SECTION 4

PROCESS INFORMATION

Attachment 4-8
Thermal Desorber Engineering Specifications

MIXED WASTE FACILITY
RCRA/TSCA PERMIT APPLICATION

PERMA-FIX NORTHWEST RICHLAND, INC.

RICHLAND, WASHINGTON

Pacific EcoSolutions

July 1, 2004

SPECIFICATION
for
INDIRECT FIRED ROTARY CALCINER
and
RELATED DOCUMENTATION AND SERVICES

Pacific EcoSolutions (PEcoS) will procure an indirect fired rotary calciner for installation at their facility in Richland WA. The procurement will include the calciner and associated documentation and services as described below.

1. Physical description

1.1. Rotary Tube

- Tube 2 ft diameter by 23 ft long.
- Tube material 309 SS, 3/8 inch wall, welded.
- Heat transfer fins (12 each) 309 SS, 3 inch by ¼ inch welded outside tube, equal spaced approximately 12' long.
- Removable lifting flights (2 each), 309 SS, 3 inch by ¼ inch, running internally the entire length of the tube.
- Replaceable 3" high dam at feed end. Two belt type seals at each end of kiln (4 total) made from "S" glass capable of 1400 °F. One seal between the tube and heat zone shroud and one seal between the tube and the end hood.

1.2. Rotary Tube Support

- Four 6 inch machined carbon steel trunnion rollers with pillow block bearings, 2 at each end of tube.
- Two 1040 carbon steel 1 ¼ inch thick round tires resting on movable end of tube trunnions and attached to the tube at points by 309 SS (leaf springs).
- Tube elongation by thermal expansion (3 to 4 inches at 1400 °F) is accommodated by growth on the discharge end trunnions into the discharge end housing.

1.3. Heat Zone Shroud

- Painted carbon steel shroud, 18 foot long heat zone with a circular cross section, 46 inch outside diameter.
- 4 inch thick ceramic insulation.
- Ceramic insulation held in place with 310 SS pins welded to inside surface with removable keepers.
- Annular space between external tube heat fins and inside surface of insulation is 3.5 inches.
- Vertical 12 inch diameter flue gas pipes at top of each end of heat zone shroud with flanged fittings and standard ASA bolt pattern.
- Maximum skin temperature on shroud approximately 300 °F when kiln is at 1400 °F.

1.4. End Shrouds

- Painted (high temp. aluminum) carbon steel end shrouds at each end.

- Each shroud lined with 2 ½ inch thick castable refractory.
- Vertical 6 inch diameter duct at top of each shroud for vapor exit, with flanged fittings and standard ASA bolt pattern.
- Rectangular solids discharge port at bottom of each end shroud, with flanged fittings and standard ASA bolt pattern.
- 3 foot diameter access port on each end shroud.

1.5. Burners
- 6 Hones burners equally spaced along length of heat zone and at bottom of one side.
- Burners firing horizontally and tangentially into the annulus between the tube and heat zone shroud insulation.
- Each burner rated at (approx) 0.25 MM Btu/hr @ 5 psig fuel pressure (propane).
- Burners can use natural gas in place of propane.
- Total maximum heat input to kiln of (approx) 1.5 MM Btu/hr.
- Air aspirated directly from atmosphere with manual adjustment of air flow.
- No flame safeguard system provided.

1.6. Rotary Drive
- Rotary tube variable speed drive.
- One electric motor capable of rotating tube from 0 to 5 rpm.
- One trunnion roller for friction drive.

1.7. Framework and Support
- Skid mounted kiln, readily bolted to the framework.
- Frame work approximately four feet high for kiln mounting.
- Spacers for setting kiln inclination angle.

1.8. Solid Feed System
- Conical hopper with 6 inch diameter outlet.
- 2 pneumatically actuated 316 SS knife valves separated by an approximate 1 foot spool piece.
- 3 inch diameter SS screw conveyor.
- Knife valve sequencing timer.
-

1.9. Solids (ash) Discharge System
- 6 inch diameter solids (ash) screw conveyor with water cooling jacket.
- (2) 6 inch SS slide gate valves.
- Conveyor inclined to lift solids to height of 55 gal drum.
- All components SS.
- Variable speed drive on conveyor.

1.10. Instrumentation & Miscellaneous
- 10 Omega type K thermocouples and wiring with digital display panel mounted
- 2 manometers
- Variable speed induced draft fan on exit of heat zone shroud.

2. Documentation

The following documentation, to the extent it is available to Seller, shall be provided to buyer:

2.1. Drawings and specifications
2.2. Codes and standards used in design and fabrication
2.3. Parts list
2.4. Operation and maintenance manuals
2.5. Recommended spare parts inventory
2.6. Specifications for procured items
2.7. Subcontractor's Certificates of Compliance / Conformance
2.8. Performance test reports, including maximum temperatures and temperature profiles experienced by the unit to date.
2.9. Supporting design and performance calculations
2.10. Quality Assurance inspection reports

3. Delivery

3.1. All parts to be adequately secured, braced, and crated as necessary to protect from damage during shipment by commercial truck.
3.2. Unit shall be available for pick-up at point of shipment, Allen, Kentucky, not later than August 16, 2004.
3.3. Seller shall provide for loading all components onto shipper's truck.

ROTARY THERMAL DESORBER END ENCLOSURES

SCOPE of WORK

Contractor to provide all labor and materials to fabricate and install enclosures on the feed and discharge ends of the rotary thermal desorber (RTD). The enclosures shall be affixed to the heated section and end shrouds to preclude air leakage into the space surrounding the rotating tube. The enclosures shall be sealed along all seams, structural members, and other components (e.g. conduits, supports, tubing, etc.) to preclude the in-leakage of air.

The enclosure shall be assembled to permit easy removal of sections for maintenance access. Nuts on threaded studs or other easily removable latches shall be used in areas needing frequent access.

Enclosures shall be capable of withstanding up to 3" w.c. (outside to inside) pressure. Use of 24 ga. (0.024") or thicker steel sheet, supported on a structure of angle steel 1"x1"x1/16"or larger, will meet this requirement.

The discharge end enclosure shall have one section, at least 8"x 8", of clear material to permit observation of the end shroud to rotor air seal by operators standing on the floor. The feed end enclosure shall have at least two sections of clear material. One section shall be at least 8"x 8" of clear material to permit observation of the end shroud to rotor air seal by operators standing on the floor. The second section shall be at least 6"x12" to permit observation of the drive motors from a raised platform.

The feed end shall include a baffle between the drive motors and rotating tube. An opening shall be provided to accommodate the drive chains. This baffle will function to shield the drive motors from thermal radiation and to direct nitrogen flow past the motors for cooling.

Thermal Desorber System

Auger Specifications

PREPARED..... For..... Meier
Est no... FMC # DM7040399X2-A
By..... Dean Mitchell, Application Sales Specialist
Date..... 10/25/04

MATERIAL..... Handled.. Unknown @ 1400F
Density.. 0.00 lbs/cu ft, for capacity
0.00 lbs/cu ft, for horsepower
Factor... 1.0 for friction

UNIT..... Name..... Unit A
Quantity. 1
Length... 10'- 0"
Path..... Inclined @ 30 degrees
Capacity. 0 cu ft/hr
Speed.... 10 rpm
Loading.. 0 percent, for capacity
0 percent, for horsepower

SCREW..... Type..... Sectional
Flight... Diameter..... 12 inches
Pitch..... ~~Full, 12.0~~ inches
Material..... 1/4 inch, 316 Stainless Steel
Type weld.... Type 2, Continuous Carrying Side
Hardsurface.. Not Required
Pipe..... Nominal size. 2.5 inch, Schedule 40 Standard Straighten
Material..... 316 Stainless Steel
Notes.....

TROUGH..... Type..... Flanged U Trough
Material..... 1/4 inch, 316 Stainless Steel
Notes..... w/WATER JACKET INCLUDED
Supports..... ~~Not Required, Since Conveyor Is Short~~

TROUGH END PLATE..... Type..... U Trough w/ Feet
Material..... 1/4 inch, 316 Stainless Steel

COVERS..... Type..... Flanged w/ Bolts @ 6 inch ctrs
Material..... 14 Ga, 316 Stainless Steel
Gaskets..... Flex-Weave 1000, Non-Asbestos, 1000 Deg F

HANGERS..... Type..... Not Required
Frame.....
Bearing.....

INLETS..... Quantity..... 1
Type..... Special, 6" - 150# Flange Pattern
Material..... 10 Ga, 316 Stainless Steel
Notes..... Shop Fitted

DISCHARGE..... Quantity..... 1
Type..... Special, 6" - 150# Flange Pattern
Material..... 7 GA, 316 Stainless Steel
Notes..... Shop Fitted

TAIL END BEARING..... Quantity..... 2
Type..... Link-Belt, Outboard w/ Ball Bearing Pillow Blocks
Size..... 2

DRIVE END BEARING..... Quantity..... 2
Type..... Link-Belt, Outboard w/ Roller Bearing Pillow Blocks
Size..... 2

SEALS..... Type..... Split Gland
Packing..... Carbon Fiber, 650 Deg F
Notes.....

Name..... DM7040399X2-A, Unit A Continued

TAIL SHAFT..... Size..... 2
Material..... 316 Stainless Steel
Bolt qty..... 2

COUPLING SHAFTS..... Size..... Not Required
Material.....
Bolt qty.....

DRIVE..... Motor.... Type..... Baldor TEFC, Energy Efficient, Class F Ins, w/ 1.15
HP..... 0.020 actual
. selected
RPM..... 1,750
Voltage..... 230 or 460 V, 3 PH, 60 HZ
Notes..... Not VFD capable

Reducer.. Model..... Falk, Model Falk 2040FZ3
Type..... Motogear, Roller Chain Drive, Class 2 Service
w/ Slide Base For Reducer
Guard.... Type X Oiltite Chain Casing
Notes.... 3:1 RC

Shaft.... Diameter..... 2
Material..... 4340 HT
Bolt Qty..... 2 316 Stainless Steel

SPEED SWITCH.. Type..... Not Required
Model....

GATES..... Quantity. Not Required
Type.....
Size.....
Material.
Notes....

PAINT..... Sur Prep. Vendor's Standard
Type..... Motors, Bearings, Seals, Etc, Are Vendor's Standard Paint
D.F.T....

INSPECT PORT...Quantity. Not Required
Type.....

FEATURES.....

ASSEMBLY..... Assembled, Match Marked, Disassembled Into Maximum Lengths For Shipment

TESTING..... Shop Power Tested, For Verification Only

UNIT WEIGHT.... 965 Pounds (Net Each)

UNIT PRICE..... _____ S. Dollars (Net Each)

SUBMITTED..... Dean Mitchell
Dean Mitchell, Application Sales Specialist

TERMS.....Freight..... F.O.B. Tupelo, No Freight Allowed
Delivery..... 6 Weeks After Drawing Approval
Payment..... Net 30 Days, Subject To Credit Approval

Thermal Desorber System

Burner Train Specifications

North American
Manufacturing Company, Ltd.
4455 East 71st Street Cleveland, OH 44105-5600 USA
Tel 216.271.6000 Fax 216.641.7852 email: sales@namfg.com

PROPOSAL 5681 Rev 1

Submitted to:
PECOS
2025 BATTELLE BOULEVARD
Richland WA 99352

Attn: Dale Green
Copies:

Subject: Rotary Incinerator Combustion system

Quote number:	22717.3
Job number:	5681
Quote date:	11/10/04
Terms of Payment:	Net 30
F.O.B.	Plant Site, Cleveland, OH
Freight:	Prepaid and Add
Delivery:	See Below

Please mail order to:
North American Mfg. Co., Ltd.
Jane Ziegler
Suite 101
1820 W Orangewood AVE.
Orange CA 92868-2043
Janeziegler@namfg.com
Phone 714-634-4891
Fax 714-634-4595

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The North American Manufacturing Co. proposes a solution for the combustion system as described herein as an equipment package, including engineering, components and packaging, at the prices below.

The following bill of material is for a six burner combustion system, complete with blower, fuel train, and burner management system.

The burner management system uses Honeywell 7800 series flame relays. One flame relay display module is included. The BMS has a Honeywell single loop temperature controller and a Honeywell high temperature limit. The system uses flame rods for flame detection. The cabinet is rated NEMA 12 Thermocouples are not included.

The burners are 4441 Tempest burners. Each burner has a limiting orifice, metering orifice, gas block valve and manual valve in the gas line. Each burner has a butterfly valve in the air line; flexes are supplied for air and gas.

Temperature and ratio control are via a cross connected system utilizing a 7216 ratio regulator cross connected to the combustion air manifold.

The fuel train and control panel will come assembled on a skid. This skid will be approximately 2' wide x 4' high x 6' long. All of the components on the skid will be wired to the control panel, field devices will need to be installed and wired by others.

The control panel will come with a complete set of drawings including field wiring which shows all of the field devices.

I will provide a P&ID drawing similar to the attached with all pipe sizes and minimum clearances required between devices.

I will make a trip over to review the initial installation plans with you and another to identify the components before installation. I will be available beyond that for consultation and start-up per the attached M-9 rate sheet. I can also provide installation services from North American Construction Services; our crews are very familiar with combustion system installation.

Depending on the schedule start-up assistance may come from our field services group based in LA.

North American Mfg. Co.
6912 77th Ave NE, Marysville, WA 98270-6523
Phone: 360-659-7432 Fax: 360-659-8083

Proposal:	22717.3
Date:	11/10/2004
Currency:	USD
Discount:	0%
Office:	Seattle
Creator:	Dave Strakele

Customer: **PECOS**
Description: **6 Burner system for small rotary incinerator**

Seq	Qty	Item	Description
	6	4441-2-RRH/F	1-1/4" Tempest Burner
	6	8777-2	1-1/4" flexible nipple
	6	1122-2	1-1/4" butterfly valve
	1	1126-6	3" butterfly valve
	1	R410-2452-HR	50 sec stroke over 150 degrees travel, 120 vac/60 Hz, 4-20 mA input, no feedback, 400 lb-inch torque, two end of travel limit switches, two aux switches, CW on incr. signal, programmable relay, Modbus communication, UL type 4, NA option
	1	8695-6-SST	3" SST orifice plate
	1	8763D-6	3" 300LBS weld neck orifice union
	1	8757-PS-W	Pressure switch, pneumatic switch, white spring, 1 - 10" wc, pack springs with switch (extra orange and blue spring)
	1	2312-19/1-T1.5D	Direct drive blower with TEFC motor
	1	2947-7	4" sleeve with clamp
	1	8757-C437F1045	Pressure switch, 1 - 26" wc
		BURNER GAS COMPONENTS	
	6	8777-0	3/4" flexible nipple
	6	1807-0	3/4" limiting orifice valve
	6	8697-0-A468	3/4" metering orifice assembly
	6	1836-03	1/4" needle valve
	6	1486G-0	3/4" solenoid shutoff valve
	6	1821A-0	3/4" ball valve
		FUEL TRAIN COMPONENTS	
	1	1821A-1	1" ball valve
	5	1836-03	1/4" needle valve
	1	8558B-1-100	1" Y type strainer, cast iron body, complete with 100 mesh SST basket
	1	7347-1-B	1" regulator, 1.2 - 2.5 psi
	1	8735-Q	Gauge, 0 - 5 psi
	2	8735-L	Gauge, 0 - 30 psi
	2	8757-C437F1052	Pressure switch, 0.5 - 5 psi
	2	1519-1	1" automatic reset gas shutoff valve 120/1/60
	1	1821A-1	1" ball valve
	6	4-25432-1	Flame rod assembly
	6	4085-5-A	Ignition cable 5 foot ring end

6 4065-6N1-6A	Ignition transformer 1 pole 50/60 primary, 6000v secondary, with 12" leads
6 4085-5	Ignition cable
1 8865 control panel	S_110404_MO_01 6 Burner BMS with Motor starter and disconnect
1 7216-1	1" ratio regulator

This proposal is for parts only. Installation is not included.

Start-up assistance will be billed per the attached M-9 sheet.

Equipment Pricing: [redacted] FOB Plant Site Cleveland, OH

Equipment Delivery: 12-14 weeks after receipt of actionable purchase order.

Respectfully Submitted by:

Dave Strakele

Combustion & Controls Specialist
North American Mfg. Co. Ltd
6912 77th Ave. N.E.
Marysville WA 98270
Phone 360-659-7432
Fax 360-659-8083
davestrakele@namfg.com

Attachments: North American Mfg. Co. Terms and Conditions of Sale
M-9 Service Rates
Preliminary P&ID

In the interest of safety, North American joins NFPA and insurance underwriters in urging the use of electronic flame supervision on most fuel burning applications. The decision whether or not to incorporate flame supervision rests with the owner and his insurance underwriter. If desired, North American can provide information concerning safety standards as they apply to your application.
Prices firm for 30 days for orders placed for delivery anytime within 4 months from date of order based on quoted delivery time. For quoted delivery time see the front page of this proposal. If design, manufacturing or shipment is delayed more than 4 months at customer request, prices will be those in effect at time of shipment.

Thermal Desorber System

Drive Motor Specifications

EQUIPMENT SPECIFICATIONS	
EQUIPMENT DESCRIPTION	**SPECIFICATION**
Rotor	24 3/4" OD
Steel Tire	36" OD
Trunion Bearings (2 ea.)	7 3/8" OD
Trunion Bearing Shaft	1 7/8" OD
Primary Drive	
Varible Frequency Drive (VFD)	Working Range 35 - 100 % RPM
Motor M-220A	GE 5K35MNB114, 1/2 HP, 1725 RPM
Gear Reducer	35 : 1 {estimated}
Drive Sprocket	No. 50 - 17T, PD = 3.401"
Driven Sprocket	No. 50 - 43T, PD = 6.774
Secondary Drive	
Motor M-220A	Baldor VM3546, 1HP, 1800 RPM
Gear Reducer	60 : 1
Drive Sprocket	No. 50 - 14T, PD = 2.809
Driven Sprocket	No. 50 - 48T, PD = 9.556

Thermal Desorber System

Scrubber Skid Specifications and Description

PROPOSAL
AIR-POLLUTION CONTROL SYSTEM FOR THERMAL DESORBER
AS PART OF
PEcoS MLLW UPGRADE PROJECT

Merlin Project TCC-PEC
Rev. 0, November 18, 2004

1.0 BACKGROUND

Pacific EcoSolutions, Inc. (PEcoS) is licensed by the State of Washington to operate equipment and systems for the receipt and treatment of solid and liquid mixed low-level wastes for volume reduction and stabilization. Nuvotec USA and Thermal Conversion Corporation are working with PEcoS to supply equipment and methods that will upgrade the existing treatment and stabilization system. New equipment is being provided to upgrade portions of the existing waste treatment system that have proven to be troublesome or inoperative. Merlin Engineering, Inc. (Merlin) has been asked to prepare a proposal for detailed engineering and supply of an air-pollution control system for handling a vapor stream exiting a solids waste feed thermal desorber.

Merlin is please to submit this proposal for the design of an air pollution control system to be used as part of the solids waste treatment system for the PEcoS MLLW Upgrade Project.

Merlin proposes to design and supply the air-pollutions control system as a single integrated package. The proposed equipment is illustrated in the attached Merlin arrangement drawing TCC-PEC-P3-D100 and in the attached Nuvotec Piping & Instrument Diagram 32004-PID-201. The proposal includes the supply of every item illustrated on the piping & instrument diagram. The principal components include an inlet vapor stream adiabatic quencher, condensate holding tank, direct-contact vapor condenser, condensate heat exchanger, hydrocyclone suspended solids separator, dual condensate pumps, dual condensate filters, inert vapor superheater, dual filters, dual induced-draft blowers, and dual carbon adsorption canisters.

3.0 DESIGN CONDITIONS

The proposed Merlin system will process a calculated maximum 103.5 lb/hr flow of process vapor and entrained solids at 14.28 psia and 1200°F originating from the upstream thermal desorber (Maximum Design Flowrates spreadsheet, TK Thompson, 7/28/04).

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These design conditions are:

Stream Number:	204	(stream exiting thermal desorber)
Temperature: (°F)	1200	
Pressure (psia):	14.28	
Entrained Solids (lb/hr):	12.8	
Vapors (lb/hr):	90.7	
Vapor Composition (vol%):		
H2O:	52.03	
N2:	44.79	
O2:	1.90	
Light HC:	0.87	(expressed as hexane, CAS 110-54-3)
Heavy HC:	0.42	(expressed as 1,3,dichlorobenzene, CAS 541-73-1)

4.0 HARDWARE DESCRIPTION

The proposed Merlin system consists of the following components.

Vapor Stream Adiabatic Quencher

Merlin proposes to design and supply a vapor stream quencher as illustrated in Merlin drawing TCC-PEC-P3-D100. The quencher is a jet-ejector type with the entrance portion of the ejector shape cast into a shock-resistant castable refractory matrix that is contained within a surrounding 304 stainless steel shell. The exit portion of the ejector shape is formed by 304 SS plate, which is cooled by the spray of the jet ejector. Contact of the hot vapor stream with the jet-ejector spray rapidly cools the vapor stream from the design temperature of 1200°F to its adiabatic saturation temperature (~182°F) by latent and sensible heat exchange. The cooled vapor stream and the excess liquid spray discharge downward into the condensate holding tank.

Condensate Holding Tank

The condensable fraction of the cooled vapor stream is collected in the condensate holding tank. The liquid in this vessel consists of a mixture of condensed water and organics. This liquid is recirculated as required to supply the liquid needs of the adiabatic quencher and the direct-contact vapor stream condenser. The holding tank provides the necessary net positive suction head required by the recirculation pumps. The level of the liquid in the tank is maintained by either the addition of supplemental water or the discharge of excess condensate to a separate downstream condensate bulk storage tank. The tank is constructed of 304 stainless steel and is supplied complete with a 304 stainless steel thermowell with Type J thermocouple, 304 stainless steel liquid level indicator transmitter with all metallic magnetic flag visual level

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indication, an internal jet-ejector type liquid mixer, and ports for condensate discharge and return.

Direct-Contact Vapor Condenser

The cooled vapor stream from the adiabatic quencher is routed through the vapor space of the condensate-holding tank into the bottom entrance of a packed-tower type direct-contact condenser. The condensable fractions of the vapor stream (water vapor and condensable organics) are cooled below their saturation temperatures by direct-contact with a countercurrent flow of cold recirculated condensate. Heat exchange is enhanced by using random tower packing to provide an extended surface for the cooling medium and to induce a turbulent vapor flow to expose all portions of the vapor to the cooling medium. This arrangement provides localized zones of subcooling that enhance the capture of small particulates by surface condensation and subsequent enlargement. The resulting larger particles are then more readily intercepted and washed from the vapor phase by the counter-current flow of cold condensate. The shell of the vapor stream condenser, the internal random packing, the packing support plate, and the coolant spray nozzles are constructed of 304 stainless steel.

As the non-condensable portion of the vapor stream exits the top of the packing, it carries with it a small amount of entrained liquid (a mist). The top of the tower is configured to contain a specialized mist-eliminator, which coalesces the mist droplets. The coalesced liquid drains by gravity back onto the top of the packing below. The tower is supplied with a dedicated rinsing spray for periodic cleaning of the mist-eliminator with fresh water. The filament mesh of the mist eliminator is fabricated of high-temperature polypropylene and kynar fibers.

Condensate Recirculation Pumps

The liquid streams required for the operation of the adiabatic quencher and the direct-contact vapor condenser are provided by recirculation of captured condensate. The proposed system includes duel condensate recirculation pumps for this purpose. These are high head sealless pumps with wetted parts of 304 stainless steel construction selected for long service life. Each pump is sized for 100% required capacity with one pump operating in service with the other pump in standby status. Failure of one pump results, through control logic, in the automatic switchover from the failed pump to the standby pump. Either pump can serve as the primary pump.

Suspended Solids Separator

A small high-efficiency hydrocyclone serves to separate entrained solids from the recirculating condensate stream. The use of a separator is superior to filtering of the entire recirculation stream because the separator will never block or throttle critical flow of liquid to the quencher spray nozzle. It is conceivable that a blocked full-flow filter could cause an unnecessary high-temperature shutdown.

The overflow fraction from the separator is routed to the system spray nozzles. The underflow fraction, containing the captured suspended solids, is routed to liquid filters for capture of the solids. The wetted portions of the hydrocyclone are constructed of

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urethane, which is pliant enough to resist erosion of the hydrocyclone by the scouring action of the entrained particulates.

Condensate Heat Exchanger

The portion of the recycled condensate that leaves as overflow from the separator is cooled by low-temperature glycol coolant in a 304 stainless steel countercurrent shell-and-tube heat exchanger. The cooled condensate is then used primarily as the cooling medium in the direct-contact condenser but is also used to extract heat from the condensate in the holding tank and to enhance sensible cooling in the adiabatic quencher.

Condensate Filters

The underflow from the hydrocyclone contains most of the entrained solids and this stream is routed through inline filters for separation of the solids. For the hydrocyclone to operate properly, a portion of the total flow to the hydrocyclone must be continuously discharged as underflow. This requirement is assured by returning the filtrate to the condensate-holding tank. Blowdown from the system to the bulk storage tank is split from the filtrate return line to ensure that the blowdown is free of solids. The filters use disposable bags supported by screen baskets in 304 stainless steel housings. The system is plumbed with two filters in parallel to allow taking a full filter off line for filter change.

Inert Vapor Superheater

A low-wattage electric resistance insertion-type heater is installed in the vapor stream leaving the top of the direct-contact condenser. This heater induces a 30°F superheat on the saturated vapor stream before entering the filters. The dried inert vapor stream prevents unintended blinding of the filter media with moisture.

Inert Vapor Filters

Duplicate bag filters are supplied to capture any trace amount of entrained particulate that may remain entrained in the inert vapor stream. These filters are plumbed in parallel so that should one become loaded, the vapor stream can be switched to the standby housing to permit placing a fresh filter in the original housing.

Induced-Draft Blowers

Duplicate induced draft blowers are used to provide the motive force for moving the vapor stream through the system. These blowers also provide the draft for evacuating the vapor stream from the upstream thermal desorber system. These are special construction blowers originally designed for use in gasoline vapor recovery systems. They have explosion-proof construction and each is fitted with an explosion-proof motor. Each blower is sized for 100% required capacity with one blower operating in service with the other blower in standby status. Failure of one blower results in an automatic switchover to the standby blower. Either blower can serve as the primary blower.

Carbon Adsorption Canisters

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Merlin is supplying duplicate activated carbon canisters for capture of trace amounts of organic vapors that may remain in the inert vapor stream leaving the upstream direct-contact vapor condenser. The carbon is contained in canisters that are modified 55-gallon drums. Each has a false bottom that is configured to accept the incoming vapor stream and to distribute the flow evenly across the bottom of the carbon. The cleaned vapor stream is discharged from a canister through a port in the top lid. The canisters are plumbed in series so the second canister will capture the eventual organic breakthrough of the upstream canister. Once breakthrough is detected, the spent canister is removed and a fresh canister is place downstream of the remaining canister. The sent canister is disposed in accordance with existing PEcoS policy and methods.

Support-Equipment Skid

Most equipment that supports the operation of the adiabatic quencher and direct-contact condenser are supplied pre-piped and pre-wired on a single skid. The skid will incorporate the condensate recirculation pumps, suspended solids separator, condensate heat exchanger, inert vapor superheater, inert vapor filters, induced draft blowers, and carbon adsorption canisters. The condensate filters will be located off the skid in a dedicated filter-change area. To accommodate this arrangement, the hydrocyclone underflow will be piped to the dedicated filter-change area and the resulting filtrate will be piped back to the skid.

System Control

The proposed system is very simple to control and few controls are required for proper monitoring and system operation. Accordingly, a dedicated stand-alone control panel is not warranted. Merlin will supply the logic for control of this system for remote implementation.

5.0 QUALITY ASSURANCE

The engineering design and equipment fabrication will be conducted in accordance with Nuvotec Quality Assurance Plan for PEcoS MLLW Thermal Treatment Project, PMT-04-PM-001, Rev 0, dated 6/17/04.

6.0 FACTORY TESTING

Custom fabricated components (adiabatic quencher, condensate holding tank, and direct-contact condenser) will be factory leak tested, after fabrication and before installation of any refractory and other internal components, in accordance with the revisions current at the time of this proposal of ERDA 76-21 "Nuclear Air-Cleaning Handbook," and ASME N510 "Testing of Nuclear Air Treatment Systems."

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UNIT EQUIPMENT LIST

TAG	FUNCTION	MFG	Type	MATERIAL	MAIN CONNECTIONS	COMMENTS
B-210	Vapor Blower	Rotron	Regenerative, Spark Proof Construction	Cast Aluminum Housing & Impeller	Special Flanges	Explosion proof motor
B-215	Vapor Blower	Rotron	Regenerative, Spark Proof Construction	Cast Aluminum Housing & Impeller	Special Flanges	Explosion proof motor
C-205	Vapor Quencher	Merlin	Jet Ejector Contactor	Refractory Lined 304 SS Shell	8" 150# RF Flange 8" 150# RF Flange	Other connections. See Merlin drawings
C-210	Vapor Condenser	Merlin	Direct Contact	304 SS	6" 150# RF Flange 2" 150# RF Flange	Other connections. See Merlin drawings
C-215	Carbon Adsorber	Entire Environmental	One-Use Drum	VOC Carbon CS Drum	2" NPT	Disposable drum
E-200	Condensate Heat Exchanger	ITT Standard	Shell and Tube	304 SS Shell 304 SS Tubes	1-1/2" NPT	2-pass
F-200	Vapor Filter	Ronningen-Petter	Pleated Filter	304 SS Housing	2" NPT	Disposable cartridges
F-205	Vapor Filter	Ronningen-Petter	Pleated Filter	304 SS Housing	2" NPT	Disposable cartridges
F-210	Condensate Filter	Rosedale Products	Bag Filter	304 SS Housing	3/4" NPT	Disposable bags
F-220	Condensate Filter	Rosedale Products	Bag Filter	304 SS Housing	3/4" NPT	Disposable bags
H-210	Vapor Superheater	Chromolox	Circulation	304 SS Housing Incoloy Sheath	2" NPT	
J-200	Condensate Sump Mixing Nozzle	Bete	High Volume Eductor	316 SS	3/4" MPT	
P-200	Scrubber Liquid Recirculation Pump	Kontro	Sealless	316 SS	1-1/2" 150# RF Flange 1" 150# RF Flange	Inverter duty motor
P-205	Scrubber Liquid Recirculation Pump	Kontro	Sealless	316 SS	1-1/2" 150# RF Flange 1" 150# RF Flange	Inverter duty motor
S-200	Hydrocyclone	Krebs	Small Diameter	Urethane	1" NPT	2" body
T-220	Condensate Sump Tank	Merlin	Controlled-Level Sump	304 SS	8" 150# RF Flange 6" 150# RF Flange	Other connections. See Merlin drawings

VALVE LIST							
TAG		LINE NUMBER	LINE LOCATION	TYPE	MFG	MATERIAL	CONN.
N/A		All Lines	Instrument Isolation Valves	Ball	Apollo	316 Stainless Steel Body	1/4" NPT
N/A		All Lines	Instrument Isolation Valves	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
CV-240		222	Pump Discharge	Ball Check	Apollo	316 Stainless Steel Body	1-1/2" NPT
CV-241		222	Pump Discharge	Ball Check	Apollo	316 Stainless Steel Body	1-1/2" NPT
CV-242		226	Vapor Quencher Supply	Ball Check	Apollo	316 Stainless Steel Body	1" NPT
CV-250		213	Vapor Blower Block	Ball Check	Apollo	316 Stainless Steel Body	2" NPT
CV-251		213	Vapor Blower Block	Ball Check	Apollo	316 Stainless Steel Body	2" NPT
CV-675		621	Plant Water Supply	Ball Check	Apollo	316 Stainless Steel Body	1/2" NPT
CV-676		621	Plant Water Supply	Ball Check	Apollo	316 Stainless Steel Body	1" NPT
HV-205		---	Tank T-220 Drain	Ball	Apollo	316 Stainless Steel Body	1" NPT
HV-206		222	Pump Suction	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-207		222	Pump Discharge	Ball	Apollo	316 Stainless Steel Body	1-1/2" NPT
HV-208		227	Condensate Filter Block	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-209		227	Condensate Filter Block	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-210		227	Condensate Filter Block	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-211		227	Condensate Filter Block	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-212		227	Condensate Filter Bypass	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-213		223	Condensate Filtrate Return	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-214		224	Jet Mixer Supply	Ball	Apollo	316 Stainless Steel Body	3/4" NPT
HV-215		225	Packed Tower Supply	Ball	Apollo	316 Stainless Steel Body	1" NPT
HV-216		226	Vapor Quencher Supply	Ball	Apollo	316 Stainless Steel Body	1" NPT
HV-217		208	Vapor Filter Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-218		212	Vapor Filter Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-219		208	Vapor Filter Bypass	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-221		210	Carbon Adsorber Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-222		234	Carbon Adsorber Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-223		210	Carbon Adsorber Bypass	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-230		222	Pump Suction	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-231		222	Pump Discharge	Ball	Apollo	316 Stainless Steel Body	1-1/2" NPT

HV-235		214	Condensate Filtrate Blowdown	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-236		214	Condensate Filtrate Blowdown	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-237		214	Condensate Filtrate Blowdown	Ball	Apollo	316 Stainless Steel Body	1/2" NPT
HV-280		208	Vapor Filter Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-281		212	Vapor Filter Block	Ball	Apollo	316 Stainless Steel Body	2" NPT
HV-680		801	Glycol Coolant Supply	Ball	Apollo	316 Stainless Steel Body	3/4" NPT
HV-681		801	Glycol Coolant Supply	Ball	Apollo	316 Stainless Steel Body	3/4" NPT
HV-682		801	Glycol Coolant Supply	Ball	Apollo	316 Stainless Steel Body	3/4" NPT

INSTRUMENT LIST

TAG			LINE NUMBER	FUNCTION	MFG	DESCRIPTION	MATERIAL	CONN.
FI-	210		224	Flow Indicator	Meter Equipment Manufacturing	Rotometer	316 SS	3/4" NPT
FI-	240		223	Flow Indicator	Meter Equipment Manufacturing	Rotometer	316 SS	3/4" NPT
FISL-	220		225	Flow Indicator Switch Low	Meter Equipment Manufacturing	Rotometer with integral flow switch	316 SS	1-1/2" NPT
FISL-	230		225	Flow Indicator Switch Low	Meter Equipment Manufacturing	Rotometer with integral flow switch	316 SS	1-1/2" NPT
FISL-	610		801	Flow Indicator Switch Low	Meter Equipment Manufacturing	Rotometer with integral flow switch	316 SS	3/4" NPT
FSV-	220		801	Solenoid Operated Valve	ASCO	110 VAC	SS	3/4" NPT
FSV-	670		621	Solenoid Operated Valve	ASCO	110 VAC	SS	1" NPT
LT-	210		T-220	Level Transmitter	Gems	4-20 MADC output	304 SS	1" RF Flg.
LV-	215		214	Solenoid Operated Valve	ASCO	110 VAC	SS	1/2" NPT
LV-	670		621	Solenoid Operated Valve	ASCO	110 VAC	SS	1/2" NPT
PDCV-	210		212	Pressure Control Valve	TBD	Butterfly valve, pneumatic operator, fail open	304 SS	1-1/2" NPT
PDI-	220		222	Differential Pressure Indic.	Orange Research	----	304 SS	1/4" NPT
PDISH-	250		208	Differential Pressure Switch	Dwyer	Switched output	Photolhelic	1/8" NPT
PDIT-	220		205	Differential Pressure Trans.	Dwyer	4-20 MADC output	Capsulhelic	1/8" NPT
PDIT-	240		212	Differential Pressure Trans.	Dwyer	4-20 MADC output	Capsulhelic	1/8" NPT
PDT-	230		227	Differential Pressure Trans.	Orange Research	4-20 MADC output	304 SS	1/4" NPT
PISL-	220		222	Differential Pressure Switch	Orange Research	Switched output	304 SS	1/4" NPT
TE-	210	A	207	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----
TE-	210	B	207	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TE-	230	A	207	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----
TE-	230	B	207	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TE-	230	A	T-220	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----
TE-	230	B	T-220	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TE-	240	A	208	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----
TE-	240	B	208	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TE-	250	A	225	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----
TE-	250	B	225	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TE-	610	A	801	Temperature Element	Idaho Laboratories	Type J, grounded, double element, spring loaded	----	----

TAG			LINE NUMBER	FUNCTION	MFG	DESCRIPTION	MATERIAL	CONN.
TE-	610	B	801	Thermowell	Texas Thermowell	Tube type, closed end	304 SS	1/2" NPT
TISH-	210		207	High-Temperature Switch	Yokogawa	Type J input, switched output	----	----
TISH-	230		T-220	High-Temperature Switch	Yokogawa	Type J input, switched output	----	----
TT-	230		207	Temperature Transmitter	TBD	Type J input, 4-20 MADC output	----	----
TT-	240		208	Temperature Transmitter	TBD	Type J input, 4-20 MADC output	----	----
TT-	250		225	Temperature Transmitter	TBD	Type J input, 4-20 MADC output	----	----
TT-	610		801	Temperature Transmitter	TBD	Type J input, 4-20 MADC output	----	----

3. SYSTEM COMPONET DESCRIPTION AND CONTROL

3.1. Summary

The following sections describe how the Thermal Desorber air pollution control system is monitored and controlled. Most of the system monitoring, alarm, and control is handled by the DCS. Some specialized control is retained at the local level as described below.

3.2. Vapor Quencher (Equipment C-205)

The Vapor Quencher reduces the temperature of the hot vapor stream from the Thermal desorber by evaporation of a portion of a spray of condensate.

Controlled functions include automatic activation of emergency water nozzles when needed and automatic interruption of thermal desorber feed when needed.

Functions monitored in the control room include Thermal Desorber hot process vapor temperature, Vapor Quencher outlet temperature, and flowrate of recirculated condensate to the Vapor Quencher spray nozzle.

Alarmed functions include high & high-high Thermal Desorber hot process vapor outlet temperature, high & high-high Vapor Quencher process vapor outlet temperature, and low scrubber solution flow to the Vapor Quencher spray nozzle.

The Quencher consists of a refractory lined stainless steel shell in the shape of a mitered elbow and with a jet-ejector profile cast into the interior of the refractory lining. The internal refractory lining is provided to limit the surface temperature of the stainless steel shell. The selected refractory is formulated to provide exceptional resistance to thermal shock.

A single, narrow-angle high-capacity liquid spray nozzle is oriented to work in conjunction with the cast-in jet-ejector configuration to provide intimate contact of a spray of recirculated condensate with the incoming hot process vapor from the thermal desorber. By evaporation of a portion of the condensate spray, the thermal desorber hot process vapor is cooled by latent heat exchange to a final maximum saturation temperature of about 180°F.

To minimize the amount of sensible cooling of the hot process vapor by the excess (non-evaporated fraction) condensate spray, the portion of the recirculated condensate that is routed through the Vapor Quencher spray nozzle is plumbed so as to bypass Condensate Heat Exchanger E-200. The configuration of the jet ejector will provide a boost in process vapor system pressure under some circumstances (particularly at low process vapor flowrates) but is optimized for liquid-gas contact and not for system pressure gain.

An added benefit of selecting a jet-ejector configuration for the Vapor Quencher is the ability of the jet ejector to intercept and capture solid particulates that are entrained in the Thermal Desorber hot process vapor. This reduces substantially the amount of entrained particulate that must be separated and flushed from packing fill of Packed-Tower Vapor Condenser C-210.

The spray nozzle for the Vapor Quencher is provided with an independent emergency water supply for delivery of emergency water to the Vapor Quencher on a need basis. The minimum particulate passage capability of the spray nozzle is large and precludes the need for a separate dedicated emergency spray nozzle to address a possible blinding of the jet ejector nozzle.

Thermocouple TE-205 located within the Thermal Desorber hot process vapor duct transmits a signal to the DCS for monitoring and alarming of the Thermal Desorber process vapor outlet temperature. The Thermal Desorber hot process vapor design outlet temperature is 1200°F. The Vapor Quencher is designed to operate continuously with an inlet temperature up to 1615°F and is constructed to withstand a maximum inlet temperature surge of 2030°F for up to 10 minutes. Accordingly, the DCS is programmed with a high temperature limit of 1615°F, above which a DCS timer will interrupt feed to the Thermal Desorber after a 10-minute period. Feed interruption is cancelled anytime the hot process vapor temperature falls below 1615°F.

The Vapor Quencher is not constructed to accept hot process vapor with a temperature above 2030°F. Accordingly, the DCS is programmed with a high-high limit of 2030°F. The Vapor Quencher and downstream equipment are protected from high-temperature damage by an independent source of emergency water for the vapor quencher spray nozzle. When the high-high temperature limit is tripped, a flow of emergency water through the Vapor Quencher spay nozzle is started by de-energizing normally open solenoid-operated valve FSV-670. The flow of emergency water is stopped when the process vapor inlet temperature falls below 2500°F.

Thermocouple TE-230 located within Condensate Recirculation Tank T-220 near the Vapor Quencher process vapor outlet transmits a signal to the DCS for monitoring and alarming of the Vapor Quencher outlet temperature.

When operating the Vapor Quencher, block valve HV-216 is opened fully to allow maximum flow of recirculated condensate through the spray nozzle. The spray nozzle is selected to pass approximately 17.0 GPM at full pump discharge pressure.

3.3. Condensate Recirculation Tank (Equipment No. T-220)

The bottom section of the scrubber system serves as a system sump for separation of the excess liquid from the Vapor Quencher and Packed-Tower Vapor Condenser and for the accumulation of condensate.

Controlled functions include condensate level control.

Functions monitored in the control room include sump condensate level.

Alarmed functions include sump solution level high & low.

The Condensate Recirculation Tank is shaped to act as a separator for removal of the excess quencher liquid from the vapor stream before the vapor stream enters the bottom of the Packed-Tower Vapor Condenser. The Tank is sized with enough liquid height to ensure adequate NPSA for the two condensate recirculation pumps.

Condensate level is monitored by an external level indicator/transmitter, LIT-210, that sends a 4-20 MADC signal to the DCS. The DCS is programmed to maintain sump level by either adding fresh water (via LV-670) or by discharging excess scrubber solution through condensate blowdown valve LV-215. The sump level low setpoint is 24" and the sump level high setpoint is 30". The DCS is programmed with adequate sump level (> LSL setpoint) as a permissive to start the system.

Prior to system startup, fresh water is added to the sump to fill the sump to its normally controlled level and to provide adequate suction head for the recirculation pumps.

3.4. Packed-Tower Vapor Condenser (Equipment No. C-210)

The Packed-Tower Vapor Condenser cools the process vapor below its saturation temperature to cause the condensation of water vapor and some volatile organics. The Packed-Tower Condenser also serves to intercept and separate entrained particles from the process vapor stream.

Controlled functions include periodic rinsing of the mist eliminator pad.

Functions monitored in the control room include condenser outlet temperature, packing irrigation flowrate, and pressure drop across the condenser.

Alarmed functions include low packing irrigation flowrate and high and high-high pressure drop across the condenser.

The quenched process vapor is routed through the Condensate Recirculation Tank and enters the bottom of the Vapor Condenser. The Condenser brings the process vapor into contact with cool recirculated condensate, which removes heat from the process vapor. Since the process vapor leaves the upstream Vapor Quencher fully saturated with water vapor, removal of heat causes most of this moisture to condense and join the condensate that is percolating down through the packing. By the

time the process vapor reaches the top of the packing, the temperature of the vapor is reduced to about 40°F and most of the water vapor and some of the volatile organics have been collected by the recirculating condensate stream.

By a process called diffusiophoresis, residual particulates that are entrained in the offgas serve as nucleation sites for condensation. The condensate layer continues to grow on each particle as the process vapor cools, which increases the mass of each particle, making it susceptible for capture by interception in the tower packing.

The packing is irrigated by recirculated scrubber solution that is distributed over the top of the packing by a low-pressure coarse-droplet spray nozzle. The flowrate of scrubber solution through the packing is set by manual flow control valve H-215 and local flow indicator/transmitter FIT-220. The design packing irrigation flowrate is 9.8 GPM.

A mist eliminator located above the tower packing removes residual water droplets from the process vapor exiting the condenser.

Residual droplets that become entrained in the process vapors leaving the top of the packing are captured by interception by a polypropylene-filament, mesh-type mist eliminator. A spray nozzle is provided for periodic rinsing of the mist eliminator. The DCS is programmed to energize solenoid-operated valve KY-670 to rinse the mist eliminator for a 10-second period every 15 minutes.

The pressure drop across the vapor condenser system is monitored as an indication of possible fouling of the system. The high sets point for the pressure differential are high at 12" WC and high-high at 16" WC.

3.5. Condensate Recirculation Pumps, two in parallel (Equipment Nos. P-200 and P-205)

Condensate is recirculation is by two identical sealless centrifugal pumps.

Controlled functions include start/stop logic for the separate pumps.

Functions monitored in the control room include pump discharge pressure and horsepower status of each pump.

Alarmed functions include low and low-low pump discharge pressure.

The pumps are plumbed in parallel to provide redundancy. Each pump is sized for 100% capacity. Check valves are supplied downstream of each pump to prevent flow back of condensate through the standby pump.

The pump discharge pressure is monitored by PIS-220. A low-pressure alarm is used to provide an advance indication that a pump may be loosing its effectiveness. The DCS is configured to switch from one pump to the other when the pump discharge pressure drops below the low-low setpoint. The low-pressure setpoint for PIS-220 is 30 PSIG. The low-low setpoint is 10 PSIG.

Power for the pump motors originates from two motor starters located in the local terminal panel. The DCS controls which pump is in service (one or the other) by energizing its associated motor starters. Either pump can be selected at the time of startup to be the pump in service.

Sealless pumps cannot run dry for any length of time (a couple of minutes at most) before the bearings, which are lubricated by the flowing fluid, are badly damaged. A wattmeter indicator/transmitter (4-20 MADC output) is included in the local terminal panel to monitor the motor power consumption of whichever pump is running. The power consumption is a direct indicator of the amount of fluid passing through the pump. If the power drops too low, a dry pump is indicated and the DCS is configured to switch pumps. If switching the pumps does not increase the power consumption above the minimum threshold, the DCS is configured to shut both pumps down to prevent significant damage to the pumps. The power threshold is determined and set during commissioning. When the power level drops below the low set point for a given pump, the power signal contacts are latched open. They can be reset by remote contact closure in the DCS.

3.8. Condensate Heat Exchanger (Equipment No. E-200)

A glycol-cooled Condensate Heat Exchanger is used to cool the fraction of recirculated condensate that is routed through the Hydrocyclone and which leaves the Hydrocyclone as overflow.

Controlled functions include on/off control of the flow of glycol through the Condensate Heat Exchanger.

Functions monitored in the control room include temperature of glycol at Heat Exchanger inlet.

Alarmed functions include glycol inlet temperature high.

The Heat Exchanger is shell-and-tube construction. A locally mounted pressure differential pressure instrument is used to check the pressure drop across the condensate side of the Heat Exchanger. The Heat Exchanger can be disassembled for cleaning if necessary.

The DCS setpoint for the glycol inlet temperature high is 32°F.

3.9. Condensate Jet Mixer (Equipment No. J-200)

An ejector-type static mixer (Jet Mixer) is submerged in the liquid within the Condensate Recirculation Tank.

Controlled functions: none.

Functions monitored in the control room: none..

Alarmed functions: none.

The mixer serves to continuously and vigorously stir the contents of the tank to prevent settling of particulate. The Jet Mixer also serves to prevent pump surging and overheating at low condensate recirculation flowrates.

3.10. Process Vapor Reheater (Equipment No. H-210)

Process vapors leaving the top of the Packed Tower Vapor Condenser are heated by the Vapor Reheater

Controlled functions: none.

Functions monitored in the control room include temperature of process vapor at outlet of Process Vapor Reheater.

Alarmed functions: none.

The process vapors that leave the top of the Packed-Tower Vapor Condenser are saturated at a nominal 40°F. The Vapor Reheater elevates the temperature of the saturated process vapor 30°F or so to induce enough superheat to allow the process vapor to pass through downstream equipment in a dry state.

The heat for the Vapor Reheater originates from self-regulating heating tape that is coiled around the outside of the duct leading from the top of the Packed-Tower Vapor Condenser. The duct is externally insulated to increase the efficiency of the Reheater. The length of tape is selected to provide the required wattage for the needed superheat. The tape is selected to limit the maximum process vapor temperature to 150°F at no-flow conditions.

3.11. Process Vapor Filters, two in parallel (Equipment Nos. F-200 and F-205)

Two cartridge-type filters are located downstream of the Vapor Reheater for capture of residual particulate that may remain in the process vapor stream.

Controlled functions: none.

Functions monitored in the control room include filter pressure drop.

Alarmed functions include high and high-high filter pressure drop.

The two Vapor Filters are plumbed in parallel to provide redundancy (each is sized to handle the entire process vapor flow).

The DCS is programmed to monitor pressure transmitter PDIT-250 and alarm high and high-high pressure drop across the filters. The initial high setpoint is 20" WC. This lower alarm notifies operators that a filter changeout is imminent. The initial high-high pressure drop setpoint is 30" WC. This alarm notifies operators that the active filter housing should be switched out of service for a change of filters.

Manually operated process vapor isolation valves are mounted at the inlet and outlet of each Vapor Filter (4 total). The isolation valves for a given filter are to be opened and closed together.

A continuous process vapor path must be maintained. Therefore, one set of filter isolation valves must be open at all times. To ensure a continuous path when switching filters in or out of service, the isolation valves for the filter being brought into service must be fully opened before closing the isolation valves for the filter being taken out of service. A bypass line with a normally closed manual valve is available to bypass both filters if needed.

3.12. Induced Draft Blowers, two in parallel (Equipment Nos. B-210 and B-215)

Following the two Vapor Filters are two identical Induced Draft Blowers that supply the motive force

to move the process vapors through the entire air pollution control system.

Controlled functions include start/stop logic for the separate blowers and control of blower speed.

Functions monitored in the control room include blower pressure boost and supply power status of each blower.

Alarmed functions include low and low-low blower pressure boost.

The blowers are plumbed in parallel to provide redundancy (each is sized to handle the entire process vapor flow). Check valves are supplied downstream of each blower to prevent flow back through an idle blower.

A single variable-frequency drive (VFD) is located in the local terminal panel to control the speed of the blower in service. To control system internal negative pressure, the speed of the blower in service is modulated in response to a 4-20 MADC signal from the DCS.

Power for the Vapor Blower motors originates from motor starters located in the local terminal panel. Since both Vapor Blowers cannot receive power at the same time, one VFD can serve both fans. The logic for switching power from the fan in service to the fan in standby originates from DCS. However, to do this, the VFD manufacturer recommends that we first shut off the VFD output, make the switchover to the standby Vapor Blower, and then reactivate the VFD output.

The DCS is configured to alarm low and low-low Vapor Blower boost. The initial low boost setpoint is 30" WG. The initial low-low boost setpoint is 10" WG. Since these blowers are fitted with VFDs, the pressure boost can be low in the normal course of operations. Therefore, the low and low-low pressure boost alarms can be active only with maximum motor speed signal output from the DCS.

3.13. Carbon Adsorbers, two in parallel (Equipment Nos. C-215 and C-216)

Two Carbon Adsorption canisters are located downstream of the Induced Draft Blowers for separation and capture of residual organic vapors from the process vapor stream.

Controlled functions: none.

Functions monitored in the control room: none.

Alarmed functions: none.

The canisters are plumbed in parallel to provide redundancy. Each canister is sized to handle 100% of the design process vapor flow.

Manually operated process vapor isolation valves are mounted at the inlet and outlet of each canister (2 three-way valves and 2 two-way valves total). The isolation valves for a given canister are to be opened and closed in a manner that will cause the process vapors to be routed through the bottom and out the top of the canister in service.

A continuous process vapor path must be maintained. Therefore, one set of canister isolation valves must be open at all times. To ensure a continuous path when switching canisters in or out of service, the system is provided with a process vapor bypass line with normally closed manual isolation valve. The bypass line must be opened before switching canisters in and out of service. The bypass line must be closed after the canister valves have been repositioned to route the process vapors through the canister in the proper direction.

Thermal Desorber System

Equipment List

Rotary Thermal Desorber Major Equipment List

P&ID Sht. & #	Name	Mfg.	Type	Material
Sheet 1				
T-205	Feed Airlock	Shredder Systems	Collection Bin	Steel
W-201	Feed Hopper	Shredder Systems	Collection Bin	Steel
FV-215	Hopper Feed Valve	Shredder Systems	Gate Valve	Steel
FV-225	Hopper Vent Valve	Shredder Systems	Gate Valve	Steel
Sheet 2				
H-200	Rotary Thermal Desorber	Rotary Kiln & Drier	(Research Model)	Stainless Steel
M-220A	Kiln Drive	General Electric	½ hp, elec.	Steel Housing
M-220B	Kiln Drive	Baldor	1 hp, elec.	Steel Housing
Sheet 3				
T-215	Discharge Airlock	PEcoS	Collection Bin	Steel
Sheet 4				
C-205	Vapor Quench	Merlin	Open Tower (Vertical)	Refractory Lined 304 SS Shell
T-220	Condensate Recirculation Tank	Merlin	Tank	304 SS
C-210	Vapor Condenser	Merlin	Packed Tower (Vertical)	304 SS
E-200	Condensate Heat Exchanger	ITT Standard	Shell & Tube	304 SS
P-200	Condensate Pump	Magnatex	Magnetic Drive	316 SS
P-205	Condensate Pump	Magnatex	Magnetic Drive	316 SS

Sheet 5				
H-210	Vapor Re-Heater	Chromolox	Elec. Resistance	304 SS Housing Inconel Sheath
F-200	Vapor Filter	Micron Technologies	Pleated Filter	304 SS
F-205	Vapor Filter	Micron Technologies	Pleated Filter	304 SS
B-210	Vapor Blower	Rotron	Explosion Proof Rotary	Aluminum
B-215	Vapor Blower	Rotron	Explosion Proof Rotary	Aluminum
Sheet 6				
C-215	Carbon Adsorber	Entire Environ.	55 gallon drum	Carbon Steel
C-216	Carbon Adsorber	Entire Environ.	55 gallon drum	Carbon Steel
Sheet 7				
F-210	Condensate Filter	Micron Technologies	Bag Filter	304 SS
F-220	Condensate Filter	Micron Technologies	Bag Filter	304 SS
T-310	Organic Liquid Collection Tank	PEcoS	Tank	Stainless
T-315	Temp. Organic Liquid Tank	PEcoS	Tank	HDPE
P-310	Transfer Pump	Yokogama	Positive Displacement	HDPE
Sheet 8				
Sheet 9				
BC-200	Flame Safeguard	Honeywell	Controller	Plastic Housing
B-600	Air Supply Blower	North American	Rotary	Steel Housing
Sheet 10				

Thermal Desorber System

Valve and Instrument List

ROTARY THERMAL DESORBER - MASTER EQUIPMENT LIST

RTD Valve List

Valve Number	Description	Line No.	Specified	Line Size (in.)	Manufacturer	Model Number	Comment / Specification
CV-240	Check Valve - Condensate Pump (P-200) Discharge	222	Merlin	1-1/2" NPT	Apollo		Ball Check, 316 SS Body
CV-241	Check Valve - Condensate Pump (P-205) Discharge	222	Merlin	1-1/2" NPT	Apollo		Ball Check, 316 SS Body
CV-242	Check Valve - Vapor Quencher Supply	226	Merlin	1" NPT	Apollo		Ball Check, 316 SS Body
CV-601	Check Valve - Natural Gas Supply (B-201)	601	Meier		N. American		Supplied w/ Burners System
CV-602	Check Valve - Natural Gas Supply (B-202)	601	Meier		N. American		Supplied w/ Burners System
CV-603	Check Valve - Natural Gas Supply (B-203)	601	Meier		N. American		Supplied w/ Burners System
CV-604	Check Valve - Natural Gas Supply (B-204)	601	Meier		N. American		Supplied w/ Burners System
CV-605	Check Valve - Natural Gas Supply (B-205)	601	Meier		N. American		Supplied w/ Burners System
CV-606	Check Valve - Natural Gas Supply (B-206)	601	Meier		N. American		Supplied w/ Burners System
CV-611	Check Valve - Combustion Air Supply (B-201)	610	Meier		N. American		Supplied w/ Burners System
CV-612	Check Valve - Combustion Air Supply (B-202)	610	Meier		N. American		Supplied w/ Burners System
CV-613	Check Valve - Combustion Air Supply (B-203)	610	Meier		N. American		Supplied w/ Burners System
CV-614	Check Valve - Combustion Air Supply (B-204)	610	Meier		N. American		Supplied w/ Burners System
CV-615	Check Valve - Combustion Air Supply (B-205)	610	Meier		N. American		Supplied w/ Burners System
CV-616	Check Valve - Combustion Air Supply (B-206)	610	Meier		N. American		Supplied w/ Burners System
CV-631	Check Valve - Air Supply Blower (B-600) Discharge	610	Meier		N. American		Supplied w/ Burners System
CV-675	Check Valve - Condensate Tank (T-220) Make-up Water	621	Merlin	1/2" NPT	Apollo		Ball Check Valve, 316 SS Body
CV-676	Check Valve - Makeup Water to Vapor Quencher	621	Merlin	1" NPT	Apollo		Ball Check Valve, 316 SS Body
FCV-630	Thermal Desorber Flame Safeguard Valve	601	Meier		N. American		Electro/Mechanical Actuator, Fail Closed, Supplied w/ Burners System
FCV-635	Thermal Desorber Flame Safeguard Valve	601	Meier		N. American		Electro/Mechanical Actuator, Fail Closed, Supplied w/ Burners System
FCV-640	Flow Control Valve - Thermal Desorber Burner Air	610	Meier		N. American		Mechanical Link to Gas Valve (TCV-200), Fail Closed, Supplied w/ Burners
FSV-205	Drum Dump Inlet Valve FV-205 Actuator - CA Solenoid Valve		Meier				Existing, part of valve assembly,
FSV-206	Airlock Inlet Valve FV-205 Seal - CA Solenoid Valve		Meier				Existing, part of valve assembly,
FSV-209	Airlock Outlet Valve FV-210 Seal - CA Solenoid Valve		Meier				Existing, part of valve assembly,
FSV-210	Drum Dump Outlet Valve FV-210 Actuator - CA Solenoid Valve		Meier				Existing, part of valve assembly,
FSV-212	Discharge Solid Airlock (FV-212) outlet valve - CA Solenoid Valve		Meier		Roto-Disc		Double Solenoid, 120VAC, NEMA 4, provided with FV-282
FSV-215	Feed Auger Discharge Valve (FV-215) - CA Solenoid Valve	200	Meier				Existing as part of reuse equipment
FSV-220	Glycol Coolant HX (E-200) Solenoid Valve	619	Merlin	3/4" NPT	ASCO		110 VAC Solenoid Operated Valve, SS
FSV-640	Thermal Desorber Flame Safeguard Vent Valve	601	Meier		N. American		115 volt Solenoid valve, Supplied w/ Burners System
FSV-670	Makeup Water to Vapor Quencher Solenoid Valve	621	Merlin	1" NPT	ASCO		110 VAC Solenoid Operated Valve, SS
FV-205	Thermal Desorber Airlock (T-205) Inlet Isolation Valve	200	Meier				Pneumatic Slide Gate Valve (Existing)
FV-210	Waste Feed Hopper (T-210) Inlet Isolation Valve	200	Meier				Pneumatic Slide Gate Valve (Existing)
FV-215	RTD Feed Auger (W-200) Discharge Valve	200	Meier				Pneumatic Slide Gate Valve (Existing)
FV-282	Discharge Airlock Outlet Valve	202	Meier		Roto-Disc	16" Roto-Disc	16 1/2" Inlet, 22" Outlet, 20" ANSI 150lb Flanges, 316SS Dome, 304SS Body,
FV-670	Plant Water Spray Vapor Condenser(C-205) - Solenoid Valve		Merlin				110 VAC Solenoid Operated Valve, SS construction NPT ends
HV-201	Drum Dump Enclosure to Building Vent	111	Meier	8" SS	Apollo	Series 143	Damper lug butterfly valve, Body ductile Iron ASTM A536, Seat EPDM, Shaft
HV-205	Condensate Tank (T-220) Drain Valve		Merlin	1" NPT	Apollo		Ball Valve, 316 SS Body
HV-206	Condensate Pump (P-200) Upstream Isolation Valve	222	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-207	Condensate Pump (P-200) Downstream Isolation Valve	222	Merlin	1-1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-208	Condensate Filter (F-210) Upstream Isolation Valve	227	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-209	Condensate Filter (F-210) Downstream Isolation Valve	227	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-210	Condensate Filter (F-220) Upstream Isolation Valve	227	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-211	Condensate Filter (F-220) Downstream Isolation Valve	227	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-212	Condensate Filter Bypass Valve	227	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-213	Condensate Recirculation to Condensate Tank (T-220)	223	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-214	Condensate Recirculation to Jet Mixer (J-200)	224	Merlin	3/4" NPT	Apollo		Ball Valve, 316 SS Body
HV-215	Condensate Recirculation to Packed Tower (C-210)	225	Merlin	1" NPT	Apollo		Ball Valve, 316 SS Body
HV-216	Condensate Recirculaiton to Vapor Quencher (C-205)	226	Merlin	1" NPT	Apollo		Ball Valve, 316 SS Body

ROTARY THERMAL DESORBER - MASTER EQUIPMENT LIST

RTD Valve List

Valve Number	Description	Line No.	Specified	Line Size (in.)	Manufacturer	Model Number	Comment / Specification
HV-217	Vapor Isolation Valve Upstream of Vapor Filter (F-200)	208	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-218	Vapor Isolation Valve Downstream of Vapor Filter (F-200)	212	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-219	Vapor Filter (F-200/F-205) Bypass Valve	208	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-221	Carbon Adsorber (C-215/216) Bypass Valve	210	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-222	Carbon Adsorber (C-215) Outlet Isolation 3-way Valve	220	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body, 3-Way Valve
HV-223	Carbon Adsorber (C-216) Outlet Isolation 3-way Valve	220	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body, 3-Way Valve
HV-224	Blower B-210 Discharge Valve	213		2"			
HV-225	Blower B-215 Discharge Valve	213		2"			
HV-230	Condensate Pump (P-205) Upstream Isolation Valve	222	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-231	Condensate Pump (P-205) Downstream Isolation Valve	222	Merlin	1-1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-235	Condensate Filtrate Blowdown	214	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-236	Condensate Filtrate Blowdown	214	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-237	Condensate Filtrate Blowdown	214	Merlin	1/2" NPT	Apollo		Ball Valve, 316 SS Body
HV-238	Carbon Adsorber (C-215) Inlet Isolation Vavle	210	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-239	Carbon Adsorber (C-216) Inlet Isolation Vavle	210	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-240	RTD Hi Temp. Process Exhaust Vent Isolation Valve	205	Meier	3" w/ #150	Tyco	3-AWM-555-33	Hi temp Wafer style, 304 stainless steel valve, hand lever operater w/ notch
HV-241	Drum Dumper Lift Bellows Compressed Air Valve		Meier	3/4"			Existing hand operated air control valve
HV-242	Discharge Drum Enclosure Process Vent Isolation Valve	112	Meier	6" SS	Apollo	Series 143	6" Damper valve, Apollo, Series 143 lug butterflyValve, Body ductile Iron
HV-280	Vapor Isolation Valve Upstream of Vapor Filter (F-205)	208	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-281	Vapor Isolation Valve Downstream of Vapor Filter (F-205)	212	Merlin	2" NPT	Apollo		Ball Valve, 316 SS Body
HV-283	Vent valve - Filter F-210		Merlin				supplied by Merlin, NPT fitting on valve
HV-284	Drain valve - Filter F-210		Merlin				supplied by Merlin, NPT fitting on valve
HV-285	Vent Valve - Filter F220		Merlin				supplied by Merlin, NPT fitting on valve
HV-286	Drain valve - Filter F-220		Merlin				supplied by Merlin, NPT fitting on valve
HV-310	Air motor CA Hand Valve (pump P-310)		Meier	1/2 copper	Nibco	series T-585-70	1/2" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats
HV-320	Tank T-310 Floating Suction Outlet Valve to P-310 Inlet		PEcoS		Nibco		
HV-321	Tank T-310 Bottom Outlet Isolation Valve to P-310 Inlet		Meier	1" sch 40, SS	Nibco	T-585-S6-R-66-	1" Stainless Steel Ball Valve, NPTF ends (Nibco # T-585-S6-R-66-LL)
HV-322	Pump (P-310) Outlet Isolation Valve		Meier	3/4" sch 40	Nibco	series T-585-70	3/4" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats
HV-324	Organic Liquids Drum-out Fill Valve		Meier	3/4" sch 40	Nibco	series T-585-70	3/4" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats
HV-325	Organic Liquid Tank (T-310) Drain Valve		Meier	3/4" sch 40,	Nibco	T-585-S6-R-66-	3/4" Stainless Steel Ball Valve, NPTF ends, (Nibco # T-585-S6-R-66-LL)
HV-326	Organic Liquid Pump (P-310) Discharge Drain Valve		Meier	3/4 sch 40	Nibco	series T-585-70	3/4" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats
HV-600	Nitrogen Supply Hand Valve	602	Meier	2" copper	Nibco	series S-590	2" Bronze Ball Valve, Nibco series S-590-R-66, 3 piece valve,
HV-601	Natural Gas Supply Hand Valve to B-201	601	Meier		N. American		Supplied w/ Burners System
HV-602	Natural Gas Supply Hand Valve to B-201	601	Meier		N. American		Supplied w/ Burners System
HV-603	Natural Gas Supply Hand Valve to B-203	601	Meier		N. American		Supplied w/ Burners System
HV-604	Natural Gas Supply Hand Valve to B-204	601	Meier		N. American		Supplied w/ Burners System
HV-605	Natural Gas Supply Hand Valve to B-205	601	Meier		N. American		Supplied w/ Burners System
HV-606	Natural Gas Supply Hand Valve to B-206	601	Meier		N. American		Supplied w/ Burners System
HV-611	Combustion Air Supply Hand Valve to B-201	610	Meier		N. American		Supplied w/ Burners System
HV-612	Combustion Air Supply Hand Valve to B-202	610	Meier		N. American		Supplied w/ Burners System
HV-613	Combustion Air Supply Hand Valve to B-203	610	Meier		N. American		Supplied w/ Burners System
HV-614	Combustion Air Supply Hand Valve to B-204	610	Meier		N. American		Supplied w/ Burners System
HV-615	Combustion Air Supply Hand Valve to B-205	610	Meier		N. American		Supplied w/ Burners System
HV-616	Combustion Air Supply Hand Valve to B-206	610	Meier		N. American		Supplied w/ Burners System
HV-620	Natural Gas Supply Hand Valve	601	Meier		N. American		Supplied w/ Burners System
HV-630	RTD Discharge Auger (W-205) Outlet - Nitrogen Isolation Valve		Meier	1/2 copper	Marsh	p/n N1514	1/2 Needle Valve Steel body, NPTF ends, Include adapter thrd to solder
HV-680	Glycol Coolant Solenoid Valve Isolation Valve	801	Merlin	3/4" NPT	Apollo		Ball Valve, 316 SS Body
HV-681	Glycol Coolant Solenoid Valve Isolation Valve	801	Merlin	3/4" NPT	Apollo		Ball Valve, 316 SS Body

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RTD Valve List

Valve Number	Description	Line No.	Specified	Line Size (in.)	Manufacturer	Model Number	Comment / Specification
HV-682	Glycol Coolant Solenoid Valve Bypass Valve (keep this valve # due to	801	Merlin	3/4" NPT	Apollo		Ball Valve, 316 SS Body
HV-685	Discharge Solids (W-205) Cooling Water Supply - Isolation Valve		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-686	Coolant Supply RTD Infeed Auger Nozzle - Isolation Valve		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-687	Coolant Supply RTD Infeed Auger Chamber - Isolation Valve		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-688	Isolation Coolant return RTD Infeed Auger Nozzle		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-689	Isolation Coolant return RTD Infeed Auger chamber		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-690	Waste Feed Hopper (T-210) Nitrogen Isolation Valve		Meier	1"	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
HV-691	Coolant Supply RTD Infeed Auger Chamber - Balancing Valve		Meier	1	Bell & Gossett	model CB-1, Part	1" Brass Balancing Ball valve, NPT ends, full shut-off capable service
HV-692	Coolant Supply RTD Infeed Auger Nozzle - Balancing Valve		Meier	1	Bell & Gossett	model CB-1, Part	1" Brass Balancing Ball valve, NPT ends, full shut-off capable service
HV-693	Inlet Seal Kiln (H-200) Nitrogen Isolation Valve		Meier	1/2" copper	Marsh	p/n N1514	1/2" Needle Valve Steel body, NPTF ends, include adapter thrd to solder
HV-694	Outlet Seal Kiln (H-200) Nitrogen Isolation Valve		Meier	1/2" copper	Marsh	p/n N1514	1/2" Needle Valve Steel body, NPTF ends, include adapter thrd to solder
HV-695	Discharge Solids Conveyer (W-205) Cooling Water Return Valve	813	Meier	1	Nibco	series T-585-70	1" bronze ball valve, Nibco series T-585-70, full port, NPTF ends, TFE seats,
LV-215	Condensate to Organic Collection Tank (T-310) Solenoid Valve	214	Merlin	1/2" NPT			115VAC, Solenoid Valve, SS Construction, 1/2" NPTF ends, Flow through
LV-670	Plant Water to Condsensate Ricirc.Tank (T-220) Solenoid Valve	621	Merlin	1/2" NPT	ASCO		110 VAC Solenoid Operated Valve, SS construction
PCV-600	Pressure Control Valve - Nitrogen Supply	602	Meier	2" copper			reusing and relocating Existing nitrogen supply PRV
PCV-630	Pressure Control Valve - Natural Gas	601	Meier		N. American		Fail Closed, Supplied w/ Burners System
PDCV-	Pressure Differential Control Valve - Feed hopper(T-210) nitrogen		Meier	1" sch 40, SS	Research	model #	BadgerMeter Inc Research Control Valve, Type 807/754, 1/2" NPTF, 316
PDCV-	Pressure Differential Control Valve - RTD Burner exhaust	201	Meier	8	Tyco	3-AWM-555-33	Wafer Style Hi Temp. Valve, Carbon Steel body, ANSI 150# pattern, 304 SS
SRV-292	Safety Relief Valve - Cooling Water Waste Feed chamber (W-200)	810	Meier			.	Reuse existing PRV as mounted in the cooling jacket
SRV-293	Safety Relief Valve - Cooling Water Waste Feed nozzle (W-200)	812	Meier	1			Relocate existing PRV relief valve form old nozzel to piping per drawings and,
SRV-295	Safety Relief Valve - Cooling Water Discharge Solids (W-205)	811	Meier	1	Watts	model 1403-3	Watts Regulator model 1403-3 rated at 570,000 btu/hr, 1" NPTF by 1" NPTF
TCV-200	Temperature Control Valve - Natural Gas RTD burners	601	Meier		N. American		Mechanical Link to Air Control Valve (FCV-640), Fail Closed, Supplied w/

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RTD Instrument List

Instrument Number	Function	Description	Vendor	Model Number	Reference Drawing / Required Process Fitting	Comments
FI-210	Condensate Return to Jet Mixer (T-220)	Rotometer,	Meter Equip Manfg		32004-PID-201, Line 224	316SS, 3/4" NPT
FI-240	Filtered Condensate Return to T-220	Rotometer,	Meter Equip Manfg		32004-PID-201, Line 223	316SS, 3/4" NPT
FI-626	Nitrogen Supply to Feed Hopper	Flow Indicator, 2 to 12 CFM, for 1" Diameter Nitrogen Supply Line	Dwyer	HFA-1-12	inline, 32004-M-041,	Inline 1/4" NPT
FIS-263	Nitrogen Supply to discharge Airlock (T-215) Hopper	Flow Indicating Switch, adjustable alarm points, Range 2-12 SCFM, mounts in any position, 1/4" FNPT process connections	Dwyer	HFO-21112	inline , 32004-M-041,	Nitrogen supply, 1/2" line,
FIT-220	Condensate Return to Packed Tower	Rotometer with integral flow switch	Meter Equip Manfg		32004-PID-201, Line 225	316SS, 1 1/2 "NPT
FIT-230	Condensate Return to Vapor Quencher	Rotometer with integral flow switch	Meter Equip Manfg		32004-PID-201, Line 226	316SS, 1 1/2 "NPT
FIT-610	Gycol Coolant Return	Rotometer with integral flow switch	Meter Equip Manfg		32004-PID-201, Line 802	316SS, 3/4" NPT
FS-211	Discharge Enclosure to Process Vent	Flow Switch	Dwyer	V4-2-SS-2U	32004-M-102, note 14, . 1 1/2" NPTF into top of 8" Process vent,	into top of 8" Process vent, 1 1/2" NPTF process fitting
FSL-605	45 deg Cooling Water Supply	Flow Switch, Brass construction, 1 1/4" NPT, 4 gpm actuation , 3 gpm deactuation, SPDT switch	Dwyer	V6EPB-B-S-4-B	inline , 32004-M-040, flag note #20	1 1/4" Cooling water Supply
FT-260	Nitrogen Supply to Feed End Seal	Direct reading flow meter with electronics to provide proportional analog output range of 4-20 mA, in-line, Range 2-12 SCFM, cast aluminum NEMA 4X housing, brass construction with ¼" FNPT connections	Dwyer	HFT-1112, (2-04)changed to GFM-1143 as ordered by Bill	inline, 32004-M-041,	0 - 7 SCFM Nitrogen to Kiln Seals
FT-261	Nitrogen Supply to Discharge End Seal	Direct reading flow meter with electronics to provide proportional analog output range of 4-20 mA, in-line, Range 2-12 SCFM, cast aluminum NEMA 4X housing, brass construction with ¼" FNPT connections	Dwyer	HFT-1112, (2-04)changed to GFM-1143 as ordered by Bill	inline, 32004-M-041,	0 - 7 SCFM Nitrogen to Kiln Seals
LS-211	Discharge Airlock Level High High	Level Switch, Rotary Paddle Switch	K-TEK	on order KP/2/MP2/CS/P3/X/X	32004-M-203, note 4	
LS-212	Discharge Airlock Level High	Level Switch, Rotary Paddle Switch	K-TEK	on order KP/2/MP2/CS/P3/X/X	32004-M-203, note 4	
LT-210	Tank-220 Level Indication	4-20 madc output	Gems		32004-PID-201, Tank T-220	304 SS 1" RF Flg.
LT-310	Tank-310 Level Indication	Ultrasonic Level Transmitter, 0.5 - 10 Ft, 4 - 20 MA output, loop powered, 3/4" NPT Mtg., 316SS probe	OMEGA	LVU-952	32004-M-041 detail 3, note 12,	Note 3/4" NPT process fitting
PDI-200	Pressure drop Hydrocyclone inlet to outlet to Heat Exchanger		Orange Research		32004-PID-201, Line 222	304SS, 1/4" NPT
PDIT-220	Pressure drop across Quench / Packed Tower	Switch for alarm on High Delta P	Dwyer		32004-PID-201, Line 205	Capsulhelic, 1/8" NPT
PDIT-230	Pressure drop across Condensate Filters	Switch for alarm on High Delta P	Orange Research		32004-PID-201, Line 227	304SS, 1/4" NPT
PDIT-240	Pressure drop across Vapor Blowers	Switch for alarm on Low Delta P	Dwyer		32004-PID-201, Line 212	Capsulhelic, 1/8" NPT

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RTD Instrument List

Instrument Number	Function	Description	Vendor	Model Number	Reference Drawing / Required Process Fitting	Comments
PDIT-250	Pressure drop across Vapor Filters	Switch for alarm on High Delta P	Dwyer		32004-PID-201, Line 208	Photolhelic, 1/8" NPT
PDT-210	RTD Kiln to Room Pressure **(AWFCO Signal)** and inupt to VFD Vapor Blowers	Draft Range Differential Pressure Transmitter, -0.25 to 0.25" WG Maximum span, Output 4 - 20 MA, NEMA 4 Coated Aluminum Head, rated 185 degree F Ambient	Rosemount	3051CD0 A 22 A 1 A B4 with 306R manifold	32004-M-102 flag note 20,see ECN #6 Isolate from heat and remote mount instrument??? and plumb with 1/4" ???tubing, Field locate instrument within 8 to 20 LF ??? of tubing from tap.????	Draft range for measurements normally between 0 to 0.05" WG, 1200 degrees F at process connection
PDT-221	RTD Vapor Outlet to Feed Hopper Differential Pressure **(AWFCO Signal)**	Differential Pressure Transmitter, -1000' to 1000" WG Maximum span, Calibrated to -10" to 810" WG, Output 4 - 20 MA, NEMA 4 Coated Aluminum Head	Rosemount	3051CD3 A 22 A 1 A B4 with 306R manifold	32004-M-102 note 13, 1/2 NPT tap extend to clear insulation	Range is - 2" WG to 30 PSI (783" WG), one process 1200 degrees F tap
PDT-225	RTD Vapor Outlet to Feed Hopper Differential Pressure Controller Input	Differential Pressure Transmitter, -1000' to 1000" WG Maximum span, Calibrated to -10" to 810" WG, Output 4 - 20 MA, NEMA 4 Coated Aluminum Head	Rosemount	3051CD3 A 22 A 1 A B4 with 306R manifold	32004-M-102 note 13, 1/2 NPT tap extend to clear insulation	Range is - 2" WG to 30 PSI (783" WG), one process 1200 degrees F tap
PDY-225	RTD Vapor Outlet to Feed Hopper Differential Pressure Controller	I/P Relay, 4 - 20 MA Input, 3 - 15 PSIG Output, NEMA 4X, input / output air connections are 1/4" NPTF	Action	IP-51-3000	32004-M-041 detail 1	
PDY-235	RTD Firebox Exhaust Gas Pressure Controller	I/P Relay, 4 - 20 MA Input, 3 - 15 PSIG Output, NEMA 4X, input / output air connections are 1/4" NPTF	Action	IP-51-3000	32004-M-041 detail 1	
PI-260	Nitrogen Supply to Feed End Seal	Pressure gauge, 0-200 psi range, 1/4" NPT connections, 4.5" dial, Aluminum case	Ashcroft	Type 2071A	32004-M-041,	
PI-261	Nitrogen Supply to Discharge End Seal	Pressure gauge, 0-200 psi range, 1/4" NPT connections, 4.5" dial, Aluminum case	Ashcroft	Type 2071A	32004-M-041,	
PI-310	Pump P-310 Discharge Presure	Pressure gauge, 2.5" dial, body & wetted parts SS, 0-100 psi range, 1/4" NPT connections with dampener	Ashcroft	Type 1008S with pulsation dampener type 1/4-1106S	32004-M-043 note 8	
PIS-270	Condensate Pumps Discharge Pressure	Alarm Low switch	Orange Research		32004-PID-201, Line 222	304SS, 1/4" NPT
PISL-600	Nitrogen Supply Pressure	Pressure Indicating Switch, 1/4" NPTF bottom instrument & 1/4" NPT to atmosphere	Orange Research	1201PGS 5E3.5LC 0 - 80 psig	32004-M-041,	PISL-600 for 2" nitrogen supply
PT-235	RTD Firebox Fluegas Pressure to Controller	Pressure Transmitter, High Termperature Rated to 375 Degrees F, 0 to -250 in WG Maximum span, Output 4 - 20 MA, NEMA 4 Coated Aluminum Head, rated 185 degree F Ambient	Rosemount	3051HG2 A 22 AD 21 A B6 with 306R manifold	32004-M-102 note 7, 1" x 6' nip weld to transition piece to extend past insulation	On 8" Flue Gas Duct - 1200 degrees F, negative exhaust pressure
SE-220	Rotor Speed sensor	Speed Element, Proximity	Omega	SPR101-12P		USE with 4 magnets on drum
ST-220	Rotor speed transmitter	Speed Transmitter, input proximity switcht at 20 PPS max, output 4 - 20 MA 12 VDC POWER SUPPLY FOR Speed Transmitter	Omega Omega	DPF-75-A PSS-D12A		Locate within 5 feet of SE-220

ROTARY THERMAL DESORBER - MASTER EQUIPMENT LIST

RTD Instrument List

Instrument Number	Function	Description	Vendor	Model Number	Reference Drawing / Required Process Fitting	Comments
TE-200	RTD Firebox temperatures A B-206 B B-205 C B-204 D B-203 E B-202 F Discharge Flange	Cast Iron Head, Type K Thermocouple probe, Thermowell for 1/4" Probe, Stainless Steel, 1/2" NPT, Well carbon steel with 4 1/2" Insertion length (5/8" OD insertion), union with nipple for 7 1/2" extension.	Omega	NB1-2-CASS-14U-12 / 3 - 7 1/2 / 1/2-260S-U 4 1/2-CS	32004-M-102 note 19, 1/2" NPTF required use existing thermocouple well 3rd from the discharge end. Provide union and nipple as required for 4.5 " insertion.	Remote element to isolate transmitter from high heat with 7 1/2" union and nipple extension
TE-205	Kiln Vapor Exit (AWFCO Signal)	Cast Iron Head, Type K Thermocouple probe, Thermowell for 1/4" Probe, Stainless Steel, 1/2" NPT, Well with 2 1/2" Insertion (thermowell 5/8" OD insertion), union with nipple for 9 1/2" extension.	Omega	NB1-2-CASS-14U-12/ 3 - 9 1/2 / 1/2-260S-U 2 1/2-304SS	32004-M-102 note 10, 1/2" NPTF required	Remote element to isolate transmitter from high heat with 9 1/2" union and nipple extension
TE-208	Vapor Exit from Packed Tower	Type J, Yokogawa hi Temp Switch, TT ?	Idaho Labs		32004-PID-201, Line 207	Texas Thermowell, 304SS, 1/2" NPT
TE-210	RTD Fluegas (AWFCO Signal)	Cast Iron Head, Type K Thermocouple Duplex probe, Thermowell for 1/4" Probe, Stainless Steel, 1/2" NPT, Well with 4 1/2" Insertion (thermowell 5/8" OD insertion), union with nipple for 7 1/2" extension.	Omega	NB1-4-CASS-14U-12 / 3 - 7 1/2 / 1/2-260S-U 4 1/2-304SS	32004-M-102 note 8, 1/2" NPTF required	Remote dual Type K elements to isolate transmitter from high heat and to support burner management with 7 1/2" union and nipple extension
TE-230	Vapor in Tank T-220 (AWFCO Signal)	Type J, Yokogawa hi Temp Switch, TT ?	Idaho Labs		32004-PID-201, Tank T-220	Texas Thermowell, 304SS, 1/2" NPT
TE-235	45 deg Cooling Water Supply	Thermowell, Stainless Steel, 1/2 NPT for transmitter head, insertion depth 2 1/2", 1/2" NPTF process, thermowell 5/8" OD		1/2-260S-U 2 1/2-304SS with nipple union extension Type 3 - 9 1/2"	32004-M-040, flag note #20, 1/2" NPTF in 1 1/4" "T" cooling water line	Thermowell and extension only.
TE-240	Vapor Exit from Strip Heater	Type J, TT ?	Idaho Labs		32004-PID-201, Line 208	Texas Thermowell, 304SS, 1/2" NPT
TE-250	Condensate exit from Heat Exchanger E-200	Type J, TT ?	Idaho Labs		32004-PID-201, Line XXX	Texas Thermowell, 304SS, 1/2" NPT
TE-310	Tank T-310 Liquid	Thermowell, Stainless Steel, 1/2 NPT for transmitter head, insertion depth 4 1/2" (5/8" OD thermowell insertion), 1/2" NPTF process	Omega	1/2-260S-U 4 1/2-304SS with nipple union extension Type 3 - 7 1/2"	32004-M-041, detail 3, 1/2" NPTF required 1 1/2" NPTF available in tank side	Thermowell and extension only.
TE-610	Glycol exit from Heat Exchanger E-200	Type J, TT ?	Idaho Labs		32004-PID-201, Line 802	Texas Thermowell, 304SS, 1/2" NPT
TT-200	RTD Firebox temperatures A B-206 B B-205 C B-204 D B-203 E B-202 F Discharge Flange	Temperature Transmitter for Type K thermocouple, 175 - 2500 Degree F max span, 4-20 MA Output with cast iron head	Omega	TX903 with head NB1	remote mount due to hi heat	Field range selection is available. Uses separate remote thermocouple element
TT-205	Kiln Vapor Exit	Temperature Transmitter for Type K thermocouple, 175 - 2500 Degree F max span, 4-20 MA Output with cast iron head	Omega	TX903 with head NB1	remote mount due to hi heat	Field range selection is available. Uses separate remote thermocouple element
TT-210	RTD Fluegas	Temperature Transmitter for Type K thermocouple, 175 - 2500 Degree F max span, 4-20 MA Output with cast iron head	Omega	TX903 with head NB1	remote mount due to hi heat	Field range selection is available. Uses separate remote thermocouple element

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RTD Instrument List						
Instrument Number	Function	Description	Vendor	Model Number	Reference Drawing / Required Process Fitting	Comments
TT-235	45 deg Cooling Water Supply	Temperature Transmitter, 0-200 Degree F, 4-20 MA Output, with 12" Type J Thermocouple Probe	Omega	NB1TXA J2 WITH 12" PROBE	same detail as TE-235	Integral probe, head and transmitter
TT-310	Tank T-310 Liquid	Temperature Transmitter, 0-200 Degree F, 4-20 MA Output, with 12" Type J Thermocouple Probe	Omega	NB1TXA J2 WITH 12" PROBE	32004-M-041, detail 3, 1/2" NPTF required 1 1/2" NPTF available in tank side, shown on detail as TE-310 only	Integral probe, head and transmitter

ROTARY THERMAL DESORBER - MASTER EQUIPMENT LIST

RTD EQUIPMENT LIST

Equipment No	FUNCTION	MFG	Model No.	Type	MATERIAL	MAIN CONNECTIONS	COMMENTS
B-210	Vapor Blower	Rotron	DR-404M	Regenerative, Spark Proof Construction	Cast Aluminum Housing & Impeller	Special Flanges	Explosion proof motor
B-215	Vapor Blower	Rotron	DR-404M	Regenerative, Spark Proof Construction	Cast Aluminum Housing & Impeller	Special Flanges	Explosion proof motor
C-205	Vapor Quencher	Merlin		Jet Ejector Contactor	Refractory Lined 304 SS Shell	8" 150# RF Flange 8" 150# RF Flange	Other connections. See Merlin drawings
C-210	Vapor Condenser	Merlin		Direct Contact	304 SS	6" 150# RF Flange 2" 150# RF Flange	Other connections. See Merlin drawings
C-215	Carbon Adsorber	Entire Environmental	VP-55	One-Use Drum	VOC Carbon CS Drum	2" NPT	Disposable drum
CP-1	Feed Panel	PEcoS					
CP-2	Main Control Panel	PEcoS					
CP-4	Vapor Condenser Skid Panel	PEcoS					
CP-5	Burner Control Panel	North American	BG807001				
CP-6	Auger VFD Control Panel	SSI					
CP-7	Liquid Staging Panel	PEcoS					
CP-8	Rotor VFD Panel	Baldor	1D15H401-E				
E-200	Condensate Heat Exchanger	ITT Standard	SSCF 4 pass	VCL-2.OP.B	304 SS Shell 304 SS Tubes	1-1/2" NPT	
F-200	Vapor Filter	Micron Technologies	H802GP1508S2A	Pleated Filter	304 SS Housing	2" NPT	Disposable cartridges
F-205	Vapor Filter	Micron Technologies	H802GP1508S2A	Pleated Filter	304 SS Housing	2" NPT	Disposable cartridges
F-210	Condensate Filter	Micron Technologies	H802GP1508S2A	Bag Filter	304 SS Housing	3/4" NPT	Disposable bags
F-220	Condensate Filter	Micron Technologies	H802GP1508S2A	Bag Filter	304 SS Housing	3/4" NPT	Disposable bags
H-200	Rotary Thermal Desorber	Rotary Kiln & Dryer Co.	150 #/hr Research	Indirect Fired Kiln	309 SS Rotor		
H-210	Vapor Superheater	Chromolox		Circulation	304 SS Housing Incoloy Sheath	2" NPT	
J-200	Condensate Sump Mixing Nozzle	Bete		High Volume Eductor	316 SS	3/4" MPT	
M-200	Motor for Condensate P-200						
M-201	Auger W-201 Drive Motor						
M-202	Drum Dumper Hydraulic Pump Motor						
M-205	Motor for Condensate P-205						
M-210	Motor for Vapor Blower B-210						
M-215	Motor for Vapor Blower B-215						
M-220A	Rotor Drive Motor	GE	5K35MNB114				
M220B	Rotor Drive Motor	Baldor	VM3546				
M-231	Lift Table Hydraulic Power Motor	Emerson					
P-200	Scrubber Liquid Recirculation Pump	Kontro		Sealless	316 SS	1-1/2" 150# RF Flange 1" 150# RF Flange	Inverter duty motor
P-202	Drum Dumper Hydraulic Pump						
P-205	Scrubber Liquid Recirculation Pump	Kontro		Sealless	316 SS	1-1/2" 150# RF Flange 1" 150# RF Flange	Inverter duty motor
P-231	Lift Table Power Hydraulic Unit						
P-310	Transfer Pump	Yokogama		Positive Displacement			
S-200	Hydrocyclone	Krebs		Small Diameter	Urethane	1" NPT	2" body
T-200	Drum Dump Station Enclosure	PEcoS					See 32004-M-209
T-205	Feed Airlock	Shredder Systems, Inc.	ATG GV02				See SSI Dwg OO-8711-D
T-210	Feed Hopper	Shredder Systems, Inc.	ATG GV02				
T-215	Discharge Airlock	PEcoS					See 32004-M-203
T-220	Condensate Sump Tank	Merlin		Controlled-Level Sump	304 SS	8" 150# RF Flange 6" 150# RF Flange	Other connections. See Merlin drawings
T-220	Receiving Hopper	PEcoS					See 32004-M-207
T-225	Discharge Station Enclosure	PEcoS					See 32004-M-200
T-310	Organic Liquid Collection Tank	PEcoS			SS	See 32004-M-041	See 32004-M-041
W-201	Feed Auger	Shredder Systems, Inc.	ATG GV02				
W-205	Burner Control System	North American					See NA Dwg PEcoS Rotary Incinerator

ROTARY THERMAL DESORBER - MASTER EQUIPMENT LIST

Equipment No	FUNCTION	MFG	Model No.	Type	MATERIAL	MAIN CONNECTIONS	COMMENTS
W-210	Drum Dumper						
W-215	Drum Hoist						See 32004-S-013
W-220	Drum Rollers	Ashland	10F10KG03B36	Roller Conveyors	CS		
W-225	Roll-up Fire Door	Overhead Door	640 Series	3' 4" wide x 5' 0" high	165 deg F		Fusible link
W-231	Lift Table	Bishamon	LX-100W	Low Profile Lift Table	CS	110 VAC	Modified with L2K Power Unit, Elec-B3D00836