MET PRO CORPORATION

Systems Division

INSTRUCTIONS FOR OPERATION AND MAINTENANCE
OF
REDUNDANT THERMAL OXIDATION SYSTEMS w/ ACID GAS TREATMENT
QUENCH & CAUSTIC SCRUBBER

MODEL NO. T-3-G / SCRUBBER
SERIAL NO. 62280
P.O. # 4500085962

FURNISHED FOR:

ROCHE VITAMINS, INC.
45 WATERVIEW BLVD.
PARSIPPANY, NJ. 07054

LOCATION:

ROCHE VITAMINS, INC.
200 ROCHE DRIVE
BELVIDERE, NJ. 07823

CALL: MET-PRO PRODUCT SUPPORT HOTLINE @ 215-631-9500 ext 209 or productsupport@met-pro.com

TO ARRANGE FOR FIELD SERVICE AND REPLACEMENT PARTS

AUGUST 2003 REV. A

1.0 INTRODUCTION

Thank you for purchasing a Met-Pro system. You can have confidence Met-Pro Corporation offers complete systems development and full customer services to assure proper installation, smooth start-up, and reliable operation of this equipment.

Our Systems Division, in Kulpsville, Pennsylvania, provides engineering, fabrication, installation, and servicing capabilities for standard and custom designed thermal and catalytic oxidizers, solvent recovery systems, systems for emission control of chemical, petrochemical, and pharmaceutical processes, paper printing, textile treating, metal decorating, food processing, and other solvent use operations. We also engineer, manufacture, sell, and service a wide array of systems which control the acidity/alkalinity of wastewater and reduce or remove the chemical and biological contaminants contained in industrial wastewaters and landfill leachates.

This document presents the operating and maintenance instructions for your Met-Pro system. These instructions presuppose the equipment has been installed and tested and is ready for normal operation. Installation instructions, if appropriate, are provided elsewhere.

If the equipment has not been properly installed in accordance with the installation instructions of the manufacturer, it may not operate correctly. Do not attempt to operate the system until it has been started by a technician from Met-Pro Corporation.

The instructions do not propose to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Met-Pro Corporation.

Field service on this equipment may be obtained at nominal rates from Met-Pro Systems Division, One Towamencin Center, 1555 Bustard Road, P.O. Box 325, Kulpsville, Pennsylvania, telephone number 215-631-9500 ext 209. Telephone support from the Service Department of Met-Pro is also available at this number. Please contact them to determine if the problem can be solved by a telephone discussion. Additionally, help is also available at *productsupport@met-pro.com*.

3.0 APPLICABLE DRAWINGS

The following drawings are applicable to this system.

General Arrangement	113312-62280 (3 sheets)
Process and Instrumentation	113313-62280 (6 sheets)
Process Flow Diagram	113311-62880 (3 sheets)
Electrical Schematic Diagram	
E801	113314-62882 (10 sheets)
E811	113314-62881 (10 sheets)
Control Panel Assembly	
E801	113348-62282
E811	113348-62881
Quench Assembly	7236-9
Scrubber Detail	7236-14
Oxidizer Detail	
E811	113316-62282
E801	113316-62281

4.0 GENERAL DESCRIPTION

The Met-Pro Thermal Oxidizer Systems control emissions from process operations at the Roche Vitamin (RVI) facility in Belvidere, New Jersey. The system is designed for the following process conditions:

Process flow	3,000 scfm @ 70 F
Solvent loading	342 lb/hr
Inlet pressure	+21" w.c.

The system consists of two identical thermal oxidizers (E801, E811) with hot gas quench (E802, E812) and acid scrubbers (C801, C811). Each oxidizer is capable of handling 3,000 scfm. In normal operation both oxidizers operate on a flow of 1,500 scfm each.

Each thermal oxidizer system consists of the following major components:

1. Inlet tee section with isolation and purge air valves, frp combustion air blower.

2. Oxidizer with burner, pilot and main gas valve train piping, deflagration arrester and instrumentation.

3. Hot gas quench with water sprays, booster pump and piping, recycle tank and pump with instrumentation.

4. Packed bed scrubber, with circulation pump, sump heater, low rate and high rate caustic addition valves, and instrumentation.

5. FRP exhaust blower with VFD control.

6. Control panel

7. Outlet stack common to both oxidizers.

In addition to the two oxidizers a process stream bypass valve and stack are also furnished. The MCC is furnished by RVI.

During normal operation the process stream is sent to both oxidizers by one of the vent header blowers supplied RVI. If one of the oxidizers is not ready for operation the entire flow is directed to the other oxidizer. If both oxidizers are out of service the process stream is directed to the bypass stack. The operation described below is identical for both oxidizers.

The process stream containing up to 50% LEL of the voc enters the oxidizer through the burner and serves as combustion air for the burner. Natural gas is added as required to maintain 1800°F in the combustion chamber. The chamber has a horizontal flow pattern and is sized to provide a 1.5 second retention time at full flow.

The hot products of combustion including HCl are pulled to the quench by the exhaust blower. This maintains a negative pressure on the oxidizer. The negative pressure prevents acid formed in the destruction of the chlorinated solvent from escaping the hot oxidizer interior and

contacting cooler exterior interfaces where it would condense and cause corrosion. The oxidizer utilizes a hot shell design which also prevents corrosion of the carbon steel shell by keeping the shell temperature above the dew point of the acid vapors. Expanded metal provides personnel protection around the hot shell.

The oxidizer burner is an Bloom gas burner with fast mix nozzle. The burner is capable of firing on air flows of 1,500 to 3,000 scfm. The design of the burner insures good mixing of the process stream with the natural gas that results in uniform products of combustion exiting the burner. The products are then released to the quench as carbon dioxide, hydrochloric acid and water vapor.

The hot air stream from the oxidizer is cooled in the quench by two fresh water sprays and one recycle spray. The recycle flow is the overflow from the scrubber that is collected in the quench tank. A vertical pump mounted on the tank provides the flow to the recycle spray nozzle. The quench tank has automatic level make up. Overflow is sent to drain. This overflow purges the system to slow the build up of solids. Water addition to the overflow maintains the water outlet temperature to 140°F when required.

In case of power failure or Emergency Stop, emergency fire water is sent to the first quench spray to prevent heat migration from the oxidizer to the scrubber.

The cooled gases and spray water exit the quench and flow into the scrubber where the acid concentration is reduced. The scrubber uses a counter flow design with the air stream moving up through the packed bed while the scrubbing liquid is sprayed down on the bed. A vertical pump continually circulates the water from the sump through the packed bed. The pH of the scrubber water is maintained automatically by caustic addition in the recirculation line. The scrubber has automatic level make up and constant water addition to replace water lost by continuous overflow to the quench tank.

The air stream exits the scrubber and is released up the stack by the exhaust blower.

The oxidizer instrumentation, components and control panel are rated NEMA 4.

The valve train is designed to meet IRI and NFPA requirements for a gas fired oxidizer.

The control panel is furnished to monitor and control the SVE system. This panel houses an Allen Bradley PLC 5/20 programmable controller, PV1400 operator interface terminal, temperature recorder and the burner flame safety relay. PLC control loops provide temperature control for the oxidizer burner, draft control for the exhaust blower and pH control for the scrubber.

5.0 OPERATING INSTRUCTIONS

The two oxidizer systems provided to RVI are identical. All descriptions, interlocks and procedures apply equally to both units. For clarity only tags numbers for oxidizer E-0801 components are listed in the text.

5.1 General Operation

The Met-Pro Thermal Oxidation System is designed to be operated in automatic mode from the control panel. The system will start up and shut down automatically with minimum operator attention required during normal operation. System functions are controlled by an Allen Bradley PLC 5/20 programmable controller and monitored at the operator interface terminal. The sequence of operation, timing functions, and interlocks are provided by the program. PID control loops programmed in the PLC controller provide control of oxidizer temperature, draft and scrubber pH. The burner flame safety relay and hardwired interlocks are located in the control panel. The control panel is a NEMA 4 enclosure, powered by 120vac. Motor controls are housed in the MCC provided by RVI.

System alarm conditions are displayed and acknowledged on the operator terminal. Alarm conditions are divided into two categories. They are Safety Limits and Alarms. When a Safety Limits alarm occurs, the burner and oxidizer will shut down. An Alarm condition will provide a warning but does not stop operation. Limit and alarm interlocks are detailed below. System status, selected timer settings, set point, valve positions, and control loops are also displayed on this terminal. The terminal uses touch screen input.

5.1.1 Operator Controls

A CONTROL POWER selector switch is provided on the control panel. Turning this switch to the OFF position will shut off control power to the unit. CONTROL POWER ON is indicated by a red light.

An EMERGENCY STOP push-button is provided on the control panel. Pushing the button will remove power from the digital outputs, stop all system operations and open the quench emergency water valve. Removing the Run Permit DCS interlock will also stop all system operation.

Operation is initiate from the START screen. The OXIDIZER START push-button initiates orderly start-up and operation of the equipment through the programmable controller. Similarly, the "OXIDIZER SHUTDOWN" push-button initiates the controlled shutdown of the equipment. The oxidizer can also be shutdown remotely by the DCS STOP interlock.

AUTO-MANUAL mode selectors and Manual mode OFF-ON selectors are provided on operator terminal screens for combustion air blower, quench pump, booster pump, scrubber pump and exhaust blower. The AUTO mode will allow the component to operate as required by the control program. The MANUAL mode allows the component to operate without interlocks from the control program when the manual OFF-ON selector is set to ON. The MANUAL mode should only be used for maintenance and checkout purposes. Selectors must be in AUTO for normal operation. All motors are started and stopped by momentary run and stop output contacts wired to the MCC. Local stop buttons are provided on the equipment

TIT T802.50	TEMPERATURE TRANSMITTER	MET-PRO	200062281Q07

TAG NUMBER	DESCRIPTION	MANUFACTURER	MODEL NUMBER
V T802.530	COOLING WATER SOLENOID 1/2"	MET-PRO	200062281Q10
FI T802.53	COOLING WATER FLOW IND. 0.5/5		
LSL T802.51	LOW LEVEL SWITCH	MET-PRO	200062281Q12
LC T802.52	FILL LEVEL SWITCH	MET-PRO	200062281Q12
LV T802.52	FILL WATER SOLENOID 1/2"	MET-PRO	200062281Q10
PI P802.51	PUMP PRESSURE GAUGE 0/60	MET-PRO	200062281Q05
FI P802.52	PUMP FLOW INDICATOR	MET-PRO	200062281Q13
FSL P802.53	PUMP LOW FLOW SWITCH 15/50	MET-PRO	200062281Q14
FE C801.50	FLOW ELEMENT	MET-PRO	200062281S01
FIT C801.50	FLOW TRANSMITTER	MET-PRO	200062281S02
L C801.51	LOW LEVEL SWITCH	MET-PRO	200062281S03
LC C801.52	FILL LEVEL SWITCH	MET-PRO	200062281S03
LV C801.52	FILL WATER SOLENOID 1/2"	MET-PRO	200062281Q10
FI C801.53	MAKE UP WATER FLOW IND. 0.5/5	MET-PRO	200062281Q11
V C801.54	MAKE UP WATER SOLENOID 1/2"	MET-PRO	200062281Q10
PDIT C802.55	PACKED SECTION DP TRANS.	MET-PRO	200062281S04
PDIT C802.56	MIST ELIMINATOR DP TRANS.	MET-PRO	200062281S04
AE C801.57A/B	pH PROBE	MET-PRO	200062281S05
AT C801.57A/B	pH TRANSMITTER	MET-PRO	200062281S06
AV C801.57A	LOW RATE CAUSTIC VALVE	RVI	
AV C801.57B	HIGH RATE CAUSTIC VALVE	RVI	
PI P801.51	PUMP PRESSURE GAUGE 0/30	MET-PRO	200062281S07

OXIDIZER	MANUFACTURER:	MET-PRO
E801	MODEL:	T-3-G
	RATING:	3,000 SCFM, 1800^{O}F
	REMARKS:	Refractory lined

BURNER	MANUFACTURER:	MET-PRO
	MODEL:	200062281B01
	RATING:	8.0 mm BTU/HR
	REMARKS:	Hastelloy C276, Refractory block

COMBUSTION AIR BLOWER

B803	MANUFACTURER:	MET-PRO
	MODEL:	200062281B05
	RATING:	3,000 CFM @ 21"W.C. @ 70^{O}F
	MOTOR:	20 HP,1800 RPM, TEFC, 256T, 460/3/60
	REMARKS:	FRP housing and wheel,

OXIDIZER ISOLATION DAMPER

V B801.59	MANUFACTURER:	MET-PRO
V B801.60	MODEL:	200062281B02, 14"DIA. Butterfly
	REMARKS:	Fail closed

OXIDIZER FRESH AIR DAMPER

V B803.52	MANUFACTURER:	MET-PRO
	MODEL:	200062280B03, 14"DIA. Butterfly
	REMARKS:	Fail open

BYPASS DAMPER

V B801.58	MANUFACTURER:	MET-PRO
	MODEL:	200062280B04, 16"DIA. Butterfly
	REMARKS:	Fail open

DEFLAGRATION ARRESTER

DA E801.67	MANUFACTURER:	MET-PRO
	MODEL:	200062281B06, 12"
	REMARKS:	Teflon lined, Hastelloy C276 internals

QUENCH

E801	MANUFACTURER:	MET-PRO
	MODEL:	7236-3000
	RATING:	3,000 SCFM, 1800^{O}F
	REMARKS:	Hastelloy C276

QUENCH PUMP

P802	MANUFACTURER:	MET-PRO
	MODEL:	200062281Q15
	RATING:	50 GPM @ 120' TDH
	MOTOR:	5 HP, 3450 RPM, TEFC, 460/3/60
	REMARKS:	CPVC material

BOOSTER PUMP

P804	MANUFACTURER:	MET-PRO
	MODEL:	200062281Q16
	RATING:	16 GPM @ 70' TDH
	MOTOR:	0.5 HP, 3450 RPM, TEFC, 460/3/60
	REMARKS:	SS material

SCRUBBER

C801	MANUFACTURER:	MET-PRO
	MODEL:	PT508-60S
	RATING:	3000 SCFM
	REMARKS:	FRP

SCRUBBER PUMP

P801	MANUFACTURER:	MET-PRO
	MODEL:	200062281S11
	RATING:	120 GPM @ 75' TDH
	MOTOR:	5 HP, 1725 RPM, TEFC, 460/3/60
	REMARKS:	CPVC material

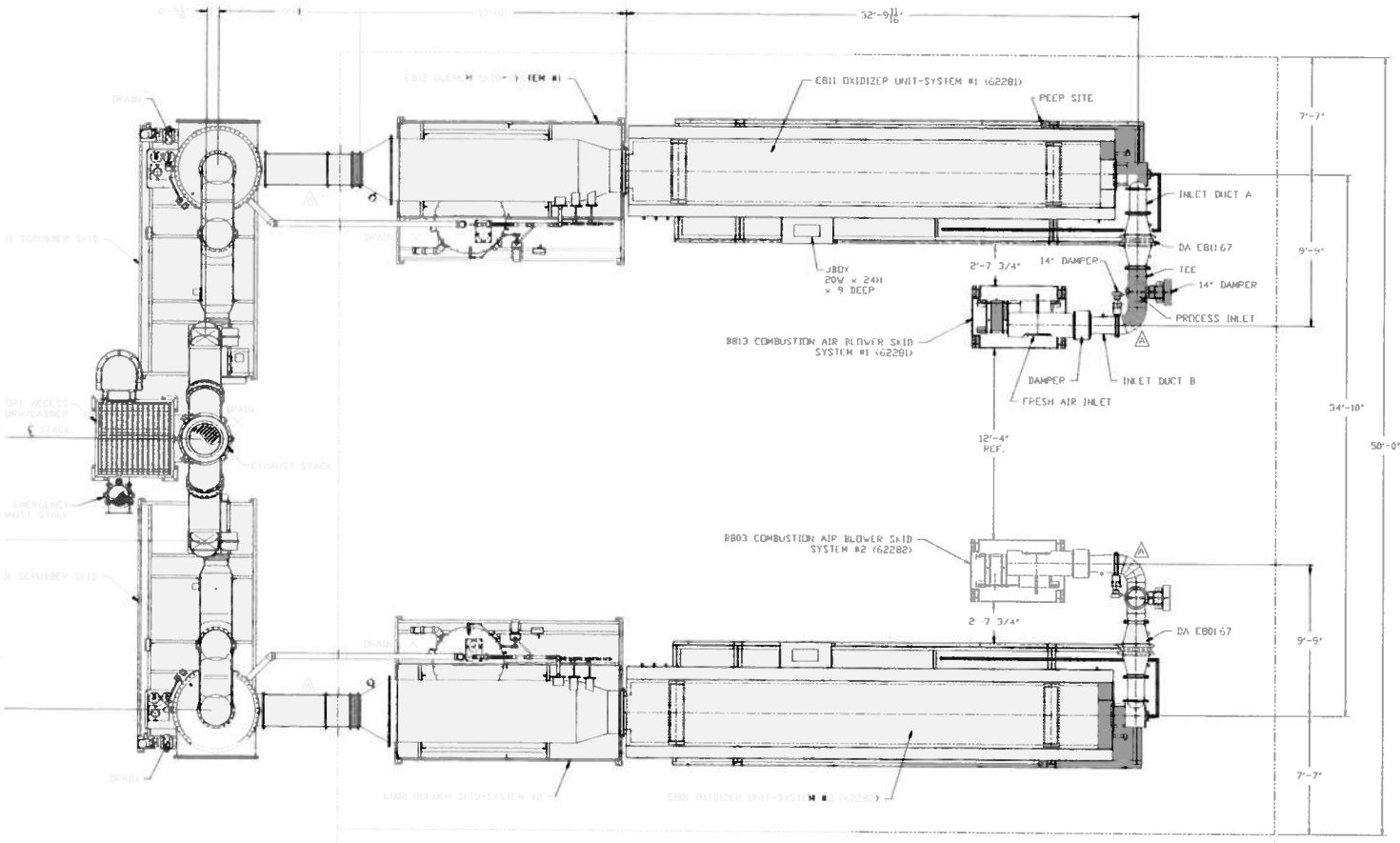
SCRUBBER HEATER

H801	MANUFACTURER:	MET-PRO
	MODEL:	200062281S12
	RATING:	4.5kW, 460/3/60

EXHAUST BLOWER

B804	MANUFACTURER:	MET-PRO
	MODEL:	200062281S16
	RATING:	6,879 CFM @ 11"W.C. @ 1770^{O}F
	MOTOR:	250 HP,1800 RPM, TEFC, 284T, 460/3/60
	REMARKS:	FRP housing, Hastelloy C276 wheel

REVISIONS				
DR	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED COMBUSTION FAN OUTLET DUCT WORK & CHANGED QUENCH OUTLET DUCT LENGTH PER MEETING WITH RVI ON 9/19/02	9/30/02	JCE



PLAN VIEW

NOTES:
1. ALL DIMENSIONS ARE APPPOXIMATE PENDING FINAL ARRANGEMENT APPROVAL.
2. BURNER PIPING AND ELECTRICAL CONTROLS ARE DESIGNED TO COMPLY WITH NFPA AND IRI STANDARDS FOR GAS FIRED BURNERS.
3. ALL OXIDIZER SKID MOUNTED COMPONENTS WILL BE WIRED TO JUNCTION BOX ON OXIDIZER. ALL OTHER WIRING AND CONDUIT FURNISHED AND INSTALLED BY CUSTOMER.
4. ALL "UPPORTS FOR OFF SKID COMPONENTS DUCTWORK, PIPING AND CONDUIT FURNISHED AND INSTALLED BY OTHERS
5. ALL CONTROL AND SIGNAL WIRING AND CONDUIT FROM CONTROL PANEL TO OFF SKID COMPONENT IS FURNISHED AND INSTALLED BY OTHERS.
6. ALL POWER WIRING LOCAL DISCONNECTS AND CONDUIT ARE FURNISHED AND INSTALLED BY OTHERS
7. WHEN VIEWING FROM BURNER END SYSTEM #1 IS RIGHT HAND AND SYSTEM #2 IS LEFT HAND.

	62280
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
BREAK SHARP EDGES TO
ALL FILLETS TO
MATERIAL

DRAWN	MM	DATE 11 SEP 02
CHECKED	RB	19 SEP 02
APPROVED	JCE	9 SEP 02

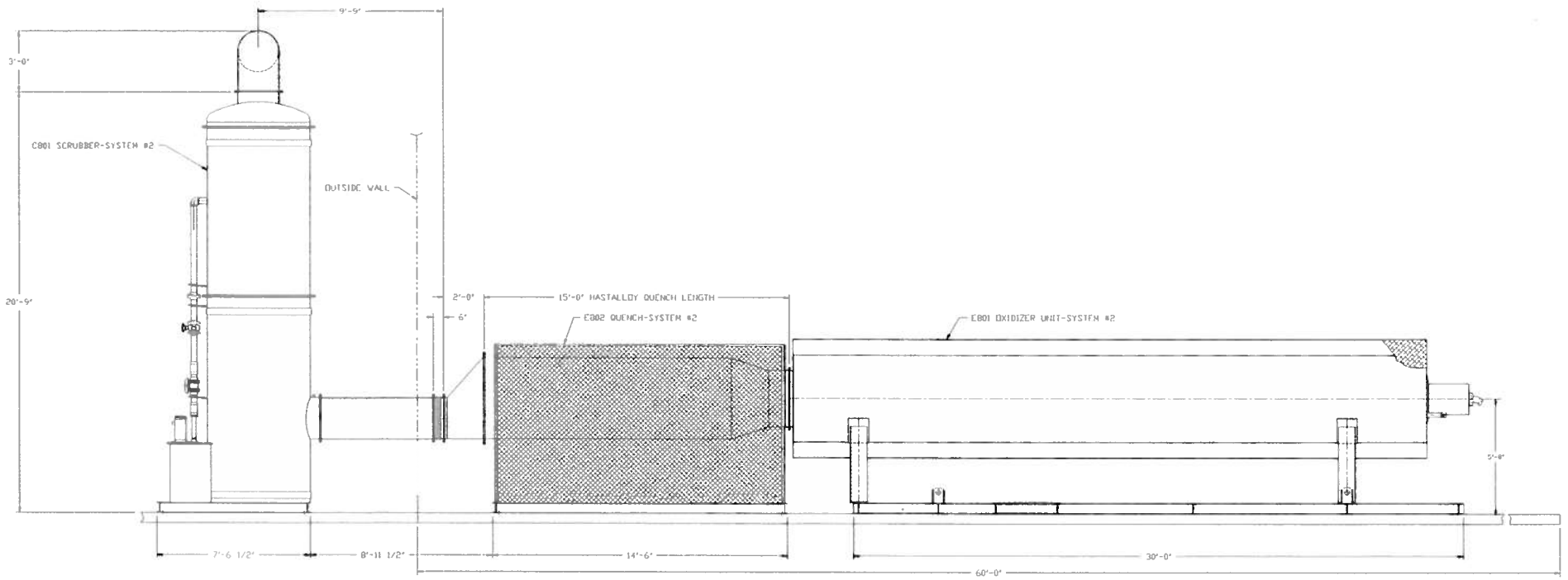
MET-PRO CORPORATION Systems Division KULPSVILLE, PA. 19443

TITLE
GENERAL ARRANGEMENT
REDUNDANT 3000 SCFM
THERMAL OXIDIZERS
WITH ACID GAS TREATMENT

SIZE	CAGE IDENT NO	DWG NO.	REV.
D	91340	113312-62280	A

FILE NAME: 62280GAL.DWG SCALE 1/4"=1" WEIGHT SHEET 1 OF 3

REVISIONS			
ZONE LTR	DESCRIPTION	DATE	APPROVED



ELEVATION VIEW

	62280
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES
BREAKS SHARP EDGES TO
ALL FILLETS TO
MATERIAL

		DATE
DRAWN	MM	11 SEP 02
CHECKED	PD	19 SEP 02
APPROVED	JCE	19 SEP 02

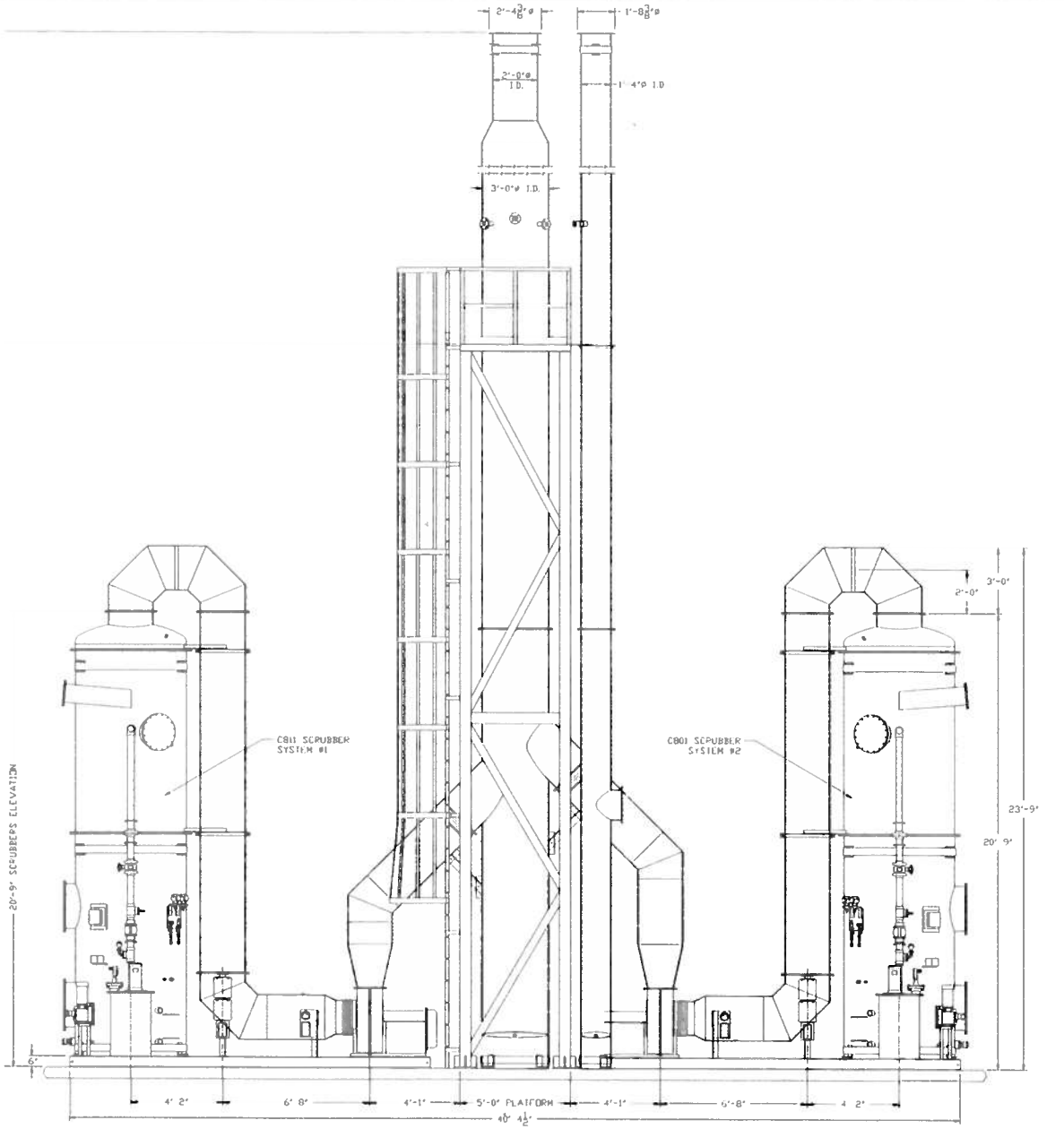
FILE NAME: 62280GA2.DWG

MET PRO Systems Division
KULPSVILLE, PA. 19443

TITLE
GENERAL ARRANGEMENT
REDUNDANT 3000 SCFM
THERMAL OXIDIZERS
WITH ACID GAS TREATMENT

SIZE	CODE IDENT NO	DWG NO	REV.
D	91340	113312-62280	

SCALE 3/8"=1' WEIGHT SHEET 2 OF 3



REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPROVED

	62280
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
BREAKS SHARP EDGES .10
ALL FILLETS .10
MATERIAL

DRAWN	HM	5 JUL 02
CHECKED	PD	19 SEP 02
APPPOVED	JCE	19 SEP 02

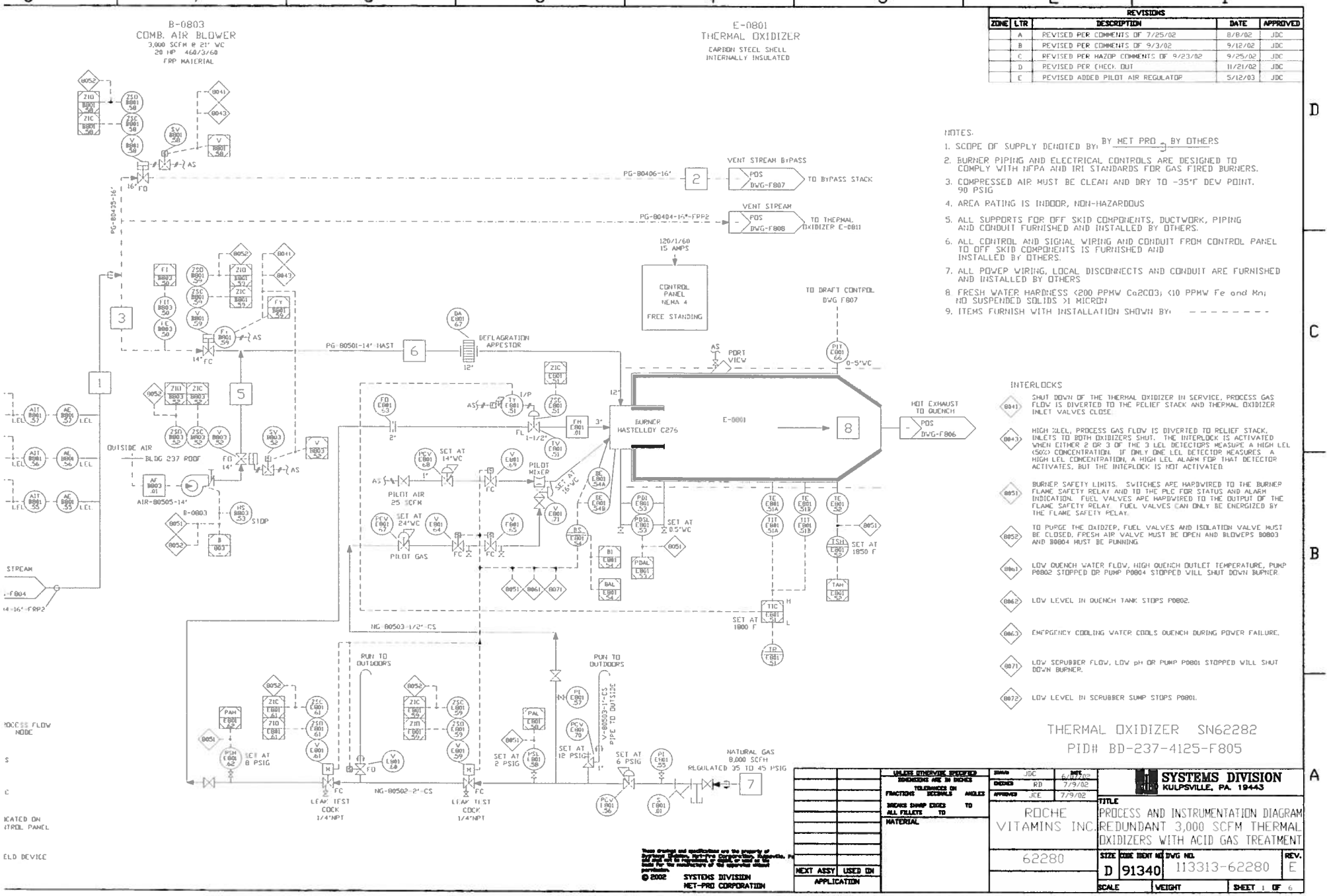
FILE NAME: 62280GA3.DWG

MET-PRO Systems Division
HULPSVILLE, PA. 19443

TITLE
GENERAL ARRANGEMENT
REDUNDANT 3000 SCFM
THERMAL OXIDIZERS
WITH ACID GAS TREATMENT

SIZE	CODE IDENT NO.	DWG NO.	REV.
D	91340	113312-62280	

SCALE 1/2"=1" | WEIGHT | SHEET 3 OF 3



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED PER COMMENTS OF 7/25/02	8/8/02	JDC
	B	REVISED PER COMMENTS OF 9/3/02	9/12/02	JDC
	C	REVISED PER HAZOP COMMENTS OF 9/23/02	9/25/02	JDC
	D	REVISED PER CHECK OUT	11/21/02	JDC
	E	REVISED ADDED PILOT AIR REGULATOR	5/12/03	JDC

NOTES:

1. SCOPE OF SUPPLY DENOTED BY: BY MET PRO ┐ BY OTHERS
2. BURNER PIPING AND ELECTRICAL CONTROLS ARE DESIGNED TO COMPLY WITH NFPA AND IRI STANDARDS FOR GAS FIRED BURNERS.
3. COMPRESSED AIR MUST BE CLEAN AND DRY TO -35°F DEW POINT, 90 PSIG
4. AREA RATING IS INDOOR, NON-HAZARDOUS
5. ALL SUPPORTS FOR OFF SKID COMPONENTS, DUCTWORK, PIPING AND CONDUIT FURNISHED AND INSTALLED BY OTHERS.
6. ALL CONTROL AND SIGNAL WIRING AND CONDUIT FROM CONTROL PANEL TO OFF SKID COMPONENTS IS FURNISHED AND INSTALLED BY OTHERS.
7. ALL POWER WIRING, LOCAL DISCONNECTS AND CONDUIT ARE FURNISHED AND INSTALLED BY OTHERS
8. FRESH WATER HARDNESS <200 PPMW $CaCO_3$; <10 PPMW Fe and Mn; NO SUSPENDED SOLIDS >1 MICRON
9. ITEMS FURNISH WITH INSTALLATION SHOWN BY: - - - - - - - -

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES
BREAKS SHARP EDGES TO
ALL FILLETS TO
MATERIAL

NEXT ASSY | USED ON
APPLICATION

DRAWN	JDC	6/12/02
CHECKED	RD	7/9/02
APPROVED	JCE	7/9/02

SYSTEMS DIVISION
KULPSVILLE, PA. 19443

TITLE
PROCESS AND INSTRUMENTATION DIAGRAM
REDUNDANT 3,000 SCFM THERMAL OXIDIZERS WITH ACID GAS TREATMENT

ROCHE VITAMINS INC.

62280

SIZE	CODE IDENT NO.	DWG NO.	REV.
D	91340	113313-62280	E

SCALE | WEIGHT | SHEET 1 OF 6