RTO Technical Specification

Cycle Therm designs, manufactures and installs regenerative thermal oxidizers (RTOs) for the destruction of volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odorous emissions.

Our current RTO is the genesis of more than 30 years of experience and discovery in RTO technology. Cycle Therm currently holds seven RTO-related patents which have been used worldwide for hundreds of applications. These patents, as well as the core of our experience, are in the design of superior electromechanical valve drive systems for both two-chamber and large multi-chamber RTO designs.

With pollution of all types at the forefront of everyone's mind these days, we are more committed than ever to supplying a low emission, simple, reliable, energy efficient and cost effective means of cleaning tomorrow's air today.

Following is a technical specification for Cycle Therm's RTO:

Energy Recovery Chambers

Energy recovery chambers, in a quantity of _____, shall be fabricated from 3/16" thick ASTM A36 grade steel plate using continuously welded construction.

Each recovery chamber shall be pre-insulated with six (6") of Pyro or Z Block thermal ceramic refractory fiber soft insulation. The insulation shall be capable of withstanding operating temperatures up to 2400 degree F. Based upon an operating temperature of 1500 degree F, an ambient temperature of 50 degree F and 5 mph wind, the cold face exterior surface of the recovery chamber shall be approximately 140 degree F.

Each recovery chamber shall include a cold face welded ceramic heat recovery support system. The support system shall be manufactured utilizing CORTEN trusses at a minimum of 3 feet support spacing, supporting 1.5", schedule 40, 304 stainless steel cross pipes and an eight gauge perforated distribution plate.

Heat Recovery Media

The heat recovery media shall consist of very low pressure drop Cell Stone® Ultra ceramic heat recovery media.

Each energy recovery chamber will be filled with 8.5 feet of random packed Cell Stone® Ultra to achieve 95% nominal energy recovery. The ceramic heat recovery media will have a service

ceiling temperature of 1800 degree F. Total pressure drop not to exceed 5.6" w.c. at the design conditions. The heat recovery media shall be provided with a two (2) year thermal decomposition warranty.

Main Purification (Combustion) Chamber

The purification chamber shall be constructed from 3/16" thick ASTM A36 grade steel plate using continuously welded construction. The chamber will be pre-insulated with eight inches (8") of Pyro or Z Block thermal ceramic refractory fiber soft insulation.

The chamber shall be equipped with one (1) man access port with davit located on the end of the chamber.

Burner

The combustion/purification chamber shall be fitted with a quantity of _____, _____ MMBTUH Maxon OVENPAK™ direct fired nozzle mixing primary air burners. The flanged burner assembly shall include mixing cone, steel jacketed refractory sleeve, pilot, spark igniter, self contained internal air and gas proportioning valves and provisions for flame safeguard sensor. The burner shall include a face mounted motor and blower with non-sparking paddle wheel -type impeller.

Burner Access Platform

A galvanized bar type grating platform with OSHA toe plates and railing will be included for service and maintenance of the burner system or systems. A ladder and cage assembly will be provided per OSHA guidelines for the height requirement.

Fuel Gas Pipe Train Assembly

The fuel gas piping assembly shall be pre-piped by Maxon and pre-wired to meet all requirements as specified in NFPA 70, NFPA 86, National Fuel Gas Code NFPA 54 and is suitable for FM and IRI approval.

The gas piping assembly shall consist as a minimum of the following;

- Main shut-off, lubricated plug valve (fuel supply connection)
- Main gas regulator (10 psig maximum operating pressure)
- Gas strainer
- Main and pilot fuel gas pressure regulators
- Maxon motorized safety shut off valve with proof of closure/open switches
- Solenoid bleed valve
- Solenoid blocking valve
- Pilot shut-off cock
- Dual pilot safety solenoid shut off valves
- High/low safety gas pressure switches
- Electrically-operated modulating gas control actuator

- Indicating pressure gauges with shut-off cocks for incoming gas pressure, main regulated gas pressure and pilot regulated gas pressure

RTO Main Fan

The RTO shall be induced draft The blower shall be manufactured by New York Blower, Robinson Industries or approved equal.

The maximum speed of the fan shall be 1800 rpm. The fan shall be direct drive, arrangement 8, class IV. The fan shall include inlet and outlet flanges, drain, drive and coupling with appropriate guard(s). Materials of construction shall be _____(carbon steel or stainless steel). The motor shall be a high efficiency TEFC, 460/3/60 1800 RPM, inverter duty.

The fan's flow will be sized to handle all process sources overcoming total RTO resistance losses, plus a minimum of 2" w.c. negative suction pressure or as required for process duct losses.

Process Fan Volume Control

Fan volume control shall be provided to maintain a preset inlet static pressure. Inlet static pressure shall be accomplished utilizing a negative pressure sensor installed on the inlet supply ductwork. The sensor shall be manufactured by Viatran or an approved equal. A 4-20ma control loop in conjunction with the main RTO fan's variable frequency converter will automatically adjust the fan to the preset pressure.

Variable Frequency Converter

The process fan speed shall be controlled via a variable frequency converter located at the main control panel. It shall be a variable torque device manufactured by Allen-Bradley, Siemens or Yokogawa. Drives shall be mounted external to the control panel in a NEMA type enclosure with its own fused safety switch and external handle.

Flow Control: Chamber Transfer Valves

The RTO shall be equipped with Cycle Therm patented, internally mounted, vertical shaft, poppet style valves designed specifically for regenerative thermal oxidizer use. Two 2-way chamber transfer flow control valves per chamber will be utilized.

Contact closure between the valve disk and valve body will be by way soft and metal seats in conjunction with air seals. Total valve leakage shall be no more than 0.02%. The valves shall be manufactured with heavy duty steel fabricated body and flexible discs, which are fastened to polished vertical steel shafts. The shaft shall be aligned by four (4) sets of roller bearings.

Mechanical Valve Drive

Transfer valves shall be connected by a common shaft and driven by a common electro mechanical valve drive. Pneumatic or hydraulic valve drives are unacceptable.

The valve drive shall be equipped with variable frequency 460/3/60 TEFC motor/reducer. The valve drive arrangement moves the interconnected flow control valves in ½ second, which minimizes airflow disruptions and pressure fluctuations. Valve timing shall be visible and manually adjustable from the operator's panel.

Exhaust Stack

The stack shall be constructed of _____ (carbon steel or stainless steel). The stack shall discharge to a maximum height of _____ above ground level. The stack shall be self supporting. Two (2) 4" test ports are provided at 90 degree for stack testing. To minimize exit velocity noise, stack sizing will be based on 3000 actual feet per minute.

Integrated Inlet and Outlet Manifold

To minimize the overall footprint and reduce long term system maintenance, the RTO shall feature integrated inlet and outlet manifolds. RTO construction consisting of elevated legs and external ductwork to convey air flow between the energy recovery chambers is unacceptable.

Main Control Panel

The main control shall be free standing, NEMA _____ (4 (outdoor) or 12 (indoor)) construction. The control cabinet shall be fabricated from 12 gauge mild steel. The exterior shall receive two (2) coats of OEM gray finish paint and the interior shall be painted gloss white.

The control panel, at a minimum, shall include a door interlocking main power disconnect, fused step down control transformer from 460/120VAC, start up and shut down timers, control circuit breakers, logic relays, push buttons, pilot lights and a 3-pen temperature recorder for inlet, combustion and outlet temperatures. The cabinet shall have approximately 20% open area for mounting future control equipment.

Combustion chamber temperature control shall be provided by one (1) stand-alone panel mounted Honeywell UDC 2500 with 4-20 ma control loop with the main gas control valve. High limit temperature safety shut down will be provided by one (1) stand alone panel mounted FM approved Honeywell UDC 4000. High limit will be a hard wired interlock.

Process duct pressure shall be controlled via stand-alone Honeywell UDC 2500 with 4-20ma loop control with pressure transmitter and variable frequency drive.

Programmable logic controller (PLC) shall be Allen Bradley 405 or 505 with integral Ethernet communications module as required. The PLC shall include a man machine interface (MMI) to guide the operator through start up, shutdown and provide alarm first outage annunciation. A

battery backed real time clock/calendar is included in the PLC. The PLC is completely wired, programmed and mounted in the control cabinet.

All wiring in the control panel shall be consistent with standards as set forth in the National Electrical Code (NEC).

Wiring

A NEMA 4 junction cabinet shall be mounted on the unit for local instrumentation terminal tie-in. Combustion controls and safeties shall be hard wired per NFPA requirements.

All wiring shall be identified at both ends with designations corresponding to the wiring diagrams. All wire will be stranded copper with 600 volt insulation type MTW, THHN, or THWN. Minimum size wire will be #14 AWG.

Performance Guarantee

When this unit is operated within the design conditions and in accordance with the written instructions as furnished (and as may be amended), it shall achieve a minimum of _____% destruction efficiency as measured by Federal EPA Method 25A (hydrogen flame ionization).

Paint

The entire RTO shall be sand blasted and painted with Sherwin-Williams High Temperature 600 F, pewter colored paint. All OEM equipment will retain the factory finish.

Thermocouples

Temperature sensing shall be provided by 316 stainless steel sheathed, dual element, type J or K thermocouples as required. They shall be mounted vertically using an external pipe coupling and wired with weatherproof aluminum heads.

Bake Out Feature

The unit shall include a manual bake-out system to carbonize organic particulate lodged in the system. The PLC will interface with a bake-out switch whose capabilities will include keeping each chamber from transferring while in bake out mode. A PLC temperature loop, once actuated by the bake-out switch, will maintain an 800 degree F combustion temperature for bake-out. Each chamber shall be manually stopped for an adequate interval after the lower bed temperature reaches in excess of 600 degree F as noted by way of the lower bed thermocouples. The operator will determine the bake out time of each chamber. The system will include, in the case of an induced draft system, a fresh air bleed just before the fan to keep fan temperatures below its safe design point.

About Cycle Therm

Cycle Therm is an international leader in the design, fabrication, and installation of Regenerative Thermal Oxidizers (RTO). The RTO we bring to market today is the genesis of over 30 years of design experience focused on a single product.

In addition, Cycle Therm provides turnkey installation services, repair and refurbishment and is a distributor of Cell Stone heat recovery media and tower packing.

For More Information

For more information on Cycle Therm's 2-chamber RTO or other Cycle Therm products, please call 570-839-8836 or visit us on the web at www.cycletherm.com.

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