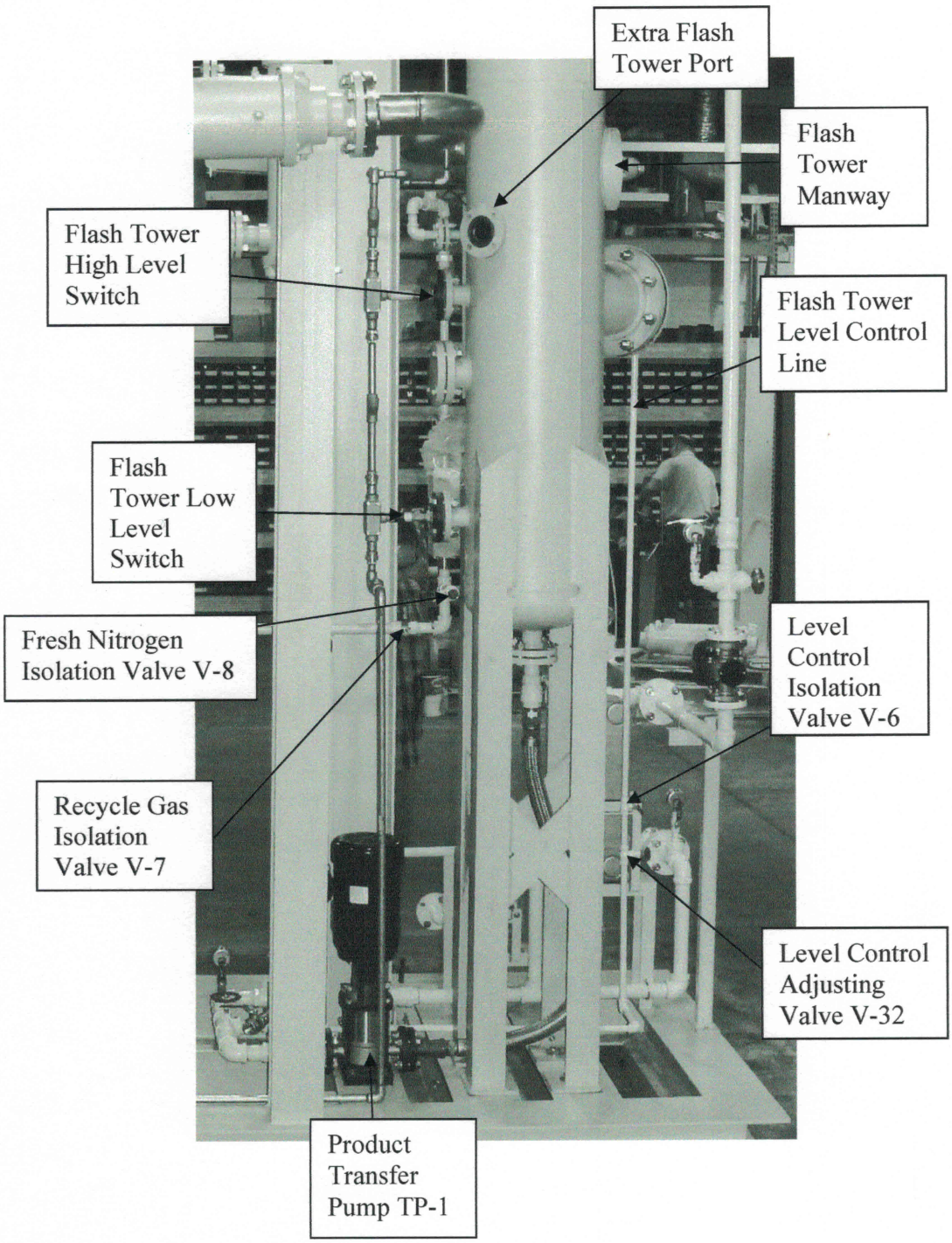
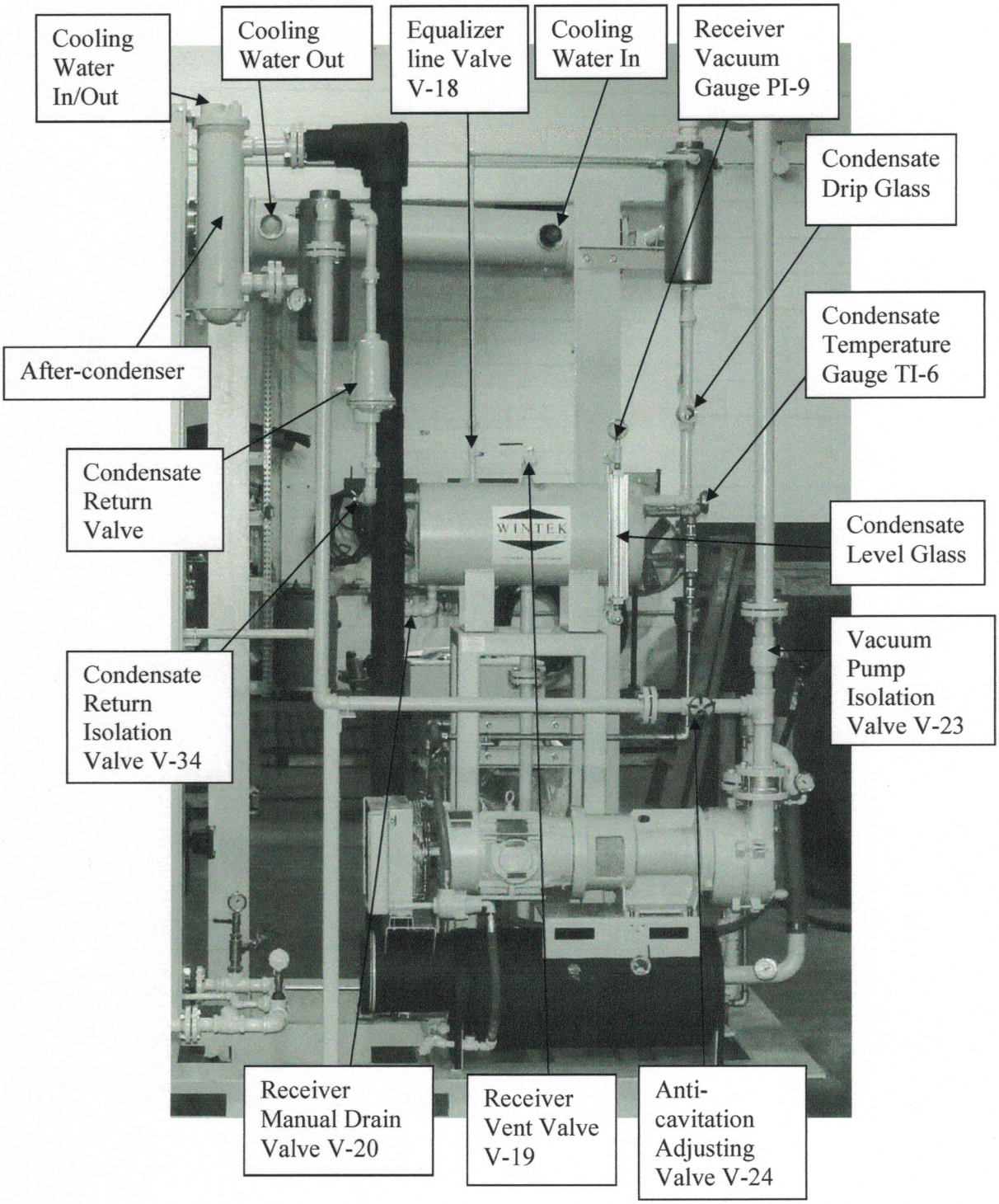

Extra Flash Tower Port
Flash Tower Manway
Flash Tower High Level Switch
Flash Tower Level Control Line
Flash Tower Low Level Switch
Fresh Nitrogen Isolation Valve V-8
Level Control Isolation Valve V-6
Recycle Gas Isolation Valve V-7
Level Control Adjusting Valve V-32
Product Transfer Pump TP-1



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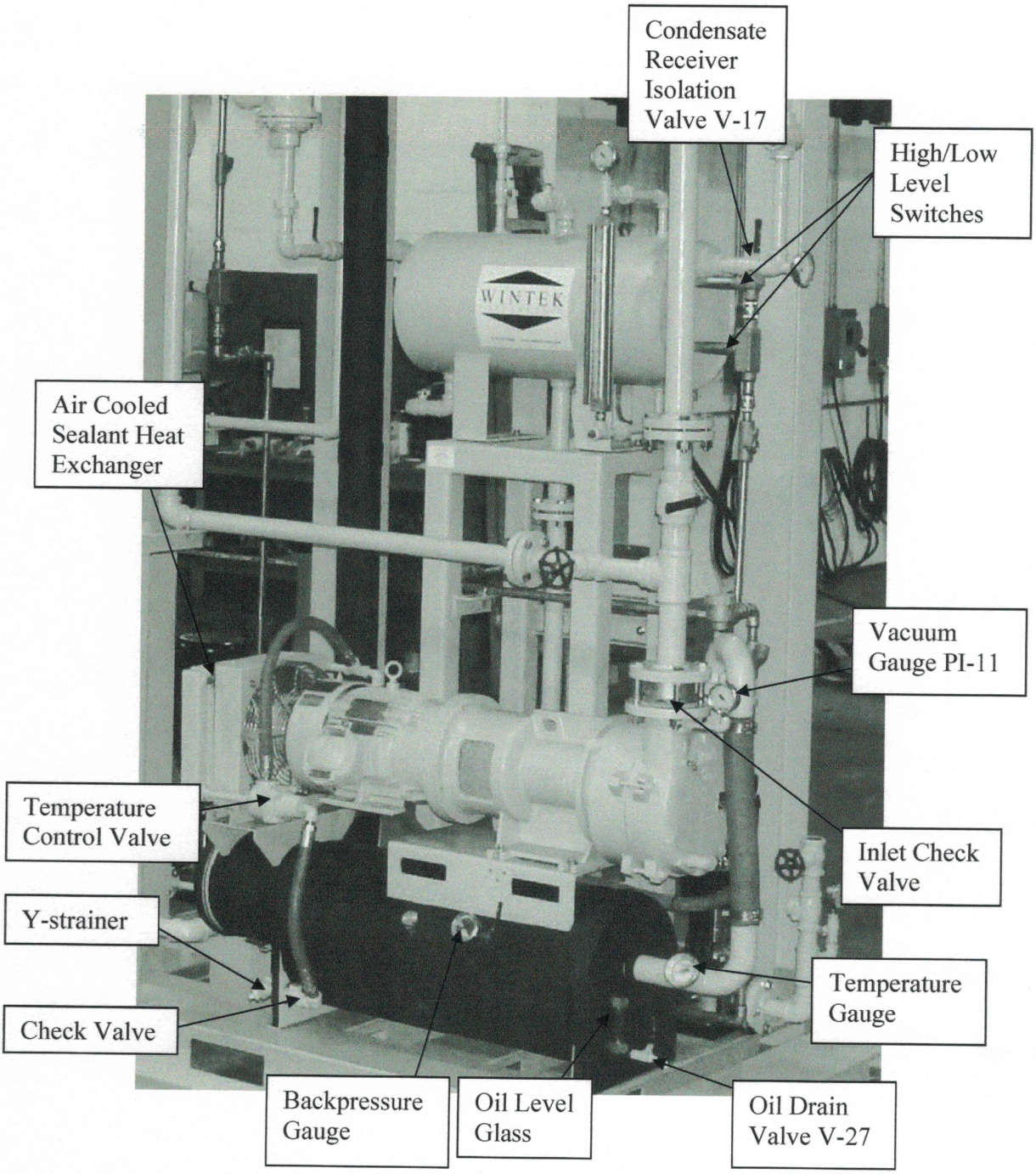
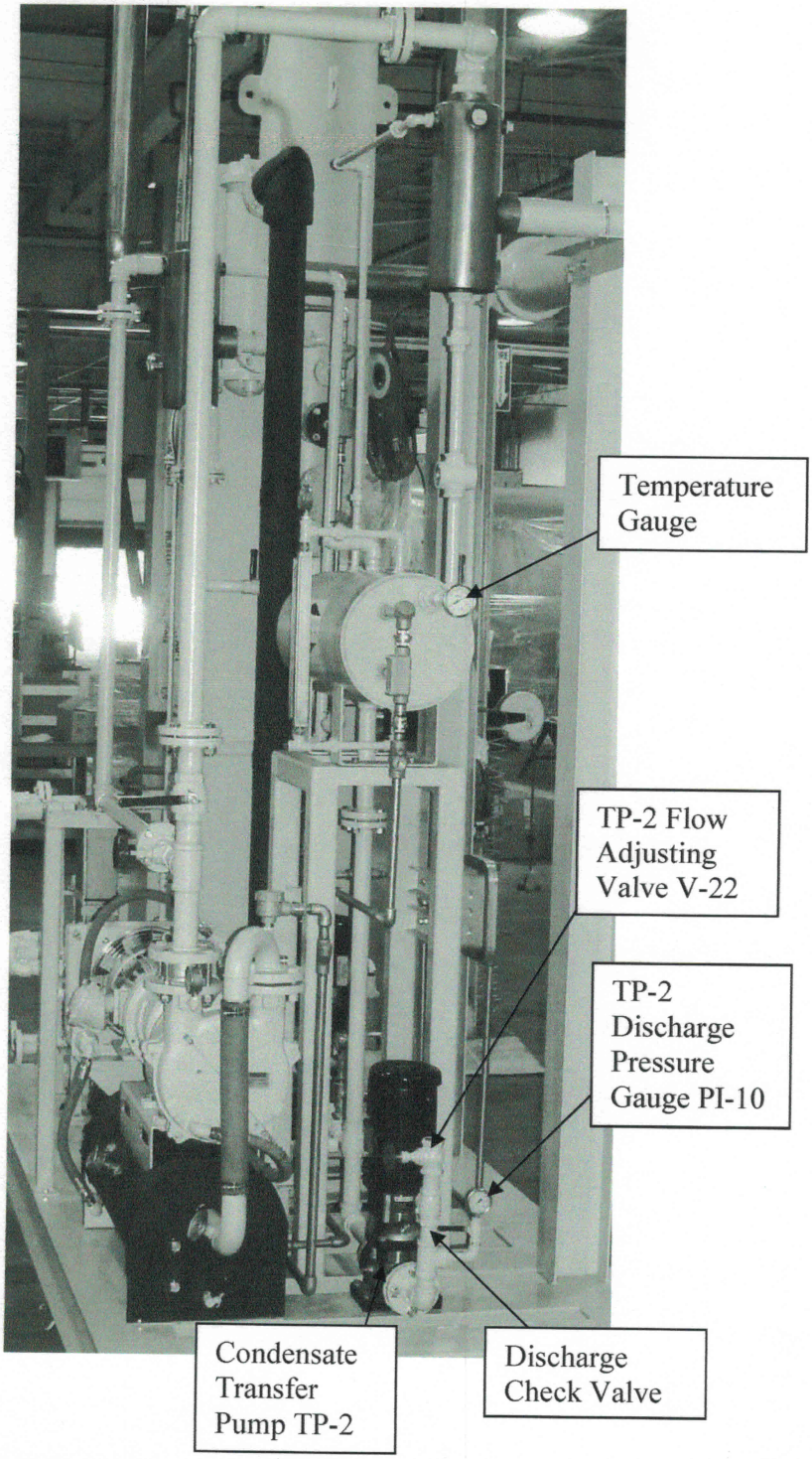

Condensate Receiver Isolation Valve V-17
High/Low Level Switches
Air Cooled Sealant Heat Exchanger
Vacuum Gauge PI-11
Temperature Control Valve
Inlet Check Valve
Y-strainer
Temperature Gauge
Check Valve
Backpressure Gauge
Oil Level Glass
Oil Drain Valve V-27


Temperature Gauge
TP-2 Flow Adjusting Valve V-22
TP-2 Discharge Pressure Gauge PI-10
Condensate Transfer Pump TP-2
Discharge Check Valve

Process Description

Wintek's Feed Oil Dehydration System is used to remove the water from your feed oil. The process utilizes a phase change mechanism via flash evaporation with nitrogen stripping gas.

The system consists of feed heat exchanger, a flash tank, a transfer pump, a pre-condenser, receiver tank with transfer pump, and a high vacuum system. By exposing the hot feed oil to a high vacuum the water will flash into water vapor and be removed by the vacuum system.

Feed Heat Exchangers

The heat exchangers heat the feed to give it suitable temperature for flash evaporation to occur. The steam (user supplied) is used as the heating source. Refer to the "system design data sheet" for heat exchanger operating pressures and temperatures.

Recoup Heat Exchangers

The recoup heat exchanger utilizes the heat content of the final product to pre-heat the feed stream. Refer to the "system design data sheet" for heat exchanger operating pressures and temperatures.

Flash Tank

This section includes the flash tank (rated for operation at deep vacuum), spray nozzle, mass transfer ceramic packing, and mist demister. It is in this section that the flash evaporation takes place. The vapors are pulled upward to the top of the tank through the mist demister and out toward the vacuum pump. The mist demister reclaims any feed oil droplets which may be entrained with the flashed water vapor. Flash tank should be heat traced and insulated, including flash tower lid.

Transfer Pump

At the bottom of each Flash tower is the feed oil transfer pump. In most systems this is a centrifugal pump (either horizontal induced impeller design for flows over 15-20 gpm; or a vertical multi-stage design for lower flows). Both pumps are design with low NPSHr feature to be able to operate under the vacuum conditions of the tower. The pump is selected with a capacity in excess of the design flow, but still within the acceptable NPSHr limits. This excess flow is recycled back to the flash tower via a float control valve (see below). The flow rate of the transfer pump is controlled (limited) with a globe valve at the discharge of the transfer pump. If the pump flow rate is not controlled, the flow rate of a centrifugal pump can be several times the design point as the discharge pressure drops, but the NPSHr will increase dramatically and put the pump into cavitation (and stall, or air-bind). So to prevent this condition, we limit the flow with the globe valve. The flow rate is set during start-up (see below).

Flash Tank Level Control and Transfer Pump flow rate setting

- Level is maintained in the flash tower via a mechanical *float valve*. As level in the flash tower lowers the float valve opens to recycle fluid from the transfer pump back to the tower sump. As level increases the float valve closes. The basic operation of this level control is to recycle the excess capacity of the transfer pump which is selected to be in excess of the customer's feed oil. The level set point in the flash tower is approximately 6" below the high level switch, and is determined by the internal float in the tower, which is on an adjustable arm. This level is set at our factory during assembly. When operating the system in normal mode (with customer feed to the tower), the normal level will always be about 6"

below the high level switch. There is an isolation ball valve on this recycle fluid line to close off the operation of the float valve, which is used when setting the maximum system flow rates on the transfer pump.

- When in start-up recycle mode (no customer feed into our system), the float valve really has no effect on the tower liquid level, because what is being pumped out of the tower is being fed right back thru the inlet connection (in recycle mode).
- When in normal operation mode, the transfer pump flow is set to be in excess of the customer's feed. So if the recycle fluid isolation valve is closed, the transfer pump will pump out and reduce the fluid level in the Flash Tower until the low level switch turns off the transfer pump.
- To set the proper flow rate on the transfer pump, the recycle fluid isolation valve is closed. Turn on the customers feed pump and set the startup valves to normal mode, and adjust the globe valve to maintain level in the flash tower mid-way between the high and low level switches. When you feel the level in the tank is steady, the flow from the customers feed is equal to the flow being pumped out of the flash tower. Since we want the transfer pump to have a somewhat higher capacity than the feed (to allow for some customer variation), open the globe valve so you can see a definite lowering of the level. Then open the float valve isolation valve. Because the level was low in the flash tower when you opened the float valve isolation, the float valve will open to bring the level back up to its normal level; and the level will rise in the tank to approximately 6" below the high level switch. During this level equalization period, the pressure gauges at the discharge of the transfer pump will drop and may even go to zero until the level reaches the normal operating level. Once the operating level reaches the normal point, the float valve will adjust to be partly open to handle the excess flow capacity of the transfer pump, and the flow leaving the system will match the flow being pumped into the system by the customer.
- Note: Once set, this is the ***maximum flow for the system***. If customer increases flow to the system beyond the set flows, then the level in the flash tower will increase until the high level switch is activated, at which point the customer's feed pump should turn off, and the vacuum pump will turn off. If the customer's feed decreases, the recycle float valve should be able to handle the reduction down to about 25% of the design flow.
- A high level switch is installed in the Flash Tower which should shut off the vacuum pump and customer's feed pump to prevent overflow from the flash tower into the vacuum pump. The low level switch should turn off the transfer pump to prevent it from running dry. If level increases to satisfy the low level switch, after a time delay, the transfer pump will restart, but maintain flash tower low level light on the panel until the reset button is pushed.

Nitrogen-purge line with Rotameter

An N_2 bleed line with Rotameter has been installed on the flash tower. The purge aids in stripping the water from the feed oil. The purge also aids in removing the water from the vacuum pump by reducing the partial vapor pressure. Please see system data sheet for Purge rate (note: a lower rate may work as well).
NOTE: Customer to supply N_2 at 15 psig (for start up only).

Vacuum System

The vacuum system included is a liquid ring vacuum pump utilizing oil sealant to run air cooled, with temperature control. To prevent water condensate accumulation in the sealant oil the vacuum pump's operating

temperature is ~200°F. The sealant separator discharge piping should be insulated (this, combined with the nitrogen strip gas, prevents water condensation in the pump). The exhaust piping should also be sloped away from the separator tank to prevent vapors that condense in the piping to accumulate in the separator tank.