UNIT COST STUDY FOR COMMERCIAL-SCALE SEDIMENT MELTER FACILITY

FOR

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

SUPPLEMENT TO

GLASS AGGREGATE FEASIBILITY STUDY

JANUARY 19, 2002

UNIT COST STUDY
FOR COMMERCIAL-SCALE
SEDIMENT MELTER FACILITY

TABLE OF CONTENTS

INTRODUCTION

Minergy Corporation respectfully submits this report to the Wisconsin Department of Natural Resources (the "Department") containing the results of the Unit Cost Study For Commercial-Scale Sediment Melter Facility. This work was necessary to fulfill the requirements of the U.S. EPA's Quality Assurance Project Plan ("QAPP") as part of their reporting of the pilot sediment melter. The activities leading to this report are in conjunction with the Glass Aggregate Feasibility Study under the agreement between Minergy and the Department dated September 21, 2000, (State of Wisconsin purchase order number NMJ00001936), as amended under State of Wisconsin purchase order number NMB0000488.

Minergy used a standard build-up estimating approach in performing the Cost Study. This approach used the information derived from Phases 1, 2, and 3 of the Glass Aggregate Feasibility Study, and on that basis, Minergy requested relevant cost, performance, and sizing data from equipment suppliers. With this data, the general plant flowsheet, mass & energy balance, and equipment arrangements were made. From this, estimates were done for construction and operations, and through financial modeling, a unit-cost forecast.

The base case estimates are made using a plant size of 250 glass tons per day. This size is consistent with that used elsewhere in the Glass Aggregate Feasibility Study. A sensitivity analysis is included for various sized melter projects.

This report is the result of a Cost Study and not an offer to construct a facility. The engineering performed within the scope of this study does not represent final detail. Further detail engineering and design would improve the accuracy of the Cost Study results. Notwithstanding the Department's or any other party's desire to proceed with detail engineering or the development of a commercial scale facility, Minergy nonetheless reserves the right to make final determination on Minergy's participation.

PROCESS DESCRIPTION

This section describes the process and equipment used in the base project with a capacity of 250 glass tons per day. The facility is designed to melt 600 tons per day of partially dewatered river sediment that has been dredged from the Fox River.

The sediment enters the plant, is mixed with previously dried sediment to make it easier to handle, and is then dried to approximately 10% moisture. (See Drawing FVRS-PF-101 – Process Flow Diagram, Sediment Drying and Preparation, and Drawing FVRS-GA-101 – Conceptual General Arrangement, Main Processing Plant.) After the sediment is mixed with a fluxing material, it is fed into a large melter, capable of maintaining temperatures in the 2900 ^{o}F range. The sediment melts into a molten material, which drains from the melter, is quenched in a water bath, and turns into a glass aggregate. The melter is designed to produce 250 tons per day of aggregate, which will be sold for building products.

The entire process is optimized to conserve energy, reduce heat losses, and minimize labor requirements.

Sediment preparation (pre-drying)

Sediment is dredged and hydraulically transported to the dewatering site, and mechanically dewatered by others at the site. The material is moved by front-end loader into the short-term storage/mixing area in the dryer plant. Three wet sediment mixers are installed in the dryer plant. (See Drawing FVRS-PF-101 – Process Flow Diagram, Sediment Drying and Preparation.) Each mixer has a rating of 11.3 tons per hour. Sediment, which has already been dried (total moisture content is approximately 10%), is added to the inlet of the mixer. The purpose for the mixing is to improve material handling and behavior in the dryers, by eliminating the self-agglomeration or“sticky phase” of the material. The moisture content of the sediment after mixing is approximately 39%.

Sediment drying

After the sediment has been prepared by mixing, it is transported by enclosed conveyors to the sediment dryer (See Drawing PC1100309 – Holo-Flite Dryer.) The heat source for the dryers will be high temperature thermal oil. The sediment moisture content is reduced in the dryers from 39% to 10%. Water vapor from the drying of the sediment is exhausted to a vapor collection system, as described in *Dryer exhaust gas treatment system*, below.

Dry sediment storage and dry sediment feed mixer

Each drying line will have a 110-ton live bottom storage hopper, for a total of 330 tons of dry sediment storage. The dry sediment storage hopper discharges sediment to a small 9-ton surge hopper at the wet sediment mixers or to a dry sediment mixer. A 200-ton lime silo provides a supply of ground limestone to the feed mixer to work as a fluxing agent for control of the melting temperature. The dry sediment mixer will have a capacity of 9.2 tons. A conveyor will transport the material discharged form the dry sediment mixer to the melter inlet surge hopper.

Melter feeding and operation

A total of six chargers supply the melter with dry and fluxed river sediment. (See Drawing Q8596-006 – Melter Plan View.) The melter heats the sediment to 2500 ^{o}F to 2900 ^{o}F. The molten material exits the main melter section and enters the forehearth. The forehearth then drains the hot glass into a water-filled quench tank. The glass furnace is heated with oxy-fuel fired burners. The burners are supplied by the fuel rails. Oxygen is provided by an on-site oxygen generation plant. Hot exhaust gas generated by the melter is exhausted into a hot gas heat recovery system and air quality control system (AQCS) prior to the exhaust stack.

Melter quench tank

The quench tank is water-filled, and receives the hot glass flow from the melter. The direct contact of the hot gas with the water will cause the material to solidify and fracture into the glass aggregate product. A set of screws will withdraw, dewater and transport the material to an adjacent storage pile. The quench tank will be in a closed cooling water loop. The quench tank temperature will be maintained by constant circulation of water through a set of heat exchangers.

Melter off-gas treatment

The exhaust gas from the melter exits at 2700 to 2850 ^{o}F into the exhaust flue. (See Drawing FVRS-PF-102 – Process Flow Diagram, Melter Exhaust Heat Recovery and AQCE.) The exhaust flue also receives cool exhaust gas from an exhaust gas recirculation fan, which blends the cooler and hotter gases together within the flue. The cooled flue gas enters a heat recovery/thermal oil (HRTO) unit. The HRTO heats thermal oil, which is used to supply energy to the sediment drying process. The flue gas exiting the HRTO is split into two parts. The first part is used as flue gas recirculation, and is routed back through a flue gas recirculation fan (FGR) into the blending section of the melter exhaust gas flue. The second part of the flue gas flow enters a high-energy venturi and packed tower section. The venturi section removes particulate from the exhaust, and the packed tower section removes SO_2. The water in the packed tower is in a closed recirculation loop. The packed tower operates in the condensing mode, requiring some blowdown water from the loop. Sodium hydroxide is added to the process to control pH and provide for optimum SO_2 removal.

After the exhaust gas exits the packed tower, the flue gas enters a wet electrostatic precipitator (wet ESP). This device provides additional control and is especially effective for fine particulate. The exhaust flow from the wet ESP proceeds to a carbon filter bed. The carbon filter bed provides for absorption of mercury, and can also absorb PCBs and other chlorinated organic compounds. After the exhaust gas exits the carbon absorber, the gas is exhausted through a 95-foot tall and 30-inch diameter stack.

Thermal oil energy supply and distribution system

The main purpose of the thermal oil system is to provide thermal energy to the sediment dryers for the drying process. (See Drawing FVRS-PF-104 – Process Flow Diagram, Thermal Oil Supply System.) The system consists of the following components:

(1) A thermal oil auxiliary heater, which uses natural gas to heat thermal oil. The amount of natural gas fired in the unit is a function of the dryer plant energy demand.

(2) The HRTO unit, which recovers energy from the melter hot exhaust gas.

(3) An auxiliary heat sink (AHS), which dissipates heat in the event that one or all of the sediment dryers are not operational, while the HRTO continues to recover heat from an operational melter. The AHS unit is a standard shell and tube heat exchanger. Heat will be dissipated to the circulation water system.

(4) Circulation pumps and control valves, which provide the necessary energy to force the circulation of the thermal oil at the required process conditions.

(5) A thermal oil expansion tank.

(6) A thermal oil drain tank. Both items (5) and (6) are standard features for thermal oil systems, and are necessary for proper operation and maintenance of the system.

Dryer exhaust gas treatment system

The process of sediment drying forces water that is contained in the wet sediment feed to vaporize, while the sediment is in contact with the heated components of the sediment dryer. To assist in efficient removal of the water vapor, a controlled volume of sweep air is admitted into the dryer housing. (See Drawing FVRS-PF-103 – Process Flow Diagram, Dryer Off Gas Treatment.) At the opposite end of the dryer housing, the combined water vapor and sweep air are exhausted from the dryer unit. The exhaust gas passes through a mechanical collector. The mechanical collector removes a significant fraction of the sediment dust that is entrained in the water vapor/sweep air mixture that is exhausted from the dryer. The dust is collected and the material is recombined with the dry sediment in any one of the dry sediment storage silos.

To provide for a "zero emissions" design, the water vapor/sweep air mixture is introduced into a venturi scrubber and packed tower arrangement. This device is similar in function to the venturi collector and packed tower used on the melter exhaust gas treatment system. The venturi collector removes an additional fraction of entrained sediment dust from the dryer exhaust stream. The water vapor is then condensed and removed by the packed tower section of the unit. A steady stream of water is circulated from a closed cooling water loop to the top of the packed tower. The condensing process increases the water volume in the cooling loop, requiring some blowdown of water to a wastewater treatment facility.

The exhaust gas that exits the packed tower section is circulated by an exhaust fan. The entire dryer and exhaust system operates under a negative pressure condition to prevent fugitive dust emissions from the dryer casings. Since some inward air leakage is expected, a small vent stream will be split off from the exhaust fan. The exhaust stream will be directed to one of the burners on the melter. This will provide destruction of any organics in the dryer exhaust. The balance of the exhaust fan discharge is directed back to the sediment dryers as the sweep air source.

Circulating cooling water system

A number of systems will require a steady stream of cooling water to remove heat. All of the systems use non-contact heat exchangers to prevent contamination of the cooling water system. The cooling system is a closed system. Heat is dissipated through a mechanical draft cooling tower. Make-up water is required to recover some evaporative losses from the system. Blowdown water will need to be drained from the cooling tower to limit total dissolved solids (TDS) concentrations in the water.

Circulating water is pumped to the users by motor-driven centrifugal pumps. The major users of circulation water are:

(1) Indirect heat exchanger for exhaust gas packed tower cooling system.
(2) Indirect heat exchanger for dryer exhaust gas packed tower cooling system.
(3) Aggregate quench tank indirect cooling heat exchanger.
(4) Cooling water for the thermal oil auxiliary heat dissipation unit.
(5) Charger cooling water.
(6) Cooling water required for the oxygen generation system.

ASU oxygen supply

Oxygen will be generated on-site. The approximate oxygen volume needed will require the generation of 171 tons of oxygen per day. The oxygen will be generated with a technology called gaseous oxygen generation, or GOX. This technology generates oxygen at a purity of 99.5%. The oxygen is generated in the gas phase (non-cryogenic). The plant will be completely designed and constructed from the foundations up by a third party. No detailed process description is included in this scope document. The sediment drying and melting facility will need to interconnect utilities and infrastructure to the oxygen plant to minimize infrastructure development costs. The main requirement will be the supply of 4160V power from the dryer and melting facility electric substation to the ASU.

Dust control system

All of the sediment conveyors, storage hoppers and silos will have a closed design. To prevent fugitive emissions from the conveyor systems, they will be ventilated continuously. The exhaust will be directed to a high efficiency fabric filter. All collected dust will be directed back to one of the dry sediment storage silos.

Plant wastewater summary

There are three sources of process wastewater for the operation. The condensate from the dryer exhaust results in a waste stream of 48 GPM. This waste stream has a wastewater loading of 1000 to 3000 ppm of total suspended solids (TSS). The suspended solids will consist of fines that are carried out of the dryers. There is a potential that PCBs are attached to the sediment particles, requiring this flow stream to be treated by the same wastewater treatment facility processing the dredged sediment.

The packed tower on the exhaust of the melter generates 15 GPM of constant blowdown. This flow stream will have high concentrations of both TSS and chemical oxygen demand (COD), and will need to be sent for additional wastewater treatment. The discharge volume and concentration levels will not require any pretreatment prior to discharge to the publicly owned treatment works (POTW).

The cooling tower generates a maximum blowdown flow of 37 GPM. This flow can be permitted as a non-contact cooling water source. If the proper permits are obtained, it is possible to either discharge the water into the stormwater sewer system or into the final effluent of the wastewater treatment facility for the dredge water.

SUMMARY OF ASSUMPTIONS

Several assumptions were made in preparing the Cost Study estimates contained in this report. These assumptions were made based on our understanding of the scope of the project at the time of the award of the Department's Purchase Order. Others were made based on equipment design features provided by suppliers and the data which was then available. Final engineering and design would address variances from the assumptions.

1. The following assumptions were made relative to incoming sediment:
   a. Previously de-watered to 50% solids
   b. Previous removal of all debris, including metal and other material greater than ¼-inch in size
   c. Received in a non-frozen state, even during winter operations
   d. Gross calorific value (GCV) of approximately 1300 Btu per pound
   e. Loss on ignition of approximately 29%
   f. Fluxing requirement of 15% lime
   g. Self-agglomeration does not occur at 39% moisture or lower
2. The following assumptions were made relative to facility permitting:
   a. No hazardous waste incinerator regulations apply
   b. Oxyfuel is best available control technology (BACT) for NO_x control
   c. Wet scrubber at 95% control is BACT for SO2
3. The following assumptions were made relative to the facility design:
   a. Facility is staffed for 24 hours per day, year-round
   b. Site soils are capable of loading to 2500 pounds per square foot
   c. No provisions have been incorporated for soil testing or boring
   d. No compactor is assumed necessary for feeding to the melter
   e. The dryers require 10 Btu per square foot per degree F
   f. Facility design will be for an industrial area
4. The following assumptions were made relative to the cost of supplies:
   a. The gas price was assumed to be $3.25 per million Btu
   b. The electricity price was assumed to be 4½ cents per kilowatt hour

c. The lime flux cost was assumed to be $25.00 per ton
d. The oxygen cost is assumed to be 6 cents per hundred cubic feet from a 3rd party

5. No provisions were included for the following items:
   a. Salvage/removal at the end of the plant's economic life
   b. Dredging, dewatering, and delivery of cake solids
   c. Hedges or other financial instruments on commodity prices
   d. Site development costs other than those explicitly listed
   e. Financing costs during and after plant construction and working capital requirements

COST SUMMARIES

Capital Costs

The cost to build the melter facility is estimated to be approximately $36,800,000. (See Table 1 – Projected Capital Costs.) The primary equipment costs include the melter ($7,500,000, installation included), the material handling system ($3,000,000), and the dryers ($2,600,000). The main building is estimated at $2,600,000 and the sediment storage building is $1,800,000. Mechanical and electrical contracting is expected to be $10,000,000.

Operating Costs

The cost to operate the melter facility is estimated to be approximately $6,800,000 annually. (See Table 2 – Projected Operating Costs.) The primary cost drivers for the facility would be labor, supplies, and fuel.

Unit Cost Analysis

Over the 15-year projected life of the facility, approximately 3.15 million tons of contaminated river sediment would be processed. The present worth of the project, assuming construction and operating costs listed above, a State of Wisconsin interest rate of 5% (used as the discount rate), and glass sales of $2 to $25 per ton, is between $84,600,000 and $106,000,000. This results in a present worth unit cost between $26.29 and $32.92 per ton. (See Table 3 – Estimated Present Worth Cost for 250 Glass Ton per Day Sediment Melting Plant.)

SENSITIVITY ANALYSIS

Overview

A series of sensitivity analyses have been performed on the base project. These analyses estimate the capital, O&M, and unit cost of melter projects of varying sizes. These costs were derived using a combination of build-up estimates, generally accepted scale factors, and operational experience. The base case project was used as a reference.

Each major capital line item was analyzed to determine the new expected values, factoring in the impacts of the larger or smaller sized plants. For example, the slope of the cost curve of a melter is rather flat because a large portion of the cost of a melter is fixed. Sediment dryer plants, in comparison, scale fairly well due to the use of multiple dryer lines for each facility (increasing or decreasing the capacity of the plant is done by using more or fewer dryer lines).

The O&M line items were also analyzed individually to determine the new expected values. These items fall into two categories: fixed and variable O&M. Variable O&M items include natural gas, oxygen, electricity, and lime flux, the consumption of which varies in proportion to the amount of processing. Fixed O&M included staffing, G&A, and maintenance, although these items were individually estimated for each plant size.

Project Sizes

The project sizes were varied as indicated:

A. 1 x 250: This is the base case project described in this report. This facility has one sediment melter rated at 250 glass tons per day and three dryers rated at 200 wet ton per day (each), along with the associated balance of plant.
B. 2 x 250: This facility has two sediment melters each rated at 250 glass tons per day and six dryers rated at 200 wet ton per day (each), along with the associated balance of plant.
C. 2 x 375: This facility has two sediment melters each rated at 375 glass tons per day and ten dryers rated at 180 wet ton per day (each), along with the associated balance of plant.

D. 1 x 100: This facility has one sediment melter each rated at 100 glass tons per day and one dryer rated at 250 wet ton per day, along with the associated balance of plant.

Sediment Storage

The sensitivity analysis included provisions for each project to operate at 240 or 350 days per year. Limiting operations to 240 days per year would coincide with the 8-month dredging season, and avoid the capital expenditure of a building to store sediment and minimize potential permitting problems with storing such material and reduce. To operate 350 days per year, a storage would be used into which one-third of the de-watered sediments would be placed during the dredging season. During the non-dredging season, the accumulated inventory would be used as feedstock to the melter plant. For each 250 glass ton per day increment of capacity, sufficient storage could be accomplished using a 60,000 square foot building. The estimated cost of such a building would be $1.8 million per 250 glass ton/day unit.

Stand-alone Facility Design

The melter projects can be designed to be stand-alone facilities or integrated into the operation of an adjacent industrial facility with which it can share resources. Integration tends to be more applicable to the smaller projects (1x100 and 1x250). It was assumed that the 1x100 project would not be feasible without integration with an existing industrial facility. The 1x250 project was studied both as a stand-alone and as integrated. The 2x250 and 2x375 plants have sufficient volume to allow full independent staffing, and therefore were studied as stand-alone.

A provision was also included to account for special foundation requirements associated with integrated projects. This is because many area industrial plants are located along shorelines with poor soil load bearing capacities.

CONCLUSION

At the beginning of the Glass Aggregate Feasibility Study, Minergy had performed some preliminary analyses that indicated a unit cost in the range of $40 - $60 per ton. The results from the Cost Study confirm those initial results.

Table 1
Projected Capital Costs for 250 Glass Ton per Day Sediment Melting Plant

Item	Cost
Melter (delivered and installed)	$ 7,511,976
Dryer (total for 3, equipment only)	$ 2,588,505
Material handling system	$ 3,019,923
Dryer off gas system equipment	$ 394,515
Thermal oil system equipment	$ 995,579
AQCE system equipment	$ 468,931
BOP equipment	$ 845,081
Utilities equipment	$ 488,383
Mechanical contractor	$ 7,886,711
Electrical contractor	$ 2,113,548
Start-up costs	$ 763,277
Main building	$ 2,634,966
Engineering	$ 5,274,684
Sediment Storage Building	$ 1,800,000
TOTAL:	$ 36,768,000

Table 2
Projected Operating Costs for 250 Glass Ton per Day Sediment Melting Plant

Item	Annual Cost
Gas	$1,315,860
Electricity	$1,086,750
Labor	$2,125,000
Supplies	$1,612,310
Lime Flux	$447,125
G&A	$257,000
TOTAL:	$6,844,045

Table 3
Estimated Present Worth Cost for 250 Glass Ton per Day Sediment Melting Plant

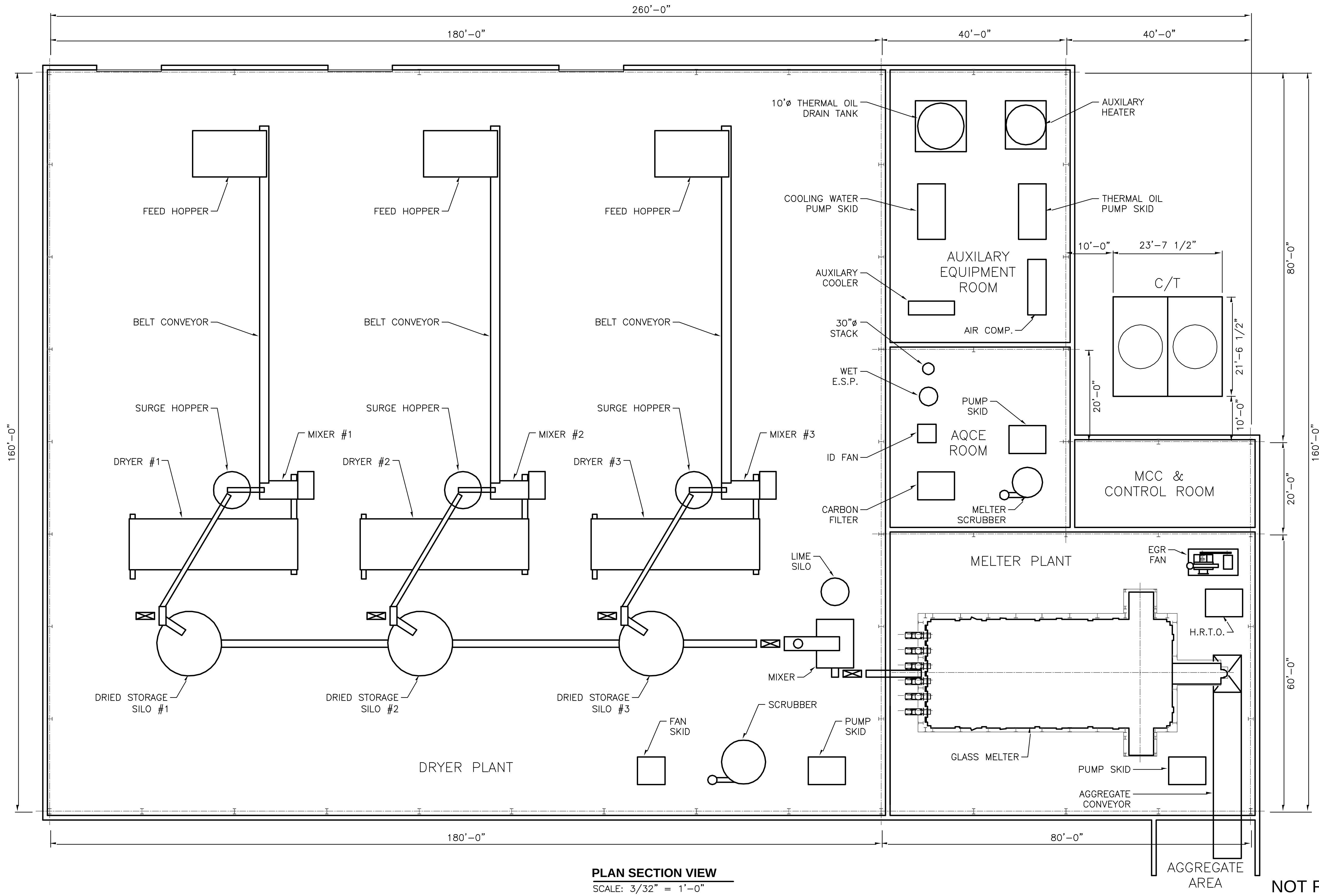
Assumptions:		
Project life =	15	years
Interest rate =	5.0%	
Days per Year =	350	
Sediment processing rate =	613	tons daily
Total sediment processed =	3,218,250	tons over project life
Construction costs =	$36,768,000	
Operating costs =	$6,844,000	annually
Income from glass sales =	$2 - $25	per ton of glass sold
Glass production rate =	255	tons daily

Estimated Costs:	**Initial Costs**	**Net Annual Costs**
Construction costs	$36,768,000	
Operating costs with no glass sales		$6,844,000
Operating costs minus glass income at $2/ton		$6,665,208
Operating costs minus glass income at $25/ton		$4,609,104

Total Present Worth Cost of Project:	
No glass sales	$107,806,380
With glass sales at $2/ton	$105,950,583
With glass sales at $25/ton	$84,608,925
Unit Costs (Per Ton of Sediment Processed):	
No glass sales	$33.50
With glass sales at $2/ton	$32.92
With glass sales at $25/ton	$26.29

Table 4
Summary of Sensitivity Options
Sediment Melting Plant

	1x100 Integrated No Storage	1x100 Integrated Storage	1x250 Integrated No Storage	1x250 Integrated Storage	1x250 Standalone No Storage	1x250 Standalone Storage	2x250 Standalone No Storage	2x250 Standalone Storage	2x375 Standalone No Storage	2x375 Standalone Storage
Daily capacity (tons)	240	240	613	613	613	613	1,226	1,226	1,840	1,840
Days/yr Operation	240	350	240	350	240	350	240	350	240	350
Project Life (years)	15	15	15	15	15	15	15	15	15	15
Sediment Processed (million tons)	0.86	1.26	2.21	3.22	2.21	3.22	4.41	6.44	6.62	9.66
Capital ($million)	25.50	26.25	36.99	38.79	34.97	36.77	63.19	66.79	87.39	92.79
Annual O&M ($million)	2.30	2.76	4.73	6.13	5.44	6.84	9.29	12.17	12.57	16.74
NPV before Glass Sales ($million)	49.35	54.86	86.04	102.40	91.44	107.81	159.58	193.16	217.88	266.50
Unit Cost (assuming $2 Glass) (dollars per ton of wet cake)	**$ 56.54**	**$ 42.96**	**$ 38.41**	**$ 31.24**	**$ 40.86**	**$ 32.92**	**$ 35.58**	**$ 29.43**	**$ 32.32**	**$ 27.01**
Unit Cost (assuming $25 Glass) (dollars per wet ton of cake)	**$ 49.91**	**$ 36.33**	**$ 31.78**	**$ 24.61**	**$ 34.23**	**$ 26.29**	**$ 28.95**	**$ 22.80**	**$ 25.68**	**$ 20.38**



PLAN SECTION VIEW

SCALE: 3/32" = 1'-0"

CONFIDENTIAL
NOT FOR CONSTRUCTION

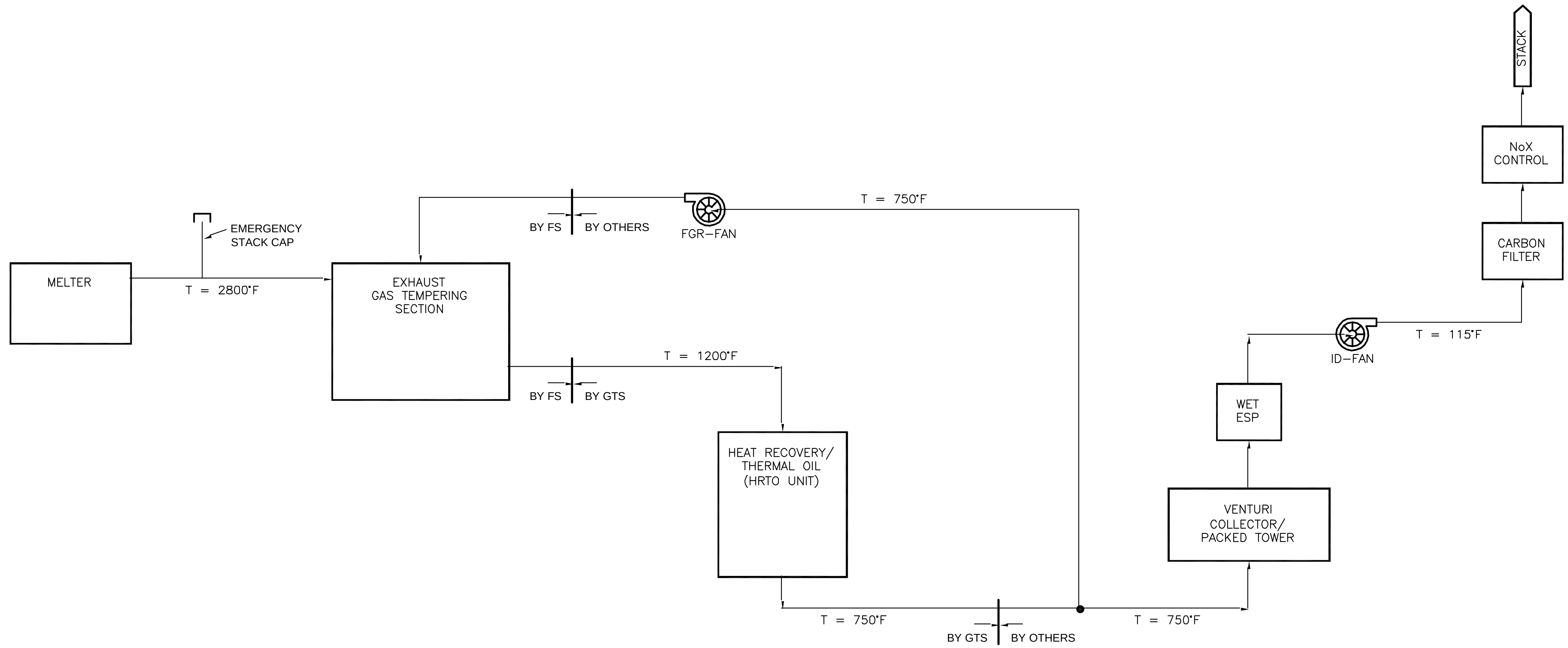
Rev. No.	Revision Description	Date	Drwn.	Chk'd
0	Issue for Review	11/28/01	RDK	TJB

THE DESIGN DATA AND INFORMATION CONTAINED HEREIN IS PROPRIETARY TO MINERGY / GLASSPACK LLC. NO PORTION OF THIS INFORMATION IS TO BE RELEASED EXCEPT AS AUTHORIZED THROUGH PRIOR WRITTEN APPROVAL BY MINERGY / GLASSPACK LLC.

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Conceptual General Arrangement
Main Processing Plant
Plan View At Grade Elevation (0'-0")
Fox Valley River Sediment

Date: December 2001
Scale: As Shown
Drawing No. FVRS-GA-101
Rev. 0

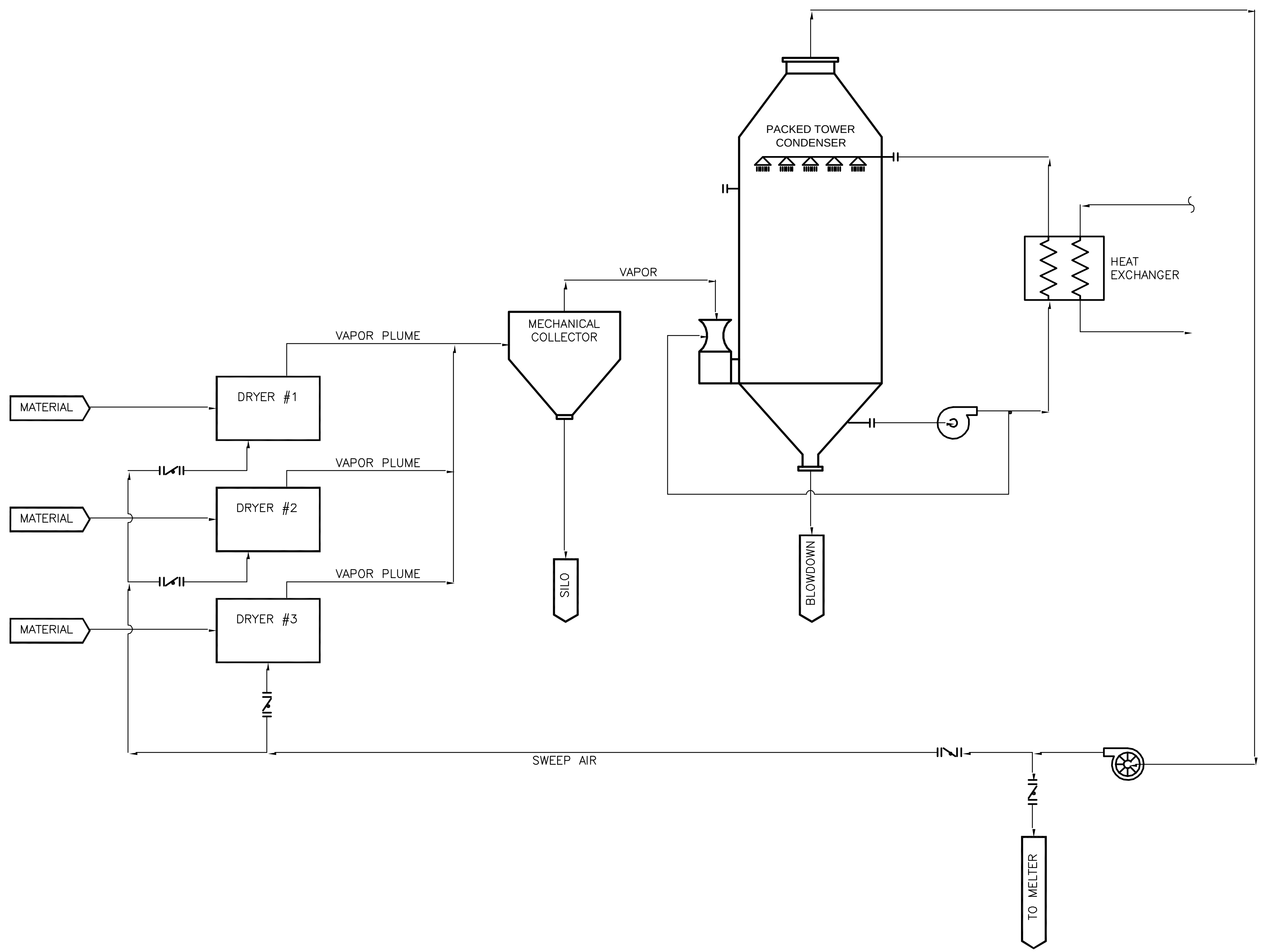


Rev. No.	Revision Description	Date	Drwn.	Chk'd

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Process Flow Diagram
Melter Exhaust Heat Recovery & AQCE
250 Glass Ton Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-PF-102
Rev.: 0



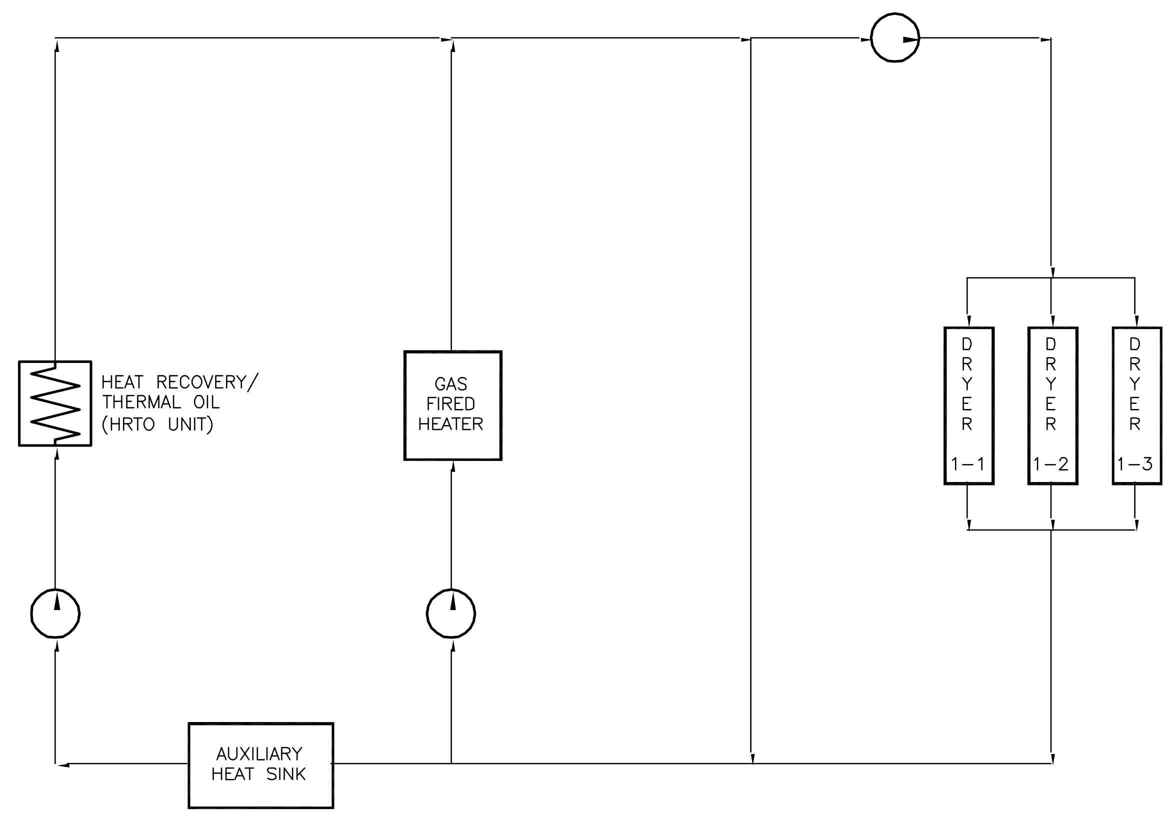
Rev. No.	Revision Description	Date	Drwn.	Chk'd

THE DESIGN DATA AND INFORMATION CONTAINED HEREIN IS PROPRIETARY TO MINERGY / GLASSPACK LLC. NO PORTION OF THIS INFORMATION IS TO BE RELEASED EXCEPT AS AUTHORIZED THROUGH PRIOR WRITTEN APPROVAL BY MINERGY / GLASSPACK LLC.

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Process Flow Diagram
Dryer Off Gas Treatment
250 Glass Ton Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-PF-103
Rev.: 0



Rev. No.	Revision Description	Date	Drwn.	Chk'd

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Process Flow Diagram
Thermal Oil Supply System
250 GlassTon Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-PF-104
Rev.: 0

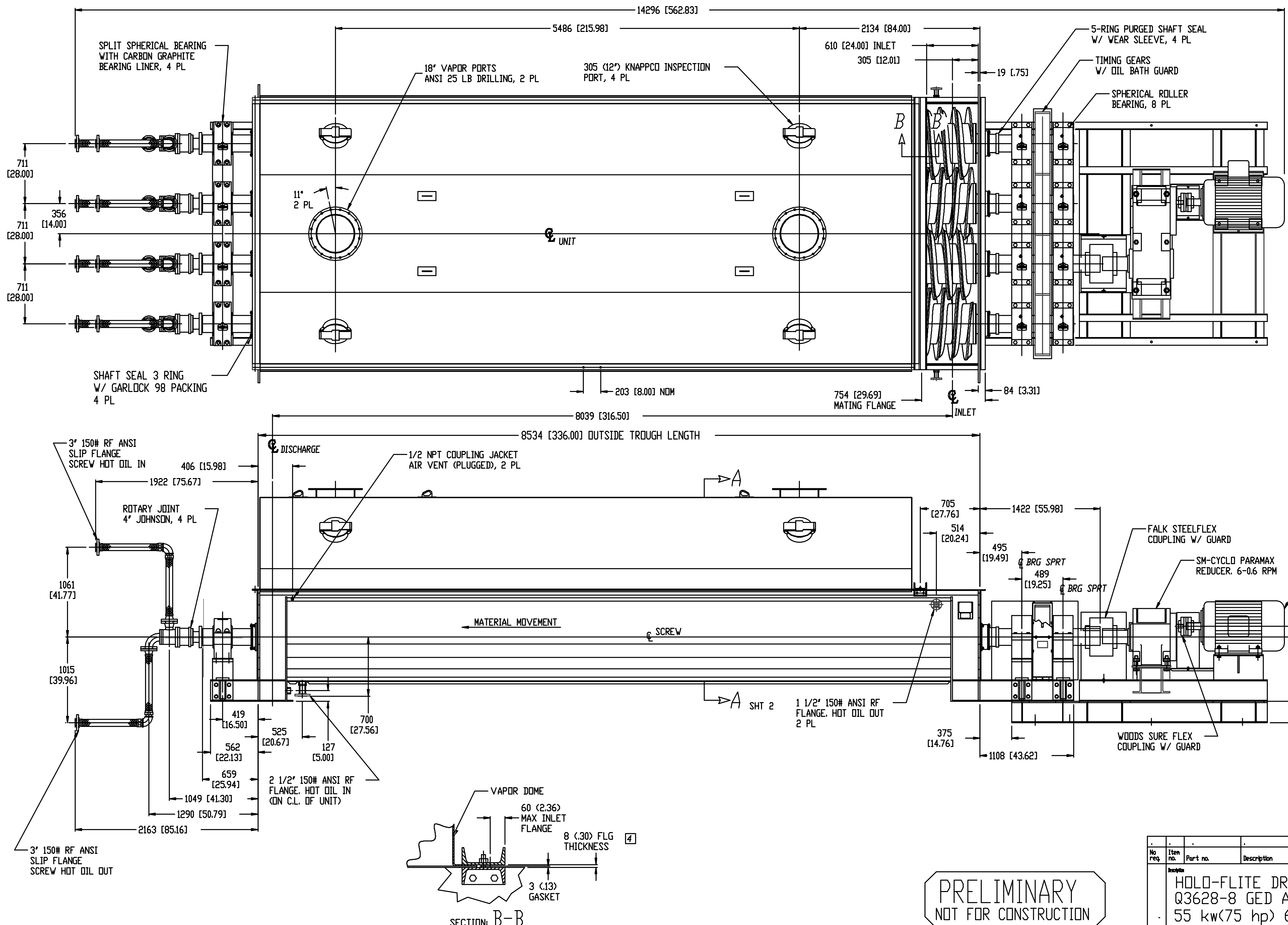
	A	INITIAL DRAWING RELEASE

ALL DIMENSIONS ARE MILLIMETERS.

GENERAL ARRANGEMENT DRAWING TOLERANCES, ISO 2768-1, CLASS DESIGNATION COARSE (C)
VALUES SMALLER THAN THOSE LISTED BELOW TO BE NOTED NEAR DIMENSION ON FIELD OF DRAWING.

ALL DIMENSIONS ARE MILLIMETERS.

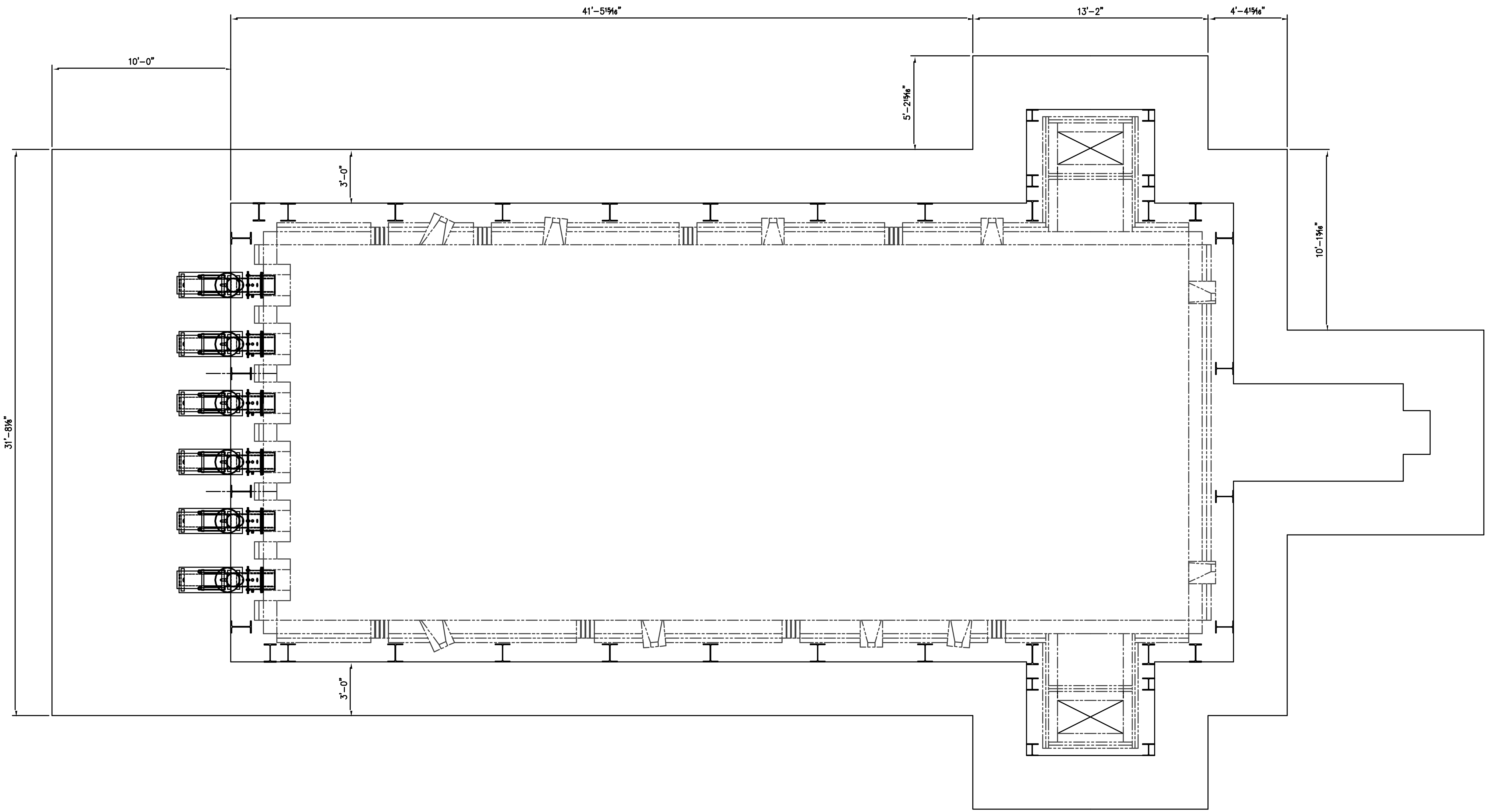
PERMISSIBLE DEVIATIONS FOR LINEAR DIMENSIONS, BASED ON LENGTH L (mm).										PERMISSIBLE DEVIATIONS FOR EXTERNAL RADII AND CHAMFER HEIGHTS, (mm).			PERMISSIBLE DEVIATIONS OF ANGULAR DIMENSIONS, USE SHORTER SIDE OF THE ANGLE L (mm).				
0.5 ≤L ≤3	3 ≤ L ≤ 6	6 < L ≤ 30	30 < L ≤120	120 < L ≤ 400	400 < L ≤1000	1000 < L ≤2000	2000 < L ≤ 4000	4000 < L ≤ 8000	8000 < L ≤12000	0.5 ≤L ≤3	3 < L ≤ 6	6 < L	L ≤ 10	10 < L ≤50	50 < L ≤ 120	120 < L ≤ 400	400 < L
± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3	± 4	± 5	± 6	± 0.4	± 1	± 2	± 1° 30′	± 1°	± 0° 30′	± 0° 15′	± 0° 10′



No req.	Item no.	Part no.	Description	Material	Drawing	Mass kg each
.	.	.	.	.	.	.

Description
HOLO-FLITE DRYER-HOT OIL
Q3628-8 GED A36 DIRECT
55 kw(75 hp) 6-0.6 RPM

Drawn: J. ANDERSON	Date: 6NOV01		
Checked: D. CLEAR	Date: .		
Approved: J. KRAMER	Date: .		
Reference Dwg: .			
Projection	File name: PC1100309-1	Scale: 1:22	Revision: A
	Size: A1	Drawing number: PC1100309	Sheet: 1



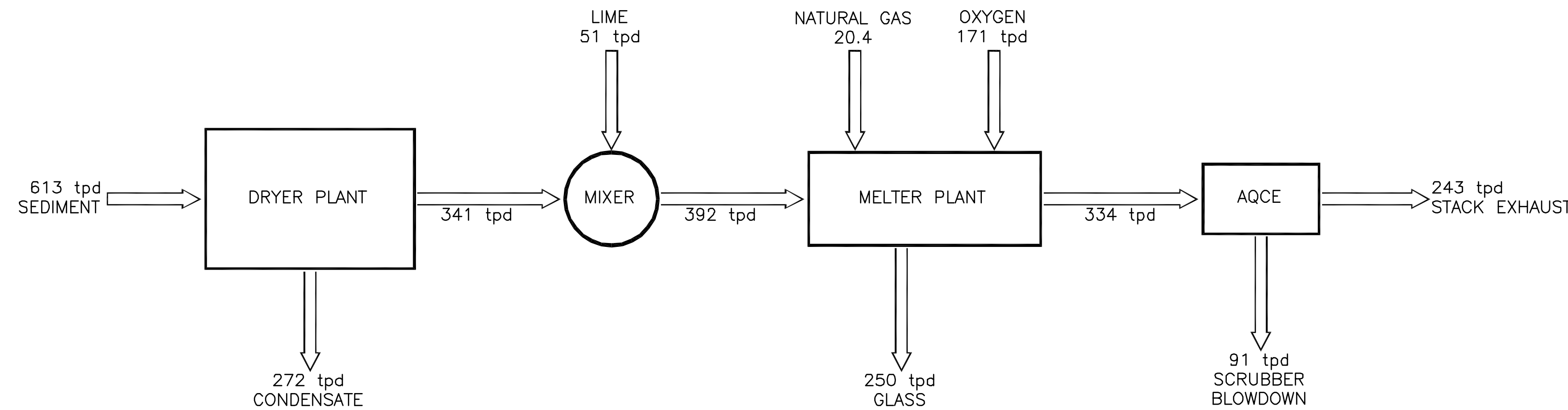
FRAZIER-SIMPLEX, INC. Engineers

ENGINEERS & CONSULTANTS TO THE GLASS & STEEL INDUSTRIES SINCE 1918.

250 TPD
GENERAL ARRANGEMENT
STEEL PLAN VIEW
FOR : MINERGY
WISCONSIN

DRAWN MPH	DATE 6/21/01	FILE	CAD FILE WIQ8596/Q8596-006
ENGINEER	SCALE 3/8"=1'-0"	DRAWING NO.	
CHCK'D	CONTRACT 8596	Q8596-006	

ile: M:\CAD - FURNACE\WIQ\WIQ8596 - MINERGY - 275 TPD\Q8596-006A.DWG Last edited: JUL. 31, 01 @ 09:59 a.m. by: mhalpern



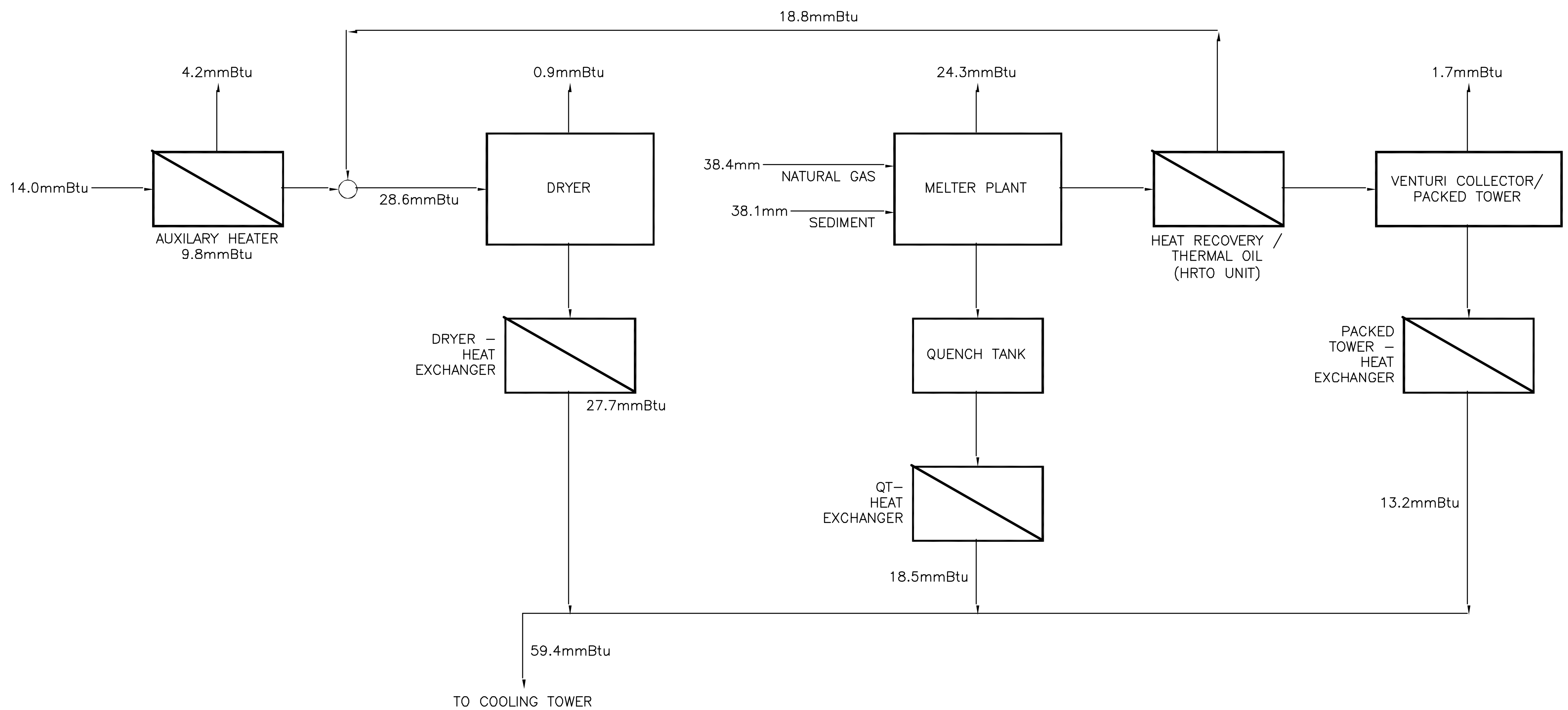
Rev. No.	Revision Description	Date	Drwn.	Chk'd

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Mass Balance

250 Glass Ton Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-MB-101
Rev.: 0



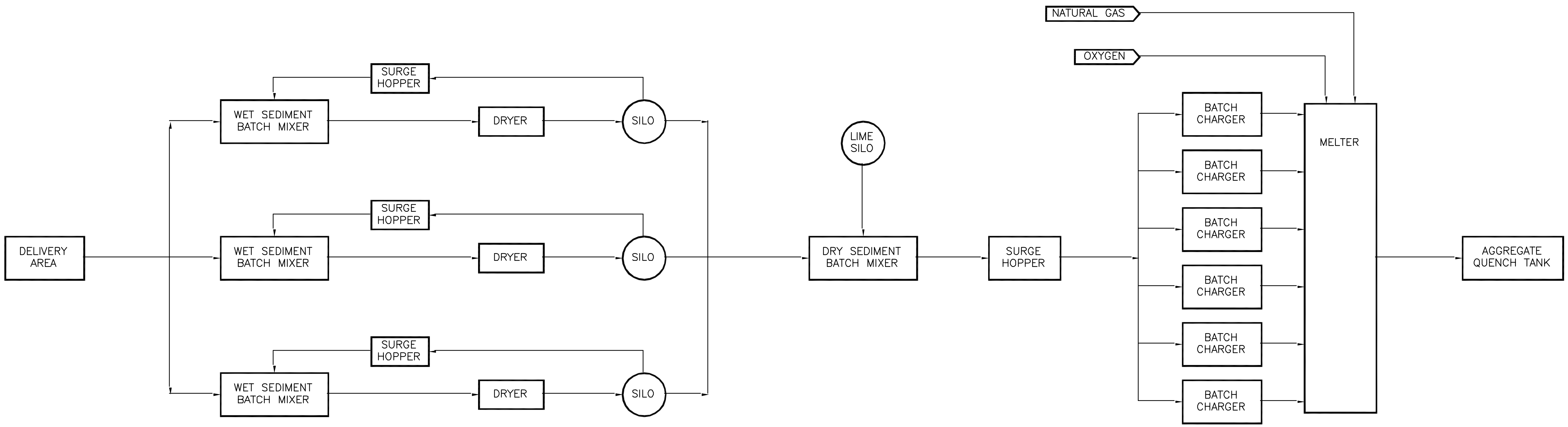
Rev. No.	Revision Description	Date	Drwn.	Chk'd

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Energy Balance

250 Glass Ton Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-EB-101
Rev.: 0



LEGEND:

mc = MOISTURE CONTROL
tpd = TONS PER DAY
ts = TOTAL SOLIDS CONTENT

Rev. No.	Revision Description	Date	Drwn.	Chk'd

MINERGY™
A WISCONSIN ENERGY CORPORATION
1512 S. Commercial St., Neenah, WI 54956

Process Flow Diagram
Sediment Drying and Preparation
250 Glass Ton Plant
Fox Valley River Sediment

Date: December 2001
Scale: None
Drawing No.: FVRS-PF-101
Rev.: 0