SOIL VAPOR EXTRACTION UNITS

1. Type of Contaminant: ☐ **DIESEL** ☐ **GASOLINE** ☑ **OTHER:** MEK (2-butanone)

2. Contaminated Material: ☑ **SOIL** ☑ **WATER**

3. Control Device: ☐ **CARBON CANISTER** ☑ **CATALYTIC OXIDIZER** ☐ **BIOFILTER**
   ☑ **THERMAL OXIDIZER** ☐ **OTHER:** _____

4. Concentration of Each Contaminant (specify unit of measure): 170,000 ppmV MEK (max April 2011); 109,000 ppmV MEK (ave April 2011)

5. Estimated VOC Rates: **BEFORE CONTROL DEVICE** 2,590 (with auto dilution) **LB/DAY**

   AFTER CONTROL DEVICE 25.9 **LB/DAY**

6. Projected**:** **Start-Up Date** July 11, 2011 **Completion Date** January 11, 2012

7. Describe type, capacity, and efficiency of controls for air emissions: Type: thermal/catalytic oxidizer;
   Capacity: 700 scfm, ~2,590 lb MEK/day (assumes operation at 100% LEL); Efficiency of controls: 99% - thermal mode, 98% catalytic mode

8. Attach full details of scope of work, treatment procedures, equipment specifications, and test results. Include calculations used to estimate VOC and Federal Hazardous Air Pollutant Emissions.

Answer to Question 8:

Scope of Work - Soil Vapor Extraction/Thermal-Catalytic Oxidation

A Compact-THERM SVE thermal oxidizer (Compact-THERM) system equipped with an explosion proof blower (20 HP, 700 scfm) and electrical control panel enclosure will be installed at the Hexcel Casa Grande site for removal of MEK from vadose zone soils. The Compact-THERM will be equipped with a moisture separator (condensate knockout tank) and transfer pump. The unit will be installed in the asphalt driveway area next to the property eastern fence line and ~300 ft north of the UST tank farm concrete cover pad. This location was chosen to minimize interference with normally heavy traffic flow. A subcontractor will excavate a 12-inch wide by 18-inch deep trench and install 4-inch diameter galvanized pipe from SVE well HCG-5 to the Compact-THERM unit. The trench will be back filled to 3-inches above the top of the pipe with previously excavated trench soils, the remainder of the trench will be back filled with 1-sack slurry to ensure 95% compaction to the base of the existing asphalt, and the asphalt removed during excavation will be replaced. The existing HCG-5 subsurface well vault will be removed and replaced with a 17-inch x 30-inch (inside dimensions) x 24-inch deep Precast vault equipped with a bolt-down galvanized steel cover. The vault assembly has an H/20 loading rating and will provide the required room for the well head completion assembly. An Enardo detonation flame arrestor will be located in the piping immediately before the Compact-THERM to prevent flames or an explosion back into the pipe toward the wellhead. The Compact-THERM and propane gas tank will be enclosed in chain-link fencing.

The Compact-THERM is expected to operate for approximately 6 months. It is anticipated that the majority of MEK will be removed from vadose soils within the first month or less, and that process gas MEK concentrations will then drop. A PID, a fixed gas monitoring instrument and a combustible gas indicator will be used to collect readings from a sampling port located in the piping from the wellhead in order to estimate total MEK mass removal from vadose soils. Any testing and reporting required by Pinal County Air Quality will be performed. When MEK levels are found to have dropped significantly, the Compact-THERM will be shut-down and removed from the site.

Treatment Procedures

The Compact-THERM SVE blower will allow flows up to 700 scfm flow from the wellhead, although initially flows from the wellhead are expected to be between 50 and 100 scfm to reduce concentrations to operational values. In thermal mode, the unit is expected to operate at MEK concentrations of about 14,000 ppmV. Air will bleed in automatically, if necessary, to reach proper VOC operation levels. The MEK in the process stream is directed through a direct-fired burner, which directly burns the MEK for efficient combustion and low make-up gas use. When process gas concentrations drop below 2,000 ppmV MEK, the unit will be switched to catalytic mode by installing a catalytic block. While operating in catalytic mode, the system will use propane gas to preheat the catalytic block to the reaction temperature required for destruction of

MEK and to supply "make up" gas to the influent soil gas stream when the concentrations drop below lower reaction limits.

Equipment Specifications

The equipment specifications, pump curve, advantages and top-view schematic for the Compact-THERM system, built by Soil-THERM Equipment, Inc., are presented in Attachment 1.

Previous Soil Vapor Extraction Test Results

A soil vapor extraction (SVE) test was performed at well HCG-5 in January 2011 using a 125 standard cubic feet per minute (scfm) blower unit to evaluate vadose zone pneumatic parameters. The results of the test indicated high vadose zone permeabilities of approximately 150 to 250 darcies (approximately 420 to 700 ft/day), values amenable to SVE.

A second SVE test was performed at well HCG-5 on January 20-21, 2011 to measure steady state MEK soil vapor concentrations for evaluating the use of SVE for vadose zone cleanup using the same blower unit as the previous test. High concentrations of MEK (1.8 percent) and what appeared to be methane (up to 5.2 percent) were detected in the SVE exhaust after approximately 30 hours of pumping. The instrument that measured methane was later

A final SVE test was performed at well HCG-5 on April 14-21, 2011 for evaluating the use of SVE for vadose zone cleanup, since the previous test was cut short due to a potential explosion hazard. Very high concentrations of MEK (from 1.9 percent to 17 percent based on lab results) were detected in the SVE exhaust within the first few hours of pumping.

All SVE tests indicate that SVE will be an effective method for removing MEK from the vadose soils. An oxidation system is necessary, as concentrations of MEK would be too high (based on the explosion hazard, inhalation hazard and VOC air quality permitting requirements) if directly released to the atmosphere.

Calculations to Estimate VOC and Federal Hazardous Air Pollutant Emissions

Thermal Mode - assuming the following:
Operation at 100% LEL MEK = 14,000 ppmV MEK in inlet stream (system will bleed in air to dilute to this concentration; may be higher depending on system operational requirements)
700 scfm flow rate

Oxidizer destruction: 14,000 ppmV MEK x (K.mol/0.0821 L-atm) x (1 atm/298 K) x 72.1 g/mol x 700 ft3/min x 60 min/hr x 24 hr/day x 28.32 L/ft3 x 1 lb/454 g = 2,594 lb/day

At 99% efficiency in thermal mode: (1-0.99) x 2,594 lb/day = **25.9 lb MEK/day emitted**

Catalytic Mode - assuming the following:
2,000 ppmV MEK in inlet stream (maximum concentration)

700 scfm flow rate

Therefore (same calc as above), oxidizer destruction = 371 lb/day

At 98% efficiency in catalytic mode: (1-0.98) x 371 lb/day = **7.4 lb MEK/day emitted (maximum)**

MEK was deleted from the Federal Hazardous Air Pollutants established list by US EPA on December 19, 2005. Although it is no longer a regulated air pollutant, MEK continues to be regulated as a VOC due to its contribution to the formation of ozone.

ATTACHMENT 1

COMPACT-THERM EQUIPMENT SPECIFICATIONS

Compact-THERM
SVE THERMAL OXIDIZER SYSTEM

SVE SYSTEM (Mounted on Oxidizer Skid)

- 6-ft (l) x 6-ft (w) x12-ft (h) skid base for oxidizer & SVE system
- Roots 59 blower, 700 cfm, 1750 rpm max 14" Hg
- SVE Blower Motor: 20 hp, TEFC, 1750 rpm, 230VAC, 3-phase motor
- Variable Frequency Drive (VFD) for 20 hp motor
- Blower has belt drive mounted motor, mounted inside noise enclosure with Roots 59 blower
- Sample port on discharge piping and inlet piping
- Dwyer DS-300-4" pitot tube with Dwyer transmitter with digital readout for Total Flow, wired to record on 8" Color Touchscreen, with 2 GB memory card
- Carbon Steel 4" Sch40 vapor piping from water knockout to burner
- Dilution Air Blower, 2 hp, to 150 cfm

MOISTURE SEPARATOR

- SOIL-THERM Stainless Steel water knockout (25 gallon capacity), 24" o.d.
- Site glass with adjustable intrinsically safe pump-on & High-High level switches
- Vacuum Relief Valve, adjustable to 14" Hg
- 4" bottom cleanout port with plug
- 1" pump hose connection w/ ball valve and check valve on pump discharge
- Inlet 0-30" Hg gauge
- Inlet sample port with ¼" ball valve
- Solberg 235P polyester filter element

TRANSFER PUMP

- Goulds Model NPE, ½ hp, 230VAC, 1-phase stainless steel knockout pump with check valve and ball valve on the discharge side of pump. 1" hose and connection to the water knockout.

***Compact-THERM* GAS FIRED OXIDIZER SYSTEM**

- *Compact-THERM* system with 24" stack section to 12-ft, raincap optional
- SOIL-THERM Model 2002 Jet-Therm burner, all stainless steel construction
- Jet-THERM burner, 100:1 turndown ratio, virtually no heat transfer loss burner.
- Oxidizer system is 24" o.d., lined with 4" ceramic fiber insulation (8#/cf) with outer layer of insulation/rigidizer for up to 1600F operation
- >99% destruction efficiency in thermal mode, >98% destruction catalytic at 300 cfm
- FM style natural gas or propane gas train, rated for 1/2-8 psig
- Gas train regulator, Equimeter 180-43, ½-2 psig spring with 5/8" internal ori., ¾" gas train inlet.
- 3" Enardo flame arrestor, Model 70803-AAF/D
- Catalyst, >98% destruction efficiency
- Null air pressure switch, Antunes JD-2
- Cooling Blower, Siemens .67hp, 230VAC, 1-phase with check valve & connecting hose

OXIDIZER SYSTEM CONTROL PANEL

- NEMA 4 panel enclosure with double latch door & disconnect, 208-230V, 3-phase, 100A
- PLC Controller with 8" Color Touchscreen Display with operating pushbuttons
- Honeywell Temperature Controllers UDC1200 for preheat & exhaust, each with 2-alarms.
- Hour meter
- Motor starters for SVE blower motor, cooling blower, and knockout pump
- Eclipse Veriflame flame safeguard system with UV scanner
- 500 VA Control Transformer with Fuses
- Chart Recorder through installed 8" Color Touchscreen, 4-channels, 2 GB memory storage
- HOA Water Pump Switch
- FOB Agoura Hills, CA
- VFD for 20 hp Motor - - - INCLUDED !

RENTAL PRICE: $3,500/mo + CA Sales Tax (minimum 6 month rental period)

Rental Options Available: Catalyst Module: $1200 + $200/month
Heat Exchanger: not available
LEL Monitor (<burner): $125/mo
Oxygen Monitor (<burner): $75/mo
Remote Internet Monitor: $150/mo + airtime
Main Blower Variable Freq. Drive: included

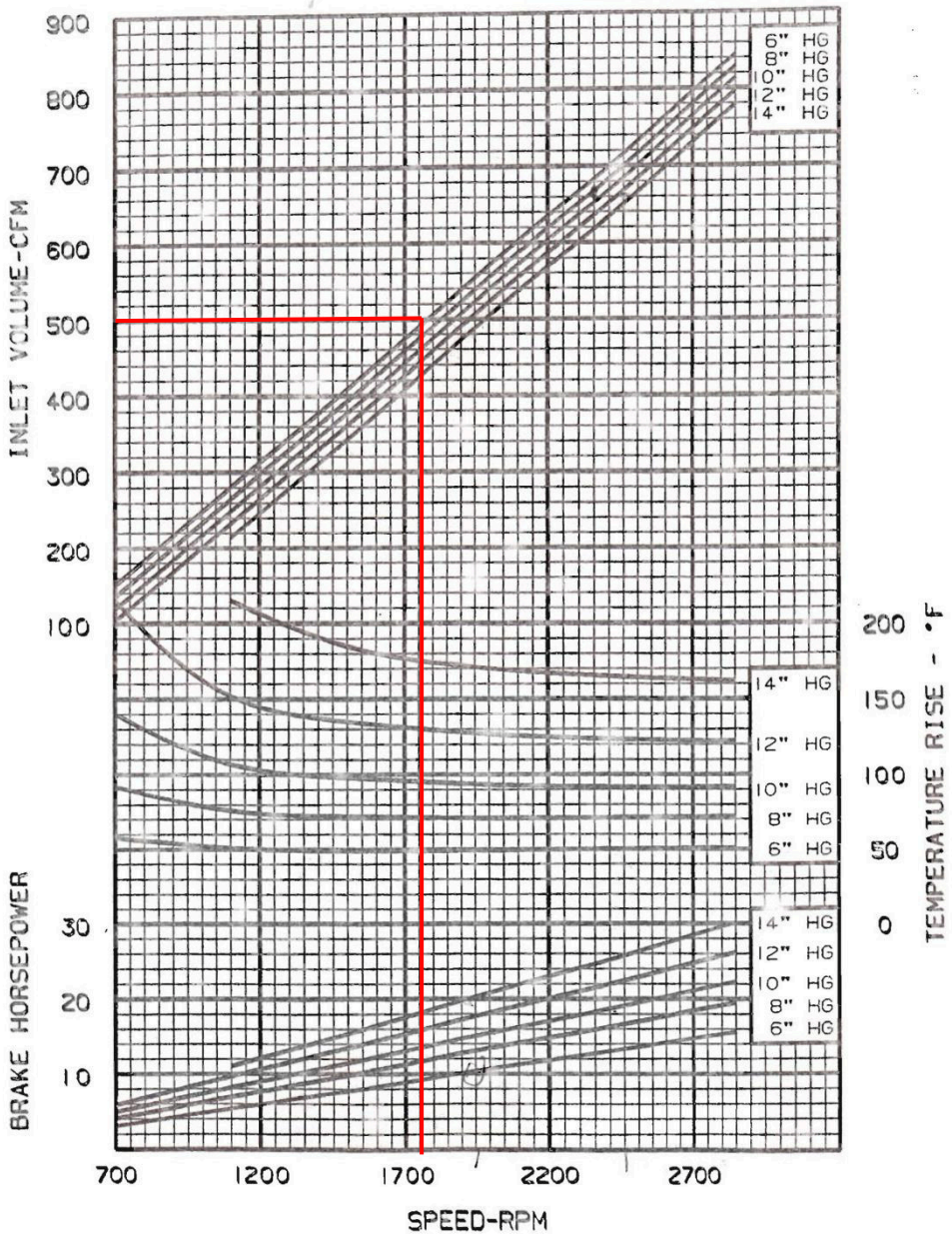
UTILITIES CONNECTIONS REQUIRED

Electrical Power Requirement: 230VAC, 3-ph, 60Hz, 100 Amps (3-ph), 100A
Natural Gas Requirement: 750 cfh @ 5 psig
Propane Gas Requirement: 200 cfh @ 5 psig

DRESSER INDUSTRIES, INC.
ROOTS DIVISION
900 WEST MOUNT STREET
CONNERSVILLE, INDIANA 47331
PRINTED IN U.S.A.

PERFORMANCE BASED ON
INLET AIR = 68°F
DISCHARGE PRESSURE = 30" HG ABS.
JULY, 1994

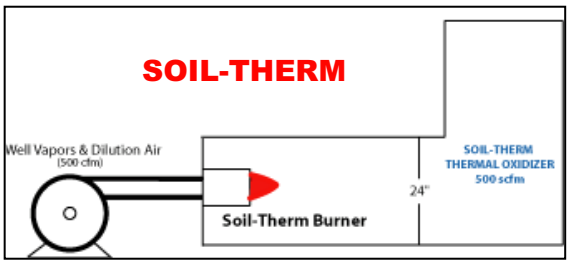
VACUUM PERFORMANCE
FRAME 59 UNIVERSAL RAI BLOWER
MAXIMUM VACUUM=15 IN. HG
MAXIMUM SPEED=2850 RPM

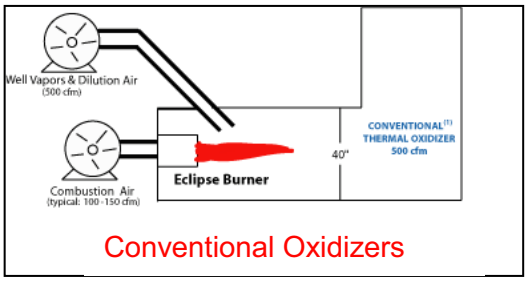


SOIL-THERM EQUIPMENT, INC.
Since 1990

Energy Savings Review (Soil-Therm vs. Conventional Oxidizers)

The following operating cost comparison between the two technologies results in a huge energy savings for our customers. In this project, please take a look at the following natural gas consumption requirements in the following operating modes at 250 scfm: (1) thermal at 25% at 1500F, (2) catalytic at 25% LEL at 700F, and (3) catalytic w/h.e. at 25% LEL at 700F[(1)]. Natural gas is currently approximately $10/MM btuh.





Soil-Therm	Gas Need (btuh)	$/hour	Annual Fuel Cost (1)
Thermal	385,000	$3.85/hr	**$33,700**
Catalytic	125,000	$1.30/hr	**$11,400**
Cat w/H.E.[(1)]	20,000	$0.20/hr	**$2,050**
Electrical (@ FLA)	~50Amps @ 230VAC, 3-ph, 60Hz		

OTHER Brands	Gas Need (btuh)	$/hour	Annual Fuel Cost (1)
Thermal	690,000	$6.90/hr	**$60,500**
Catalytic	255,000	$2.55/hr	**$22,400**
Cat w/H.E [(1)]	119,000	$1.19/hr	**$11,200**
Electrical (@ FLA)	~70Amps @ 230VAC, 3-ph, 60Hz		

The above tables demonstrates SOIL-THERM's 'direct fire' technology will save you substantial amounts of natural gas and REDUCE your fuel bill by thousands of dollars, every month! Because Conventional Oxidizer systems (doesn't matter if they use a low-NOx burner or not) employ "combustion air burners", with huge heat transfer losses during operation that result in significantly higher fuel costs, as shown in the comparison drawings above. For the GI Trucking application, SOIL-THERM will guarantee superior energy savings and lower fuel costs than any other conventional oxidizer system.

The cost savings, at every operating mode, is significant and at least twice as much natural gas consumption as the Soil-Therm system. Using a Soil-Therm system, you can also expect to generate: (1) lower NOx emissions, (2) lower Greenhouse emissions, and (3) reduce your dependence on and protect our valuable natural gas energy sources.

Recommendation. We would also recommend for long term operation that customers consider a Heat Exchanger when concentrations stay below the 25% LEL point, after dilution. The energy savings are significant, which will pay for this option in less than 6 months on reduced natural gas consumption.

[(1)] Note: Data and energy estimates provided above are estimates only. Actual results may vary.

ADVANTAGES

Using Your SOIL-THERM TECHNOLOGY

1. **Patented Combustion Technology.** SOIL-THERM is the only remediation equipment manfuacturer in California that has been awarded two US Patents for our Jet-THERM combustion remediation burner process. SOIL-THERM has spent over 20 years researching and developing aerospace combustion technologies for environmental and remediation applications. The award winning ***Jet-THERM*** technology has significant benefits over all the others by having (1) very low retention times, (2) smaller size burner with higher throughput, (3) high direct flame turbulence involves all the VOC's through the heart of the 3000F flame region, and (4) very high destruction efficiencies.

2. **Safety.** SOIL-THERM ***Jet-THERM*** direct burner technology provides greater safety features over conventional 'pre-mix' burners used by other oxidizer manufacturers. It is well documented that burners that inject the supplemental fuel separately into the flame of the burner provide significantly greater safety from flashback, and pre-ignition of the gases that could cause fires. SOIL-THERM has the perfect safety record to prove it!

3. **Energy Efficient.** Jet-THERM oxidizer technology (classified as a 'raw gas burner') will always be more energy efficient than conventional oxidizers on the market. In thermal mode operation, SOIL-THERM is typically more than ½ lower fuel bill than others.

4. **Low NOx Emissions**. Short residence times and fast VOC destruction in the flame zone of the ***Jet-THERM*** burner, has demonstrated NOx levels of only 22 ppmv @ 3% Oxygen at the stack of the oxidizer system. At operating temperatures of 1700F, NOx levels of 38 ppmv @ 3% Oxygen have been obtained. Typical conventional oxidizers have stack NOx emissions of >80 ppmv in both thermal & catalytic modes of operation.

5. **Low CO Emissions**. Low CO emissions are the result of complete destruction of the VOC's and fuel. Lower CO stack emissions can range from 0.0 to 40 ppmv - - compared to conventional oxidizers having stack emissions from 80 – 300 ppmv.

6. **Low Greenhouse Emissions.** Lower supplemental consumption means lower greenhouse emissions. The lowest in the environmental cleanup market.

7. **Smallest equipment sizes.** Powerful Compact-THERM systems with 370 cfm flows are installed onto a 4-ft x 3.5-ft skid. The smallest skid sizes and enclosed system sizes on the market! That's a whopping 30 cfm per square foot of space! (compared to only 4 cfm per ft^2 on our competitor's systems) You'll per notice immediately that all SOIL-THERM systems are super small in size, due to our patented 'direct fire' Jet-THERM burner technology.

8. **Smallest integrated systems.** Operators of SOIL-THERM systems have known for years that working directly with an equipment manufacturer that specializes in integrated packaged systems that optimize

available space and resources can make the project a huge success. Small spaces to full size integrated systems, SOIL-THERM is the leader.

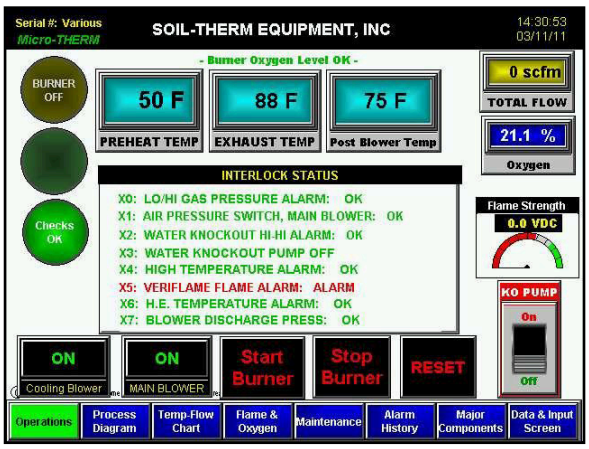
9. **Touchscreen Controls**. Touchscreen interface controls offer our customers more information, troubleshooting and training information, safety information, and flexibility to add system components at a later date. Powerful datalogging of up to 16 optional channels every 1sec with standard 4 GB memory card.

10. **Competitive Prices**. Most of the features that come with a standard SOIL-THERM system are expensive options on others. SOIL-THERM continues to design and build very competitively priced equipment for our customers, for operation for years to come. That's probably why SOIL-THERM systems have the highest resale price on the market.

11. **Reliability**. SOIL-THERM has been building systems for over 21 years, and we know the good parts and the unacceptable components for continuous operation, low maintenance, and high reliability. Top quality construction and name brand parts are always installed on every Soil-Therm system.

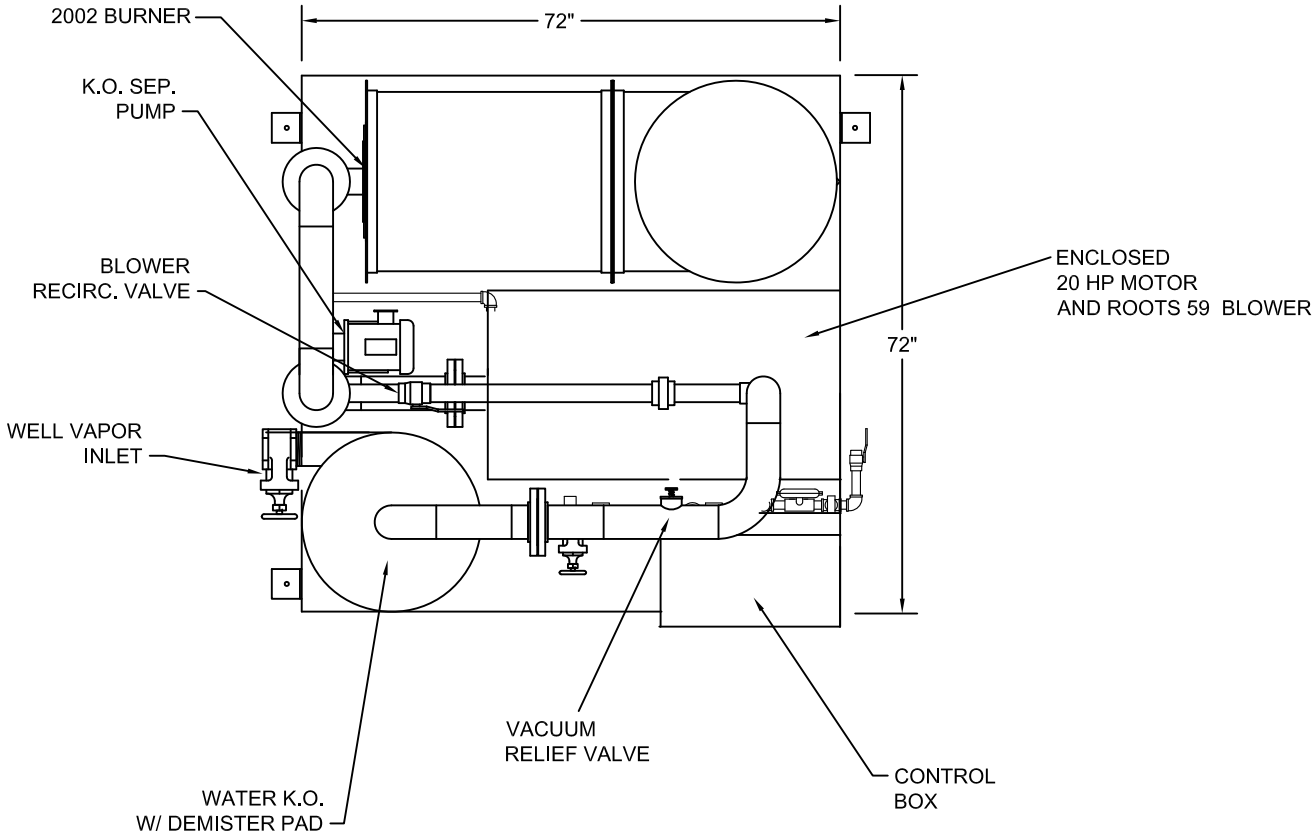
12. **Lowest Maintenance.** SOIL-THERM continues to build equipment that takes the least amount of maintenance and attention by our operators. Our ***Compact-THERM*** and ***Micro-ELECTRIC*** oxidizer systems have no belts, pulleys, oil change blowers, or other high maintenance components to minimize field maintenance service requirements.

13. **Simplest to Operate.** SOIL-THERM systems have been noted to be the simplest operating systems on the market. Information located on the touchscreen can walk the operator through the steps of starting, stopping, and efficiently operating their SOIL-THERM system. Pictures, diagrams, and helpful hints on the touchscreen provides additional assistance , And our technical support people are very experienced in every system we sell.



8" Color Touchscreen w/Options

14. **Advanced Monitoring Capabilities.** Over the internet, monitor and control your equipment from just about anywhere! Turn it on, turn it off, activate pumps and switches, and control your system from your office. Check on your system with actual snapshots on your IPAD at a restaurant! Get data out of your system, anytime! Nobody has more experience in remote monitoring and programming touchscreens than SOIL-THERM**!** Another advantage - - reduce your site visits, and monitor from your office! We'll show you how.



NOTES: UNLESS OTHERWISE SPECIFIED

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LIMITS ON DIMENSIONS UNLESS SPECIFIED OTHERWISE
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BREAK ALL SHARP EDGES

REV	BY	DATE	CHK	APPVD

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SOIL-THERM EQUIPMENT, INC

2002/COMPACT-THERM
TOP VIEW

SIZE | SCALE | DWG NO. | REV A

NEXT ASSY: