2.0 SOURCE DESCRIPTION

[illegible] manufacturer.

2.1 PROCESS DESCRIPTION

The manufacturing process begins with selected woods, which are dried, sawed, shaped and sanded. The equipment used for these operations are saws, routers and sanders. The wood is then assembled into a piece of furniture and subsequently sent to a spray booth in the finishing area where multiple layers of toners, stains and topcoats are applied.

The two wood-fired boilers on-site are used to dispose of the wood scraps and produce steam for various plant operations.

2.2 BOILER SPECIFICATONS

Boiler 1 is a combination wood-fired unit with a supplemental oil burner installed. Boiler 2 is wood-fired only. The boiler specifications are provided below:

Manufacturer:	English Boiler & Tube of Richmond, Virginia
Model:	20SF250
Maximum Capacity:	20,700 pounds per hour (600 hp)
Maximum Btu Input:	29,900,000 btu/hr
Design Pressure:	250 psig
Normal Operating Pressure:	150 psig
Saturated Steam Temperature:	366 °F
Radiant Heating Surface:	771 ft^2
Convection Heating Surface:	2582 ft^2
Total Heating Surface:	3353 ft^2
Furnace Volume:	1660 ft^3

2.3 BOILER FUEL TYPES

Descriptions of the fuels and boiler firing rates are shown below. The operators have the capability to adjust the mix of fuel based upon demands and availability. The combustion control algorithm is also adjustable based upon actual fuel being burned.

Wood Fuel

The wood fuel is primarily maple and cherry and is derived from different waste sources throughout the manufacturing process. A detailed description of the various wood fuels is shown in the following table.

Type	*Source*	*Consistency*	*Density*	*Moisture*
Chips	Saw Mill	1" x 1" x 1/4"	18 lb/ft³	40-70%
Head Saw Waste	Saw Mill		15 lb/ft³	40-70%
Hogged	Hog	Small chips	10-12 lb/ft³	5-7%
Planer Shavings	Rough Mill		4-6 lb/ft³	5-7%
Sander Dust	Sanding		3-5 lb/ft³	5-7%

The average fuel (as burned) heat value is approximately 6,000 BTU/lb. The maximum fuel capacity for the boiler is 6,876 pounds of wood fuel per hour based on the following calculations:

Steam Flow:	20,700 lb (steam)/hr
Btu required for 1 pound steam:	1,196 Btu/lb (steam)
Fuel Heat Value:	6,000 Btu/lb (wood)
Combustion Efficiency:	75%
Boiler Efficiency	80%

Heat load:	20,700 x 1,196 = 24,757,200 Btu/hr
Stoichiometric fuel load:	24,757,200/6,000 = 4,126 lb (wood)
Actual fuel load:	4,126/.75/.80 = 6,876 lb (wood)/hr

Maximum operating range is approximately 6,000 lb (wood)/hr according to plant personnel (87% of maximum capacity) during cold weather events. The boiler operating range on any given day is dependent on the outdoor ambient temperature.

Oil Fuel

Boiler 1 has the following oil burner installed:

Burner Manufacturer:	Industrial Combustion
Model:	DL252S
Oil Input:	180 gal/hr

No. 2 Oil Heating Value:	166,667 Btu/gal
Btu Input:	30,000,000 Btu/hr

2.4 CONTROL EQUIPMENT DESCRIPTION

Each boiler is fitted with a backward inclined, high efficiency induced draft (I.D.) fan to control furnace draft. The fan is fitted downstream of the multiple cyclone (multiclone) fly ash particulate control system for each boiler as shown on Figure 4. The multiclone specifications are described below:

Manufacturer:	Clarage of Birmingham, Alabama
Model:	MTSA-30(27)-9CYT-A-WRV-STD
Capacity:	20,000 acfm (maximum)
Temperature:	450 °F (0.0414 lb/ft^3)
Pressure Drop:	3.0 inches of water column (maximum)

Supporting documentation for the particulate cyclone system, including a performance curve indicating the removal efficiency for various particulate diameters are provided in Appendix B.

901M04C3	Combustion Chamber - Interior Arrangement
901M04C4	Combustion Chamber - Cleanout Doors
901M04C5	Combustion Chamber - Fuel Feed Arrangement
901P01C	Boiler/Maintenance Facility - General Layout

3.2 EQUIPMENT

.1 SCOPE

The system shall include, but not be limited to, the following components:

A. Combustion Chamber
1. Prefabricated and mated to the boiler on site.
2. Acts as the furnace area of the boiler.
3. Air-cooled double wall construction.
4. Cast refractory walls with 3000 Deg. F. rating (minimum).
5. Cast insulating refractory with 2200 Deg. F. rating (minimum).

NOTE:
Consideration may be given to the shipment of the combustion chamber without refractory. Placement of the refractory at the job site may best more economical and would allow the use of poundable refractory.

B. Fuel Feed System

1. Provide fuel distribution in the furnace area.

2. Shall be of underfeed stoker type

3. Fuel storage an deliver to system covered under Section 6, Fuel System, by others.

4. Components

a. Fuel surge/metering bin

1. Sized for 20 minute supply at low fire (minimum) to maximum firing rate capacity.

2. Two independent feed augers
   a. 3/8 inch fully welded flights.
   b. Appropriately sized AC variable frequency drives
   c. Motors: 230/460 VAC, 3 ph., TEFC, inverter duty, super E premium efficiency.

3. V trough design with 2.5 inch clearance between auger and trough.

4. Combination bridge beaker/fuel blender

b. Rotary Air lock

1. Low sped gear drive with angled rotor blades and stationary knife.

c. Blow Back Prevention

1. Fuel delivery system shall be fitted with primary electronic and secondary hydraulic water burn-back controls.

C. Combustion Air System

1. Overfire Air System

a. Overfire Air Fan

Capacity:	8000 ACFM @ 3" Static Pressure and 125 F.
Type:	Single Wheel, Backward Inclined
Drive:	Belt
Motor:	230/460 VAC, 3 ph., TEFC, inverter duty, super E premium efficiency

Arrangement to be determined.

b. Inlet ducting to preheater.

c. Outlet ducting to combustion chamber

2. Underfire Air System

a. Underfire Air Fan

Capacity: 2000 ACFM @ 3" Static Pressure

and 125 F.
Type: Single Wheel, Backward Inclined
Drive: Belt
Motor: 230/460 VAC, 3 ph., TEFC, inverter duty, super E premium efficiency
Arrangement to be determined.

b. Inlet ducting to preheater

c. Outlet ducting to combustion chamber.

3. Breeching and Combustion Air Preheater

a. To be prefabricated and field assembled.

b. Breeching to be 12 gauge minimum in a rectangular configuration from the boiler outlet to the entrance to the multiclone.

c. The breeching will be fitted with at least one (1) sealed expansion joint to eliminate stress in the system.

d. Breeching to be fitted with convection baffles and preheater supports.

e. Preheater to be a plenum fabricated from 14 gauge galvanized steel.

f. Appropriately sized combustion air duct drop legs will be provided for underfire and overfire air.

g. Air ducting from preheater to fans provided by others.

4. Induced Draft/Emission/Stack System

a. Fabricated as a preassembled package and field erected.

b. Induced Draft Fan
Type: Single wheel, backward-inclined
Construction: High temperature steel.
Capacity: 21,000 ACFM at 600 Deg. F.
Static Pressure Requirement: 5 inches H2O

Motor: 30 HP, 230/460 VAC, 3 ph., TEFC, inverter duty, super E premium efficiency

c. Particulate collector (multiclone) appropriately sized for application. Unit to be Clarage type 9CYT - type "A" vanes or approved equal.

d. A 36 inch diameter, stub stack shall be provided and have 42 foot AGL discharge height.

e. At rooftop level, an OSHA approved catwalk will be installed to facilitate stack testing. This structure will also act as the upper stack support.

f. The stack shall be fitted with a 4 inch IPS stub fitting with 150# flange for mounting of Oxygen Analyzer. Two (2) 1 inch weldolet fitting shall be provided for testing purposes on opposite sides of the stack. Location shall be 4 feet above catwalk level, above.

g. All components carbon steel, primed and painted.

h. The vendor shall supply the Project Engineer with base/footing and catwalk drawing(s) for installation by the building erection Contractor.

D. Cleanout Doors

.1 The combustion chamber shall be fitted with two fully insulated, plug type, airtight doors for the purpose of ash removal and servicing the interior of the furnace and boiler

.2 The doors shall have a minimum dimension of 60 inches high by 24 inches wide and be designed to swing out for full opening access.

.3 The doors shall have a minimum of six 96) positive closure dogs to assure an air tight seal.

E. Observation Ports

.1 The combustion chamber shall be fitted with a minimum of four (4) observation ports located in such a manner as to allow the viewing of all portions of the furnace interior.

Planer Shavings	6800	7	6 Light Curly
Sander Dust	7400	4-5	8 Explosive

.3 Emissions Considerations

.1 The new boiler facility must be capable of continuous operation within the guidelines of EPA emission factors as shown in AP-42, Section 1.6 (Wood Waste Combustion in Boilers) and Section 1.3 (Fuel Oil Combustion).

.2 State of New York DEC further mandates the application of BACT (best available controls technologies) be applied. Present BACT is able to obtain a 90% reduction in particulate through the use of multiclone and combustion control strategies.

2.2 BOILER

.1 QUALITY ASSURANCE

.1 The boiler(s) will be designed and manufactured to the codes and standards as set forth under the following:

a. ASME Boiler and Pressure Vessel Code
b. ASME Power Test Code
c. ABMA Manual of Industry Standards
d. National Board of Boiler and Vessel Inspectors
e. State of New York Boiler Code

.2 All equipment shall comply with State of New York laws and regulations governing at the time of permit issue.

.2 DESIGN CONSIDERATIONS

.1 The boilers are to be water tube type, Model SF550250 as manufactured by English Boiler Company, Richmond, Virginia.

.2 The boiler(s) to be supplied will based upon the following design conditions:

Type:	Water Tube
Steam Capacity:	18,000 PPH (minimum)
Btu Input:	20,000,000 Btu (maximum)
Design Pressure:	250 Psig
Operating Pressure:	150 Psig
Saturated Steam Temperature:	366 Deg.

Steam Drum Diameter:	36 Inch (minimum)
Steam Drum Thickness:	0.75 Inch (minimum)
Fuels:	As described above
Continuous Blowdown:	2.5 %
Feedwater Temp:	225 Deg. @ Boiler Inlet
Ambient Temperature:	90 Deg.
Elevation:	1200 Feet
Overall Height:	24 Feet (maximum)*
Overall Length:	24 Feet (maximum)*
Overall Width:	12 Feet (maximum)*
Total Heating Surface:	3000 Sq. Ft. (minimum)
Heating Surface / HP:	5.75 Sq. Ft./HP (maximum)
Grate Area/Heating Surface Ratio:	35:1 (maximum)

* includes Combustion Chamber

.3 BOILER TRIM

.A Each boiler as specified herein shall be provided with the following boiler trim equipment. This equipment shall be factory mounted, complete with integral connecting piping, valves, and fittings. All valves and control apparatus is to be designed for the specific application for which it is to be utilized in full compliance with the regulatory codes. Drain lines, as applicable, shall be terminated with a valve 4' above the operating floor. The subassemblies shall be shipped loose for field mounting.

Description of Item	Location On Boiler	Size	Quant.
1. Safety Valves	Steam Drum	3"	2
2. Bot. Blowdown Valve.	Lower Drum	1.5"	2
3. Cont. Blowdown	Steam Drum	1"	1
4. Vent Valve	Steam Drum	1"	1
5. Chem. Feed Valve	Steam Drum	1"	1
6. Steam Gage Vlv..	Steam Drum	1"	1
7. Feed H2O St. Vlv.	Steam Drum	2"	1
8. Feed H2O Chk. Vlv.	Steam Drum	2"	1
9. Soot Blower Vlv.	Boiler Bank	2"	1
10. Water Column	Steam Drum	1"	1
11. Water Col. Trim	Steam Drum	1"	1
12. Low Water Cutoff.	Steam Drum	1"	1
13. Aux. LWCO	Steam Drum	1"	1
14. High Water Cutoff	Steam Drum	1"	1
15. Connections for Drum Level Transmitter	Water Column	.5"	2
16. Connection for Pressure Transmitter	Steam Drum	.5	1

B. Oil Burner

1. The Number 1 boiler will be fitted with a # 2 oil fired swig-out burner to provide backup firing capabilities in the event of wood fuel delivery loss.

2. The burner shall have a minimum steam capacity of 18,000 pounds per hour at an efficiency of 80% and shall burn no more than 175 gallons of # 2 oil per hour.

3. Total power required to operate the burner shall not exceed 30 horsepower.

.C Soot Blowers

.1 The boiler shall be designed for a manual, chain driven, valve-in-head type soot blower system which is to be furnished and factory mounted to the steam generating unit.

.2 Each boiler tube lane in the convection zone is to be cleaned by an element orifice.

.3 The system shall include a chain operated steam supply shut-off valve & drain valve.

.4 The soot blower shall be manufactured by Diamond, Copes Vulcan or approved equal.

.4 BAFFLES

.1 The baffles are arranged to route the gas properly over the heating surfaces in order to obtain maximum heat absorption.

.2 The baffles are securely installed without being affected by or interfering with the free expansion or contraction of the boiler.

.3 Each baffle is to be constructed of not less than 1/8 inch steel or if in a high heat resistant area a special alloy metal of not less than 1/8 inch nominal thickness.

.4 Baffles shall be capable of withstanding the existing temperature under maximum load conditions.

.5 HYDROSTATIC TEST

.1 All pressure parts of the completed boiler, before applying any refractories or casing materials and being enclosed in the setting, shall be in the presence of the Authorized Inspector of Hartford Steam Boiler Inspection & Insurance Company and any other inspector as required by the

contract specifications, be hydrostatically tested as required by Section I of the ASME Code at no less than one and one-half times the maximum allowable working pressure. Upon completion of the hydrostatic test, the Authorized Inspector shall certify the unit by signing a completed Data Report which shall be submitted to the owner's representative as evidence of ASME compliance.

.2 A second hydrostatic test shall be performed by the Manufacturer or his representative, in accordance as above, after the boiler is installed on site to assure that no leaks have developed during transport and erection of the unit(s).

.6 BOILER CASING

.1 The external steel casing shall be 22 gauge boxed ribbed steel casing and will completely enclose the unit with the exception of the drum ends. The drum heads shall be insulated in the field.

.2 The external casing covering the roof and side walls shall be of structural reinforced design, requiring no buckstays and shall be of seal welded construction resulting in a gas tight envelope around the pressure vessel assembly.

.3 The average surface temperature of the casing shall not exceed 140 F. with an ambient temperature of 100 F. and surface wind velocity of two (2) feet per second while the boiler is operating at full capacity.

.4 All furnace tubes shall be membrane type except in the area where the gases leave the furnace and enter the convection zone. The inboard row of tubes, between the furnace and the convection zone, shall be finned forming a membrane wall to prevent short circuiting of flue gas from the furnace to the boiler flue gas outlet.

.5 The convection tubes shall be 2.00" O.D. by .095" minimum wall thickness, and all furnace wall tubes, rear wall tubes and membrane wall tubes shall be 2.00" O.D. by .120" minimum wall thickness. All boiler tubes shall be electric resistance welded as per Section II of the ASME Code and shall be material specification SA-178-Gr.A.

.7 PAINTING

.1 All exterior boiler surfaces will be made free from rust, slag, oil film, an any other materials that may impede the proper adherence of paint. Solvent cleaning shall be performed prior to the application of any coatings

2. Prior to leaving the factory, the exterior surfaces shall be painted with one

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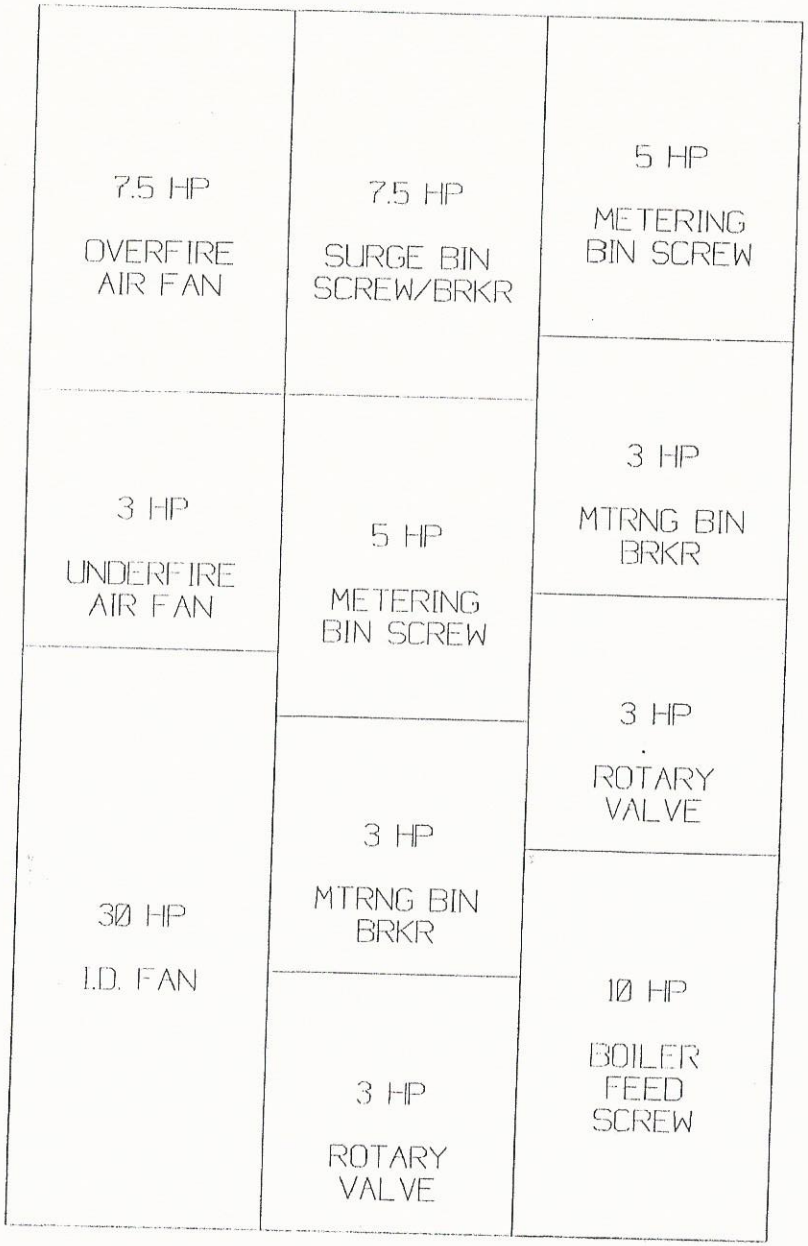
BOILER # 1
MOTOR CONTROL CENTER



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Fisher-Allen Inc

STEAM GENERATION
EQUIPMENT LIST

ITEM	Type	HP	Voltage	Amps	Comments
Boiler # 1+2					
Induced Draft Fan	VFD	30	460	39/39	FCE105 / FCE205
Overfire Air Fan	VFD	7.5	460	11/11	FCE104 / FCE 204
Underfire Air Fan	VFD	2	460	3/3	FCE102 / FCE202
Fuel Metering Bin Screw	VFD	5	460	7.5/7.5	FCE101 / MMB11 / MMB12 FCE201 / MMB21 / MMB22
Fuel Metering Bridge Breaker	M	3	460	4.5/4.5	MBB11 / MBB21
Boiler Fuel Feed Screws	VFD	10	460	14/14	MBS11 / MBS 21
Feedwater Pump	VFD(2) M(1)	15	460	19/19	FCE103 / FCE203 / MFW303
Surge Bin screws/breakers	M	7.5	460	11/11	MSB31 / MSB32
Silo Unloader	Laidig				MUL03
Exit Screw	Laidig	5	460	7.5	
Sweep Screw	Laidig	10	460	14	
Bucket Elevator	M	10	460	14	MCV08
Cross Screw	M	5	460	7.5	MCV09
Sweet Conveyor	M	7.5	460	11	MCV05
Cross Conveyor	M	3	460	4.5	MCV06

Dump Hopper Screw	M	3	460	4.5	MCV07
Belt Conveyor	M	5	460	7.5	MCV01
Rotary Valves	M	10	460	14	MRV11 / MRV12 / MRV21 / MRv22
Control System			120	15	
				310	Total 230/460 full load amperage required

MECHANICAL COLLECTOR

GENERAL
INSTALLATION AND OPERATION
INSTRUCTION MANUAL

⚠ WARNING ⚠

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS EQUIPMENT COULD CAUSE DEATH, BODILY INJURY, OR PROPERTY DAMAGE.
READ THESE INSTRUCTIONS BEFORE USING OR SERVICING THIS EQUIPMENT.

CLARAGE
245 Center St. N. • Birmingham, AL 35204
Phone:(205) 581-3267 Fax: (205) 251-6258
A Twin City Fan Company

A4167 UL REGISTERED FIRM ISO 9001
CLARAGE
Birmingham, AL, USA

MANUAL #OP-8100-1 (Rev.3/97)

GENERAL INFORMATION

INTRODUCTION

The primary purpose of this unit is to remove particulate from a gas stream. Centrifugal force is the method for particulate separation. The mechanical collector is a device used in air pollution control. Examples of its use would be the removal of fly ash from flue gas or the recovery of cement, lime or sinter dust.

Support steel should be designed for the load levels as indicated on the drawings. Load levels given DO NOT include wind, expansion, seismic or ducting that may be attached to the collector. Support pads are not normally drilled. This allows the customer flexibility in the location of bolts. Attachments should allow for collector expansion.

The collector is not normally designed to support duct loads. Clarage is to be notified during the collector design phase if additional loads are to be considered. Duct work shall be free of sudden enlargement or contraction ahead of or behind the collector or the performance may be affected. Turning vanes shall be used in all turns in the duct work entering or leaving the unit. Expansion joints are to be supplied in the ductwork to prevent expansion loads on the collector.

Operating Conditions

Operating conditions are shown on the applicable project drawings. These conditions must not be exceeded or the unit may be endangered and/or the warranty violated.

Available Options

Safety and performance options for collectors are as follows (Refer to the applicable project drawings which indicate the options selected by the customer.):

1. Hopper high or low dust-level indicators
2. Hopper temperature indicators
3. Automatic rapping devices
4. Hopper discharge valves and seals
5. High Brinnell inlet tubes
6. Cast outlet tubes
7. T.A. (Total Access) design
8. Sectionalizing dampers
9. Bypass dampers
10. Venturi pickup station

If any of the above safety or performance options are purchased, applicable operating and maintenance instructions are attached to this manual.

Description of the Unit (Figure 1)

1. Dusty gas enters the inlet (1).
2. The dusty gas is directed down the inlet tube (3).
3. The dusty gas is caused to spin in the inlet tube by the spin vanes (2).
4. The particulate settles to the bottom of the inlet tube, is shaved off by the discharge boot (4) and falls into the hopper (9).
5. The dust is removed from the hopper (9) by the dust removal device such as a rotary feeder, valve or double dump valve at the discharge flange (8).
6. The cleaned gas is directed up the outlet tube (5) and exits the collector at outlet (7).
7. Optional recovery vanes (6) at the bottom of the outlet tube, stop the spin and reduce the unit pressure drop.

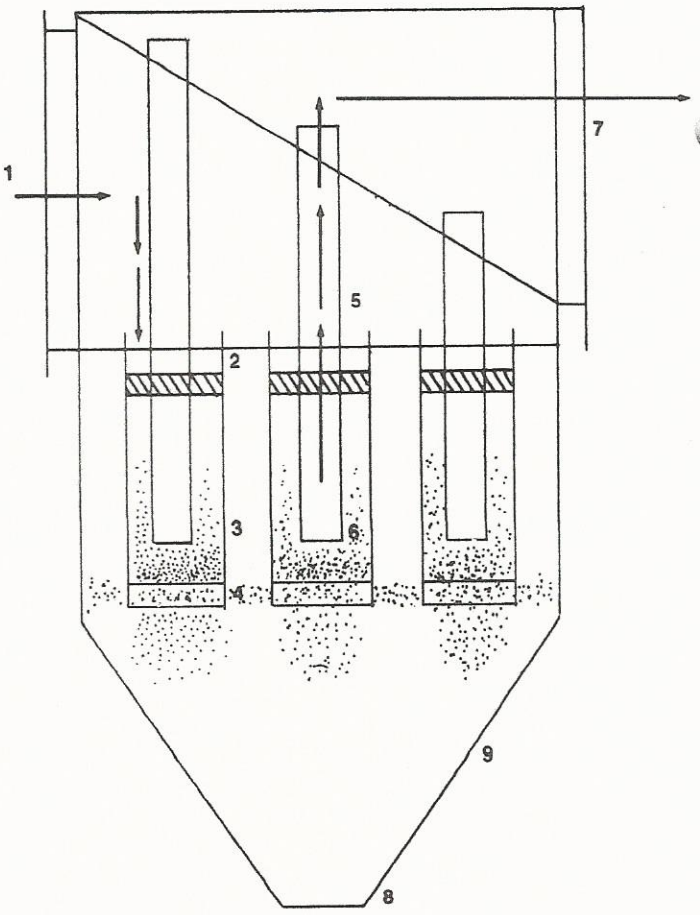
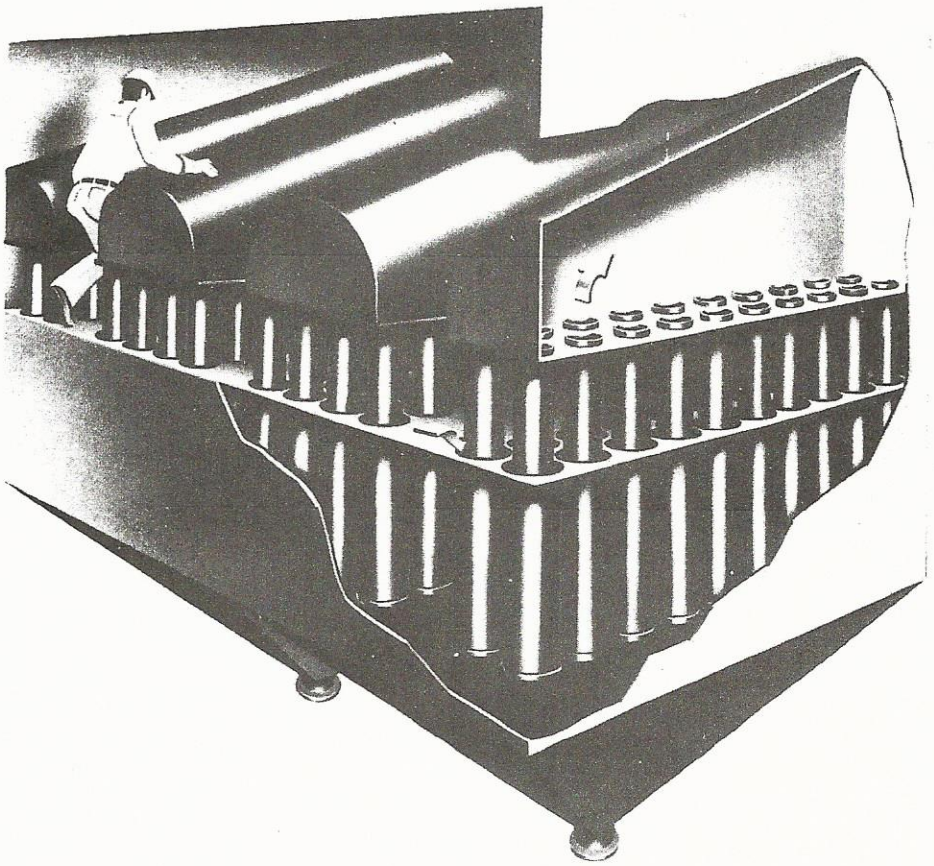
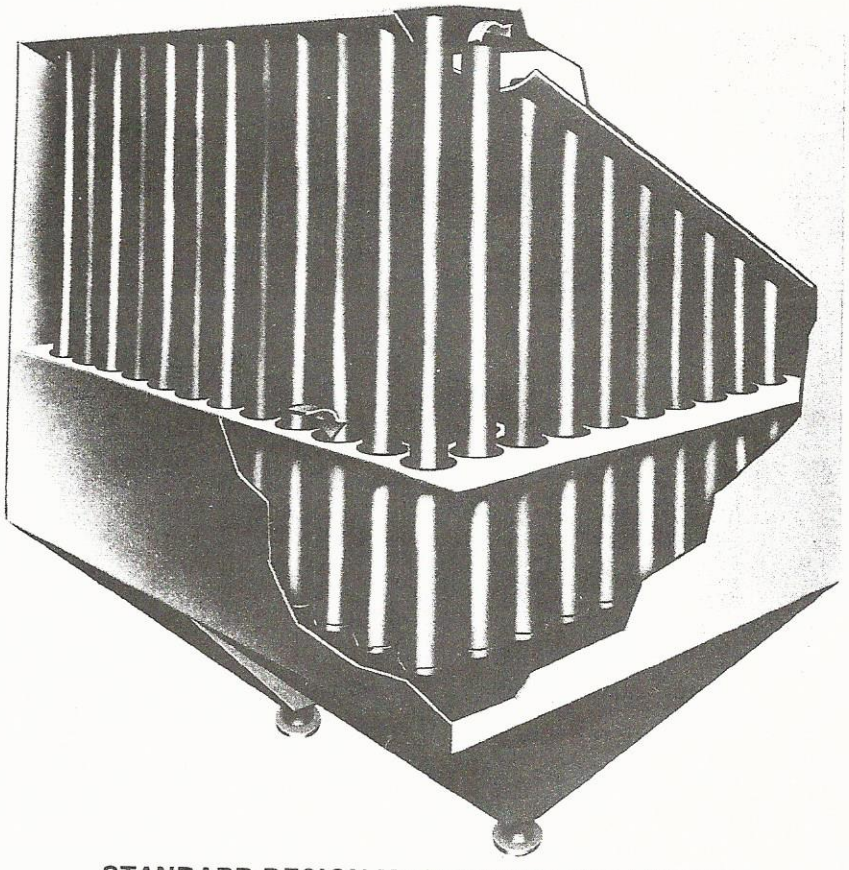


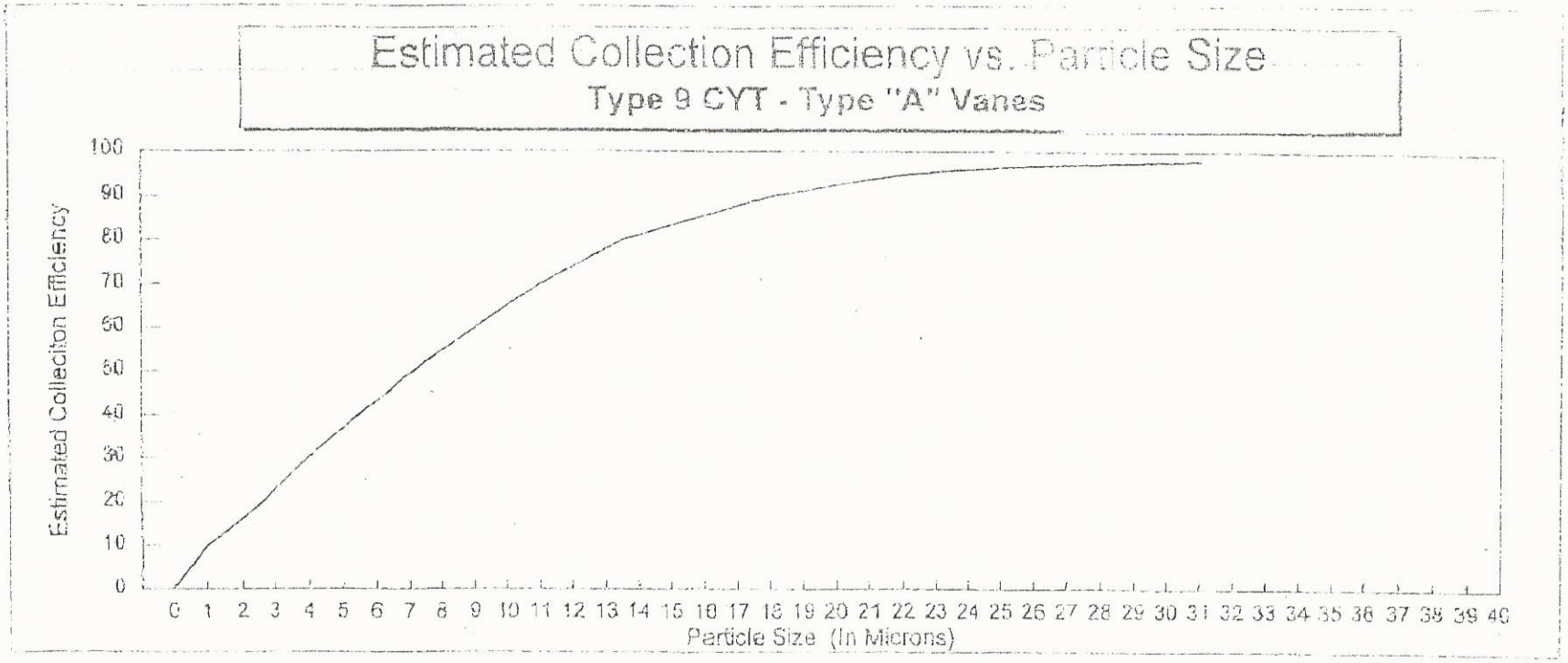
FIGURE 1



TOTALLY ACCESSIBLE DESIGN — THE "T.A." UNIT



STANDARD DESIGN MECHANICAL COLLECTOR
FIGURE 2



NOTES:

1. The curve above is offered as a guideline. It is not to be construed as a guarantee or contract obligation.
2. This prediction is based on all particles corrected to a specific gravity of 2.2., and a pressure drop of 2.5" S.P. across the collector.