Bruce's Copy

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Bob Martinez, Governor Dale Twachtmann, Secretary John Shearer, Assistant Secretary

June 18, 1990

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Alvin N. Critzer, Plant Manager
Harris Semiconductor
P. O. Box 883
Melbourne, Florida 32901

Dear Mr. Critzer:

Re: Amendment to Construction Permit: AC 05-157786
Harris Semiconductor: Building 51

The Department has reviewed your cover letter with enclosures received May 14, 1990, which requested a reduction in the allowable VOC/solvent emission limit contained in the above referenced construction permit. The Department agrees with the request and the following will be changed:

Specific Condition No. 1

FROM:

The maximum allowable VOC/solvent emissions from Building No. 51 shall be 33.3 tons per year.

TO:

The maximum allowable VOC/solvent emissions from Building No. 51 shall be 27.3 tons per year.

Attachment to be Incorporated

- Mr. Alvin N. Critzer's letter with enclosures received May 14, 1990.

This letter must be attached to the construction permit, No. AC 05-157786, and shall become a part of the permit.

Sincerely,

for STEVE SMALLWOOD, P.E.
Director
Division of Air Resources
Management

SS/BM/plm

Attachment

c: C. Collins, Central Dist.
K. Smith, HS

HARRIS SEMICONDUCTOR

HARRIS · RCA · GE · INTERSIL

May 3, 1990

RECEIVED

MAY 14 1990

DER - BAQM

Mr. C. H. Fancy
Deputy Bureau Chief
Department of Environmental Regulation
Bureau of Air Quality Management
2600 Blair Stone Road
Tallahassee, Florida 32301

Subject: HARRIS SEMICONDUCTOR, PALM BAY
B-59 & B-51 Consolidated Air Permit Modifications
Permit nos. AC 05-174445 & AC 05-157786

Dear Mr. Fancy:

On March 30, 1990, Harris Semiconductor submitted the required 1989 solvent mass balance report for the Palm Bay facility. The results of this report showed building 59's solvent (VOC) emissions to be 5.46 tons/year. The current permit estimates the building's emissions to be 2.37 tons/year.

While activity and operations in building 59 has increased, consolidation of wafer fabrication operations in building 51 indicate a decrease in chemical activity and the resulting air emissions. The current permit limit for building 51 is 33.29 tons/year; however, mass balance results for 1989 demonstrated that the emissions for this building are considerably less (17.30 tons/year.)

As discussed in the 'Conclusions and Recommendations' section of the mass balance report, we specifically request that the annual VOC emission limit for building 59 be increased to 8.37 tons/year to account for the emissions, and, in turn, the permit limit for building 51 be reduced to 27.29 tons/year.

Consequently, the following table presents the projected potential VOC emissions from the facility:

SOURCE		POTENTIAL VOC EMISSIONS (tpy)	
BUILDING	4	10.96	
	51	27.29	
	54	95.65	
	55	0.28	(fugitive)
	57	1.66	
	58	3.24	
	59	8.37	
	60	0.75	
	61	0.25	
	62	0.83	
	63	6.14	
		TOTAL = 155.42	

Please note that the requested modifications do not effect the current VOC emission limit for the site.

Enclosed are the modified permit applications for buildings 51 and 59. If you should have any questions about the enclosed information, please contact Nancy Baldisserotto at (407) 729-4061.

Sincerely,

Al N. Critzer
Plant Manager

cc: C. Collins
B. Mitchell

Attachment Available Upon Request

DEPARTMENT OF ENVIRONMENTAL REGULATION

WIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Stationary [ ] New[1] [X] Existing[1]

APPLICATION TYPE: [ ] Construction [ ] Operation [X] Modification

COMPANY NAME: Harris Semiconductor COUNTY: Brevard

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Building 51

SOURCE LOCATION: Street Palm Bay Road City Palm Bay

UTM: East 17-538700 North 17-3100900

Latitude 28 ° 01 ' 20 "N Longitude 80 ° 36 ' 10 "W

APPLICANT NAME AND TITLE: Al N. Critzer, Plant Manager

APPLICANT ADDRESS: P.O. Box 883, Melbourne, Fl 32901

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Harris Semiconductor

I certify that the statements made in this application for a modified permit are true, correct and complete to the best of my knowledge and belief. Further I agree to maintain and operate the pollution control source and pollution contro facilities in such a manner as to comply with the provision of Chapter 403, Florid. Statutes, and all the rules and regulations of the department and revisions thereof. also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: Alvin N Critzer

Alvin N. Critzer, Plant Manager
Name and Title (Please Type)

Date: 5/9/90 Telephone No. (407) 724-7078

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project hav been designed/examined by me and found to be in conformity with modern engineerin principles applicable to the treatment and disposal of pollutants characterized in th permit application. There is reasonable assurance, in my professional judgment, tha

[1] See Florida Administrative Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed Lawrence R. Hutker

Lawrence R. Hutker
Name (Please Type)

Harris Semiconductor
Company Name (Please Type)

P.O. Box 883, Melbourne, Florida 32901
Mailing Address (Please Type)

lorida Registration No. 35972 Date: 5/9/90 Telephone No. (407) 729-4655

SECTION II: GENERAL PROJECT INFORMATION

. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

This is a modification of Building 51 Consolidated Air Permit No. AC 05-157786.

1. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction N/A Completion of Construction

. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

N/A

. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

AO 05-109853 issued 11/5/85; expires 10/30/90. AO 05-109855 issued 11/5/85; expires 10/30/90. AO 05-117085 issued 05/20/86; expires 05/22/91. AO 05-71405 issued 09/13/83; expires 09/12/88. AC 05-157786 issued 03/31/89; expires 12/30/90.

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 52

if power plant, hrs/yr_____; if seasonal, describe:_____

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? No

   a. If yes, has "offset" been applied? _____

   b. If yes, has "Lowest Achievable Emission Rate" been applied? _____

   c. If yes, list non-attainment pollutants. _____

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. No

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. No

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No

   a. If yes, for what pollutants?_____

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
---SEE ATTACHMENT C ----				

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): not applicable

2. Product Weight (lbs/hr): not applicable

C. Airborne Contaminents Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminent	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/yr	T/yr	
---SEE ATTACHMENT B ----							

[1]See Section V, Item 2.

[2]Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated without control (See Section V, Item 3).

J. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
---SEE ATTACHMENT D ---				

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis:

Percent Sulfur: _____ Percent Ash: _____

Density: _____ lbs/gal Typical Percent Nitrogen: _____

Heat Capacity: _____ BTU/lb _____ BTU/gal

Other Fuel Contaminants (which may cause air pollution): _____

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average _____ Maximum _____

G. Indicate liquid or solid wastes generated and method of disposal.

Waste water from air scrubbers is discharged to on-site Waste Water Treatment Plant--discharge to deepwell under UIC - Permit #UC05-126519.

--------SEE ATTACHMENT D--------

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: _____ ft. Stack Diameter: _____ ft.

Gas Flow Rate: _____ ACFM _____ DSCFM Gas Exit Temperature: _____ °F.

Water Vapor Content: _____ % Velocity: _____ FPS

SECTION IV: INCINERATOR INFORMATION

not applicable

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____

Manufacturer _____

Date Constructed _____ Model No. _____

	Volume $(ft)^3$	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diamter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) _____

Brief description of operating characteristics of control devices: _____

_____

_____

_____

_____

Ultimate disposal of any effluent other then that emitted from the stack (scrubber water, ash, etc.):

_____

_____

_____

_____

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]

2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach propose methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods use to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test wa made.

3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).

4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)

5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).

6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify th individual operations and/or processes. Indicate where raw materials enter, where sol id and liquid waste exit, where gaseous emissions and/or airborne particles are evolve and where finished products are obtained.

7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of air borne emissions, in relation to the surrounding area, residences and other permanen structures and roadways (Example: Copy of relevant portion of USGS topographic map).

8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processe and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

[ ] Yes [ ] No

Contaminant	Rate or Concentration

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[ ] Yes [ ] No

Contaminant	Rate or Concentration

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

D. Describe the existing control and treatment technology (if any).

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter: ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable use additional pages if necessary).

1.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy [2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other [illegible] where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1] Explain method of determining efficiency.
[2] Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data

1. _____ no. sites _____ TSP _____ ( ) SO^2 _____ Wind spd/dir

Period of Monitoring _____/_____/_____ to _____/_____/_____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. _____ Year(s) of data from ____/____/____ to ____/____/____
month day year month day year

2. Surface data obtained from (location)_____

3. Upper air (mixing height) data obtained from (location)_____

4. Stability wind rose (STAR) data obtained from (location)_____

C. Computer Models Used

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate	
TSP	_____	grams/sec
SO^2	_____	grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

ATTACHMENT A.

PROCESS DESCRIPTION

PROCESS DESCRIPTION - BUILDING 51

Building 51 is a wafer fabrication facility. The second floor of the two-story building houses two clean room modules. Both fabrication areas employ a series of manufacturing procedures referred to as layering, patterning, doping and heating processes. The frequency and sequence of these processes can vary depending on the desired nature of the final product.

In the controlled environment of the fabrication clean rooms, wafer surfaces first undergo acid and/or solvent cleaning, followed by thermal oxidation in furnaces to form a layer of silicon dioxide on the wafer surface.

During the patterning process, the wafers are initially baked and primed. Coaters then spin a thin layer of "photoresist" on the wafer, after which the wafers are soft baked. Next, the circuit pattern is projected onto the wafers via "alligners" or "steppers." Developers are then applied to remove unpolymerized areas of photoresist. This is followed by a solvent rinse.

Next, the wafers hard-baked, inspected to determine accuracy, and etched by wet (acid bath) or dry (plasma vapor) mechanisms. Once etching is complete, the photoresist is stripped off the wafer using chemical baths or plasma techniques.

In another step of the fabrication process, "dopant" atoms are either diffused into the wafer in diffusion furnaces, or accelerated into the wafer using "ion implantation." Additional material may be layered on the wafer surface in vapor and crystal (epitaxial) deposition furnaces. Metallization to interconnect uppermost circuit layers is performed by deposition (using "sputtering" systems) or evaporation.

Wet stations that house vats containing a variety of acid and caustic compounds are located throughout the clean rooms. Storage cabinets safely hold virgin chemicals until they are ready for use. Exhausted gas cabinets house cylinders that supply process gases to the 'fab' operations.

The exhaust system for the building is divided amongst five scrubbers. The scrubbers numbered F51S01, F51S02, and F51S03 serve the east module, while F51S04 and F51S05 serve the west module. Scrubbers numbered F51S01, F51S03 and F51S04 are acid scrubbers, while F51S02 and F51S05 provide pollution control and exhaust for equipment containing solvents.

ATTACHMENT B.

AIR EMISSIONS

SOLVENT EMISSIONS - BUILDING 51

A solvent mass balance was performed on building 51 for calendar year 1989, with the following results;

1. 1988 ENDING INVENTORY = 5.61 tons
2. SOLVENTS PURCHASED = 97.01 tons
3. WASTE SHIPMENTS = 78.12 tons
4. TRACE AMOUNTS DEEPWELL INJECTED = 5.82 tons
5. 1989 ENDING INVENTORY = 1.38 tons
6. VOC AIR EMISSIONS = 17.30 tons

Note: Please refer to 1989 Solvent Mass Balance Report for lists of assumptions.

TOTAL PROJECTED VOC EMISSIONS FOR BUILDING 51 = 27.29 TONS/YEAR.

SOLVENT MONITORING--BUILDING 51

Monitoring work was conducted on the building 51 solvent scrubber systems F51S02, F51S03, F51S04, & F51S05 in August of 1987. Tests employed were EPA methods 25A (flame ionization detection) and TO-1 (Tenax adsorption and GC/ms analysis.)

FID test results revealed that total accumulative monitored VOC emissions for the building were 6.25 pounds/hour expressed as propane. The following assumptions were made regarding monitoring work on this building:

-VOC values refer to all organic emissions including organic solvents.

-All data was corrected for 2 ppm background noise that is normally present in the ambient air.

AUGUST 1989

EPA METHOD 25-A (F.I.D. ANALYSIS) BUILDING 51
AVERAGE MONITORED VOC EMISSIONS DURING PRODUCTION HOURS

F51S02 (LB/HR)	F51S03 (LB/HR)	F51S04 (LB/HR)	F51S05 (LB/HR)
2.69	0.18	0.14	3.24

ACID MONITORING--BUILDING 51

Monitoring was performed on the building 51 scrubbers F51S01, F51S03, and F51S04 during August of 1989. Samples were collected using modified EPA method 8 sampling train. The impinger medium consisted of a 0.1 N sodium hydroxide solution. The analytical methodology utilized to determine the ions of highest concentration is as follows:

Chloride ion--EPA Method 325.3
Fluoride ion--EPA Method 340.2
Nitrate, phosphite, and sulfate ions--ion chromatography

All results were in pounds per hour as "X", where "X" represents the acid compound present in highest concentration.

The test results revealed that the total accumulative monitored acid emissions for the building were 2.61 tons/year expressed as hydrochloric, hydrofluoric, nitric, phosphoric and sulfuric acids. This figure is based on a hypothetical production schedule of 8760 hours a year. The monitoring was performed over an 8 hour time interval when the full production was occurring.

When a resulting acid concentration was expressed as a "less than 'y' " value, where 'y' represents the lowest detectable limit possible using the analytical methodology employed, acid emissions were taken to be equal to this 'y' limit value.

RESULTS OF ACID MONITORING--BUILDING 51
PERFORMED IN AUGUST OF 1989

Scrubber #		HCl	HF	Nitric Acid	Phosphoric Acid	Sulfuric Acid	TOTAL (TON/YR)
UTLET 51S01	(lb/hr)	0.029	0.001	0.048	0.001	0.022	
	(ton/yr)	0.1270	0.0044	0.2102	0.0044	0.0964	0.4424
UTLET 51S03	(lb/hr)	0.0710	0.0240	0.1220	0.0010	0.0880	
	(ton/yr)	0.3110	0.1051	0.5344	0.0044	0.3854	1.3403
UTLET 51S04	(lb/hr)	0.0560	0.0650	0.0010	0.0010	0.0660	
	(ton/yr)	0.2453	0.2847	0.0044	0.0044	0.2891	0.8278
							2.6105

TOTAL ACID EMISSIONS INTO SCRUBBER OUTLETS = 2.61 TONS/YEAR

ATTACHMENT C.

RAW MATERIALS & CHEMICALS

BUILDING 51
SOLVENTS

1,1,1 TRICHLOROETHANE
1,2,4 TRICHLOROBENZENE
1-METHOXY-2-PROPANOL
2-ETHOXYETHYL ACETATE
2-METHOXY-2-PROPANOL
ACETONE
AMMONIUM FLUORIDE
AROMATIC PHENOL
BUTYL CELLOSOLVE
CELLOSOLVE ACETATE
CHLOROPENTAFLUOROETHANE
CHLOROTRIFLUOROMETHANE
DICHLORODIFLUOROMETHANE
ETHANOL
ETHANOLAMINE
ETHYL BENZENE
ETHYLENE GLYCOL MONOBUTYL ETHER
ETHYLENE GLYCOL MONOETHYL ETHER ACETATE
GLYCOL ETHER
ISOPARAFFINIC HYDROCARBONS
ISOPROPANOL
METHANOL
METHYL ETHYL KETONE
METHYLENE CHLORIDE
MONOETHANOLAMINE
N-BUTYL ACETATE
N-METHYLPYRROLIDONE
POLYPHENYL ETHER
PROPYLENE GLYCOL MONOETHYL ETHER ACETATE
PROPYLENE GLYCOL MONOMETHYL ETHER
TETRAFLUOROETHANE
TETRAFLUOROMETHANE
TRICHLORODIFLUOROETHANE
TRICHLOROTRIFLUOROETHANE
TRICHLOROTRIFLUOROMETHANE
XYLENE

BUILDING 51
PROCESS CHEMICALS

ACETIC ACID
AMMONIA
AMMONIUM FLUORIDE
AMMONIUM HYDROXIDE
CERIC SULFATE
CHROMIC ACID
CHROMIUM TRIOXIDE
CHROMIUM TRIOXIDE
COPPER SULFATE
DICHLOROBENZENE
DIMETHYLPOLYSILOXANE
DODECYLBENZENESULFONIC ACID
ETHYLENE DIAMINE TETRAACETIC ACID
FERRIC CHLORIDE
GUM RESIN
HEXAMETHYLDISILAZANE
HYDROFLUORIC ACID
HYDROGEN PEROXIDE
NITRIC ACID
PHENOL-FORMALDEHYDE RESIN
PHOSPHATE
PHOSPHORIC ACID
POTASSIUM HYDROXIDE
SILICON
SODIUM HYDROXIDE
SULFURIC ACID
TETRAMETHYL AMMONIUM HYDROXIDE

BUILDING 51
PROCESS GASES

ALUMINUM OXIDE
ARGON
ARSINE
BORON TRIFLUORIDE
SULFUR HEXAFLUORIDE
CARBON DIOXIDE
DICHLOROSILANE
HELIUM
NITROGEN
NITROUS OXIDE
OXYGEN
PHOSPHINE
SILANE
ARSENIC
BORON TRIBROMIDE
NITROGEN DIOXIDE
HYDROGEN CHLORIDE
PHOSPHORUS TRICHLORIDE
HYDROGEN

ATTACHMENT D.

CONTROL EQUIPMENT

HARRIS SEMICONDUCTOR -- AIR PERMIT INFORMATION

CURRENT PERMIT

BUILDING: 51
PERMIT NUMBER: AO 05-117085
PERMIT TYPE : OPERATING

DATE ISSUED : 05/20/86
RENEWAL DATE: 03/23/91
DATE EXPIRES: 05/22/91

AREA SERVED: ANALOG EXPANSION
PROCESS DESCRIPTION: EXHAUST SYSTEM SCRUBBER

PERMIT LIMITS

VOL. RATE (SCFM): 9.500
ACID MIST (LB/HR): 0.0437
SOLVENTS (LB/HR): --
VOCS (LB/HR): --
OPER. (HRS/YEAR): 6336

SPECIFIC CONDITIONS

ANNUAL OPERATING REPORT : 03/01
NOTIFICATION OF VE TEST : NOT SPEC.
ANNUAL VIS EMISSION TEST: NOT SPEC.

EQUIPMENT INFORMATION

MANUFACTURER : TRI-MER CORP.
LOCATION : B51 ROOF
HARRIS ID NUMBER : F51S01
VOLUME FLOW RATE (CFM): 9.500
RECIRCULATION RATE (GPM): 30
MAKEUP WATER RATE (GPM): 3.0

MODEL NUMBER : F/W 3
STACK HEIGHT (FT):
STACK DIAMETER (IN):
STACK VELOCITY (FPM):
DUCT MATERIAL :

PERMIT HISTORY

PERMIT NUMBER: AO 05-38487
DATE EXPIRED : 04/08/86

PERMIT NUMBER:
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

SCRUBBER INFORMATION

HARRIS ID # : F51S01
MANUFACTURER : TRI-MER CORP. MODEL NUMBER : F/W 3
SERIAL NUMBER: 7026 MATERIAL : PVC
DESCRIPTION : HORIZONTAL COUNTER-FLOW. MIST ELIMINATOR.
POLYPRO FILTER PACK:DRAWING D1000-585 (6/80)

DESIGN DATA
VOLUME FLOW RATE (CFM): 9.500 PRESSURE DROP (IN):
RECIRCULATION RATE (GPM): 30 MAKE UP RATE (GPM): 3.0

ACTUAL DATA
VOLUME FLOW RATE (CFM): PRESSURE DROP (IN): N/E DATE: 6/3/87
RECIRCULATION RATE (GPM): N/E MAKE UP RATE (GPM): N/R DATE: "

RECIRCULATION PUMP INFORMATION

MANUFACTURER : FLOTEK MODEL NUMBER : C7P3-1194V
SERIAL NUMBER: 603887B801 HP : 1 RPM : 3450/2850
BRKR LOCATION: NEXT TO UNIT FED FROM MCC : TAC 76127

FAN INFORMATION

HARRIS ID # : F51E13
MANUFACTURER : TRI-MER CORP. MODEL NUMBER: 24 UB
SERIAL NUMBER: 7026 MATERIAL : PVC
DESCRIPTION : CENTRIFUGAL BLOWER. BACKWARD INCLINED BLADES

DESIGN DATA
VOLUME FLOW RATE (CFM): 6,000 STATIC PRESS (IN):

ACTUAL DATA SPEED (RPM): DATE:
VOLUME FLOW RATE (CFM): STATIC PRESS (IN): DATE:

FAN MOTOR INFORMATION

MANUFACTURER : LINCOLN MODEL NUMBER :
SERIAL NUMBER: HP : 15 RPM : 1750
BRKR LOCATION: NEXT TO UNIT FED FROM MCC : TAC 76127

HARRIS SEMICONDUCTOR -- AIR PERMIT INFORMATION

CURRENT PERMIT

BUILDING: 51
PERMIT NUMBER: AO 05-109855
PERMIT TYPE : OPERATING

DATE ISSUED : 11/05/85
RENEWAL DATE: 08/31/90
DATE EXPIRES: 10/30/90

AREA SERVED:
PROCESS DESCRIPTION: SILICON WAFER CHEM TREAT AIR WASHER (SYS 6)

PERMIT LIMITS

VOL. RATE (SCFM): 10.000
ACID MIST (LB/HR): --
SOLVENTS (LB/HR): --
VOCS (LB/HR): 1.246
OPER. (HRS/YEAR): 6336

SPECIFIC CONDITIONS

ANNUAL OPERATING REPORT : 03/01
NOTIFICATION OF VE TEST : 11/06
ANNUAL VIS EMISSION TEST: 11/21

EQUIPMENT INFORMATION

MANUFACTURER : DUALL IND.
LOCATION : B51 PENTHOUSE
HARRIS ID NUMBER : F51S02
VOLUME FLOW RATE (CFM): 10,000
RECIRCULATION RATE (GPM): 30
MAKEUP WATER RATE (GPM): 1.5

MODEL NUMBER : F-101
STACK HEIGHT (FT):
STACK DIAMETER (IN):
STACK VELOCITY (FPM):
DUCT MATERIAL :

PERMIT HISTORY

PERMIT NUMBER: AO 05-36166
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

SCRUBBER INFORMATION

HARRIS ID # : F51S02
MANUFACTURER : DUALL IND. MODEL NUMBER : F-101
SERIAL NUMBER: 447[illegible] MATERIAL : PVC
DESCRIPTION : HORIZONTAL CROSS-FLOW. FOUR STAGE. MIST ELIMINATOR. SINGLE FILTER PACK. OPEN ORIFICE TYPE SPRAY NOZZLES

DESIGN DATA
VOLUME FLOW RATE (CFM): 10,000 PRESSURE DROP (IN): 2.0
RECIRCULATION RATE (GPM): 30 MAKE UP RATE (GPM): 1.5

ACTUAL DATA
VOLUME FLOW RATE (CFM): 8,200 PRESSURE DROP (IN): N/E DATE: 1/16/87
RECIRCULATION RATE (GPM): 12 MAKE UP RATE (GPM): N/E DATE: 6/3/87

RECIRCULATION PUMP INFORMATION

MANUFACTURER : GENERAL ELECT. MODEL NUMBER : 5K47SG976
SERIAL NUMBER: N/A HP : 2 RPM : 3450
BRKR LOCATION: FED FROM MCC :

FAN INFORMATION

HARRIS ID # : F51E18
MANUFACTURER : DUALL IND. MODEL NUMBER: 49
SERIAL NUMBER: 4476 MATERIAL : PVC
DESCRIPTION : CENTRIFUGAL BLOWER

DESIGN DATA
VOLUME FLOW RATE (CFM): 10.000 STATIC PRESS (IN):

ACTUAL DATA SPEED (RPM): DATE:
VOLUME FLOW RATE (CFM): 8.200 STATIC PRESS (IN): 4.3 DATE: 1/16/87

FAN MOTOR INFORMATION

MANUFACTURER : MODEL NUMBER :
SERIAL NUMBER: HP : 15 RPM : 1750
BRKR LOCATION: FED FROM MCC :

ttachment :

HARRIS SEMICONDUCTOR -- AIR PERMIT INFORMATION

CURRENT PERMIT

BUILDING: 51
PERMIT NUMBER: AO 05-109853
PERMIT TYPE : OPERATING

DATE ISSUED : 11/05/85
RENEWAL DATE: 08/31/90
DATE EXPIRES: 10/30/90

AREA SERVED:
PROCESS DESCRIPTION: SILICON WAFER CHEM TREAT AIR WASHER (SYS 3 AND 5)

PERMIT LIMITS

VOL. RATE (SCFM): 24.000
ACID MIST (LB/HR): 0.0649
SOLVENTS (LB/HR): --
VOCS (LB/HR): 0.0174
OPER. (HRS/YEAR): 6336

SPECIFIC CONDITIONS

ANNUAL OPERATING REPORT : 03/01
NOTIFICATION OF VE TEST : 11/06
ANNUAL VIS EMISSION TEST: 11/21

EQUIPMENT INFORMATION

MANUFACTURER : DUALL IND.
LOCATION : B51 PENTHOUSE
HARRIS ID NUMBER : F51S03
VOLUME FLOW RATE (CFM): 24,000
RECIRCULATION RATE (GPM): 72
MAKEUP WATER RATE (GPM): 4.0

MODEL NUMBER : F-101
STACK HEIGHT (FT):
STACK DIAMETER (IN):
STACK VELOCITY (FPM):
DUCT MATERIAL :

PERMIT HISTORY

PERMIT NUMBER: AO 05-36165
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

SCRUBBER INFORMATION

HARRIS ID # : F51S03
MANUFACTURER : DUALL IND. MODEL NUMBER : F-101
SERIAL NUMBER: 41[redacted] MATERIAL : PVC
DESCRIPTION : HORIZONTAL CROSS-FLOW. FOUR STAGE. MIST ELIMINATOR. SINGLE FILTER PACK. OPEN ORIFICE TYPE SPRAY NOZZLES

DESIGN DATA
VOLUME FLOW RATE (CFM): 24.000 PRESSURE DROP (IN): 2.0
RECIRCULATION RATE (GPM): 72 MAKE UP RATE (GPM): 4.0

ACTUAL DATA
VOLUME FLOW RATE (CFM): PRESSURE DROP (IN): N/E DATE: 6/3/87
RECIRCULATION RATE (GPM): N/E MAKE UP RATE (GPM): N/E DATE: "

RECIRCULATION PUMP INFORMATION

MANUFACTURER : LINCOLN MODEL NUMBER : 2509
SERIAL NUMBER: 1605666 3420 HP : 1.5 RPM : 3420
BRKR LOCATION: FED FROM MCC : #5

FAN INFORMATION

HARRIS ID # : F51E03
MANUFACTURER : TRI-MER CORP. MODEL NUMBER: 44 CW
SERIAL NUMBER: 5303 MATERIAL : PVC
DESCRIPTION : CENTRIFUGAL BLOWER. BACKWARD INCLINED BLADES

DESIGN DATA
VOLUME FLOW RATE (CFM): 30.000 STATIC PRESS (IN):

ACTUAL DATA SPEED (RPM): DATE:
VOLUME FLOW RATE (CFM): STATIC PRESS (IN): DATE:

FAN MOTOR INFORMATION

MANUFACTURER : MODEL NUMBER :
SERIAL NUMBER: HP : 30 RPM : 1750
BRKR LOCATION: FED FROM MCC : #5

HARRIS SEMICONDUCTOR -- AIR PERMIT INFORMATION

CURRENT PERMIT

BUILDING: 51
PERMIT NUMBER: AO 05-109853
PERMIT TYPE : OPERATING

DATE ISSUED : 11/05/85
RENEWAL DATE: 08/31/90
DATE EXPIRES: 10/30/90

AREA SERVED:
PROCESS DESCRIPTION: SILICON WAFER CHEM TREAT AIR WASHER (SYS 3 AND 5)

PERMIT LIMITS

VOL. RATE (SCFM): 24.000
ACID MIST (LB/HR): 0.0649
SOLVENTS (LB/HR): --
VOCS (LB/HR): 0.0174
OPER. (HRS/YEAR): 6336

SPECIFIC CONDITIONS

ANNUAL OPERATING REPORT : 03/01
NOTIFICATION OF VE TEST : 11/06
ANNUAL VIS EMISSION TEST: 11/21

EQUIPMENT INFORMATION

MANUFACTURER :
LOCATION : B51 PENTHOUSE
HARRIS ID NUMBER : F51S04
VOLUME FLOW RATE (CFM): 12,100
RECIRCULATION RATE (GPM):
MAKEUP WATER RATE (GPM):

MODEL NUMBER :
STACK HEIGHT (FT):
STACK DIAMETER (IN):
STACK VELOCITY (FPM):
DUCT MATERIAL :

PERMIT HISTORY

PERMIT NUMBER: 36163
DATE EXPIRED : 11/21/85

PERMIT NUMBER:
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

SCRUBBER INFORMATION

HARRIS ID # : F51S04
MANUFACTURER : DUALL IND. MODEL NUMBER : F-101
SERIAL NUMBER: 41[redacted] MATERIAL : PVC
DESCRIPTION : HORIZONTAL CROSS-FLOW. FOUR STAGE. MIST ELIMINATOR. SINGLE FILTER PACK. OPEN ORIFICE TYPE SPRAY NOZZLES

DESIGN DATA
VOLUME FLOW RATE (CFM): 24.000 PRESSURE DROP (IN):
RECIRCULATION RATE (GPM): 72 MAKE UP RATE (GPM): 4.0

ACTUAL DATA
VOLUME FLOW RATE (CFM): PRESSURE DROP (IN): N/E DATE: 6/3/87
RECIRCULATION RATE (GPM): N/E MAKE UP RATE (GPM): N/E DATE: "

RECIRCULATION PUMP INFORMATION

MANUFACTURER : LINCOLN MODEL NUMBER : 2500
SERIAL NUMBER: 1597787 HP : 1.5 RPM : 3420
BRKR LOCATION: FED FROM MCC : #5

FAN INFORMATION

HARRIS ID # :
MANUFACTURER : HARTZELL MODEL NUMBER: 41-40-GR3
SERIAL NUMBER: 15530 MATERIAL : FIBERGLASS
DESCRIPTION : CENTRIFUGAL BLOWER. BACKWARD CURVED BLADES

DESIGN DATA
VOLUME FLOW RATE (CFM): 24500 STATIC PRESS (IN):

ACTUAL DATA SPEED (RPM): DATE:
VOLUME FLOW RATE (CFM): STATIC PRESS (IN): DATE:

FAN MOTOR INFORMATION

MANUFACTURER : MODEL NUMBER :
SERIAL NUMBER: HP : 30 RPM :
BRKR LOCATION: FED FROM MCC : #5

Attachment :

HARRIS SEMICONDUCTOR -- AIR PERMIT INFORMATION

CURRENT PERMIT

BUILDING: 51
PERMIT NUMBER: AO 05-71405
PERMIT TYPE : OPERATING

DATE ISSUED : 09/13/83
RENEWAL DATE: 07/14/88
DATE EXPIRES: 09/12/88

AREA SERVED:
PROCESS DESCRIPTION: SILICON WAFER CHEM TREAT SOLVENT SCRUBBER (SYS 6)

PERMIT LIMITS

VOL. RATE (SCFM): NOT SPEC.
ACID MIST (LB/HR): --
SOLVENTS (LB/HR): 0.0893
VOCS (LB/HR): 0.0008
OPER. (HRS/YEAR): 6336

SPECIFIC CONDITIONS

ANNUAL OPERATING REPORT : 03/01
NOTIFICATION OF VE TEST : 08/10
ANNUAL VIS EMISSION TEST: 08/20

EQUIPMENT INFORMATION

MANUFACTURER : HARRISON
LOCATION : B51 PENTHOUSE
HARRIS ID NUMBER : F51S05
VOLUME FLOW RATE (CFM): 18,000
RECIRCULATION RATE (GPM): 45
MAKEUP WATER RATE (GPM): 4.5

MODEL NUMBER : HF-180
STACK HEIGHT (FT):
STACK DIAMETER (IN):
STACK VELOCITY (FPM):
DUCT MATERIAL :

PERMIT HISTORY

PERMIT NUMBER: N/A
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

PERMIT NUMBER:
DATE EXPIRED :

SCRUBBER INFORMATION

HARRIS ID # : F51S05
MANUFACTURER : HARRISON — MODEL NUMBER : HF-180
SERIAL NUMBER: N/[redacted] — MATERIAL : POLYPRO
DESCRIPTION : HORIZONTAL CROSS-FLOW. PLASTIC SADDLE PACKING.LIQUID DISTRIBUTION THROUGH MAIN HEADER. NO SPRAY NOZZLES DWG HPS-217-C 11/21/83

DESIGN DATA
VOLUME FLOW RATE (CFM): 18.000 — PRESSURE DROP (IN):
RECIRCULATION RATE (GPM): 45 — MAKE UP RATE (GPM): 4.5

ACTUAL DATA
VOLUME FLOW RATE (CFM): — PRESSURE DROP (IN): N/E DATE: 6/3/87
RECIRCULATION RATE (GPM): N/E — MAKE UP RATE (GPM): N/E DATE: "

RECIRCULATION PUMP INFORMATION

MANUFACTURER : GENERAL ELECT. — MODEL NUMBER : 5K33KN42
SERIAL NUMBER: AYD/ — HP : 1/3 RPM : 1725
BRKR LOCATION: — FED FROM MCC : #5

FAN INFORMATION

HARRIS ID # :
MANUFACTURER : TRANE — MODEL NUMBER: 81 TYPE AF
SERIAL NUMBER: K3H244576 — MATERIAL :
DESCRIPTION : SIZE 44. CLASS I

DESIGN DATA
VOLUME FLOW RATE (CFM): — STATIC PRESS (IN):

ACTUAL DATA — SPEED (RPM): — DATE:
VOLUME FLOW RATE (CFM): — STATIC PRESS (IN): — DATE:

FAN MOTOR INFORMATION

MANUFACTURER : US ELECTRICAL — MODEL NUMBER :
SERIAL NUMBER: — HP : 30 RPM : 1760
BRKR LOCATION: — FED FROM MCC :

Plastic Packed Scrubbers

THE HARRISON SYSTEM

Harrison is a prime designer and producer of complete plastic exhaust systems, custom engineered scrubbing systems, as well as duct and fittings, tanks, and hoods. As a result of this capability and experience, design and manufacture of standard, pre-engineered fume scrubbers is a natural extension.

MATERIALS

Self-supporting or fiberglass armored PVC and Polypropylene, fiberglass armored Kynar, and solid fiberglass construction offers a wide range of resistance to acids, alkalis, solvents, and other corrosives at operating temperatures to approximately 250°F. Harrison systems do not use any metal in contact with the process stream.

PRE-ENGINEERING

Pre-engineered design reduces cost by eliminating the necessity to re-invent each item ordered. It results in more reliable service thru improved workmanship achieved by repetitive production control, and speeds quotations and approval drawings because costs and designs are immediately available. In addition to significant savings in approval and order time, Harrison reduces delivery time by stocking scrubber components including packing, support grids, distributor plates, nozzles, duct reducers, and sheet stock.

SCRUBBER CONFIGURATION

Most fume removal applications can be served by the two scrubber designs shown in this catalog. Vertical Counter Current style directs liquid down vertically, and unwanted fumes upward in the opposite direction. Horizontal Cross Flow unit directs liquid down vertically, but unwanted fumes are driven horizontally at 90° to the liquid. In both designs, liquid and fumes are inter-mixed in the packed bed section of the scrubber where fumes are removed by chemical reaction or water solubility. Scrubber shape does not affect performance. Horizontal design presents a low profile and is suitable where head room is limited. Verticals require more head room, but use only minimum floor space.

SCRUBBER DESIGN AND OPERATION

Highest scrubber efficiency (volumetric % of contaminate removed) is obtained by having the proper amount of contact surface area (packing) wetted by sufficient liquid (recirculated liquid rate) for an optimum residence time (packing depth) to allow unwanted fumes to take a treacherous path thru the wetted packing to permit their maximum removal from the carrier air stream by chemical reaction or water solubility. Air stream resistance encountered in the packing (static pressure loss) is a function of air velocity, cross-sectional packing area, and packing depth. Harrison scrubbers utilize proven packing depth to achieve efficiencies approaching 99+%, when operated within recommendations.

LIQUID DISTRIBUTION AND MIST ELIMINATION

Simple liquid distribution is achieved thru a main header pipe feeding perforated laterals, without use of troublesome spray nozzles. Nozzles are subject to plugging, and produce a difficult-to-remove atomized mist carryover. In the Harrison design, any large droplets of liquid caught in the upward moving air stream are easily and efficiently removed by a short bed of dry packing located above the liquid distributor.

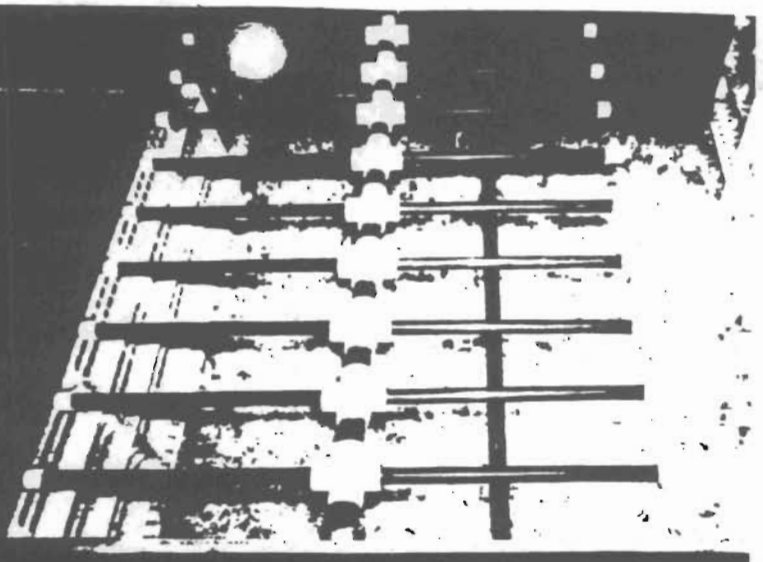
STATIC PRESSURE LOSS

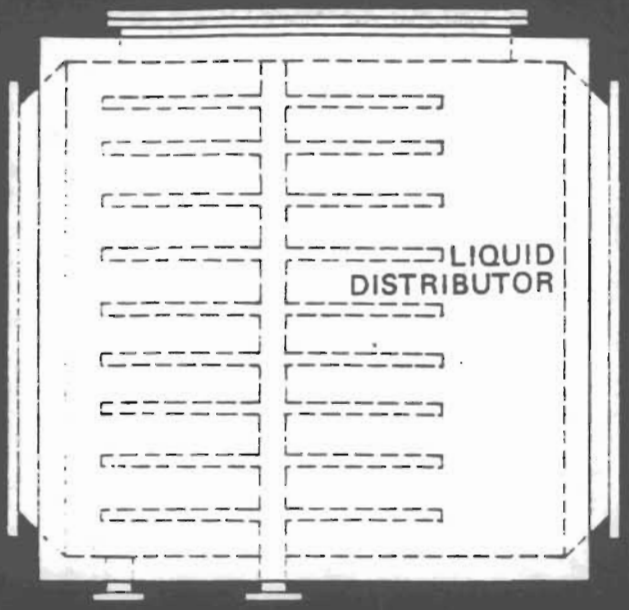
Use of high-surface-area, low-pressure-drop plastic saddles in a balanced design result in low static pressure loss of only 0.4 inches H_2O (w.g.) per foot of packed depth in Vertical Counter Current scrubbers, and 0.33 in Horizontal Cross Flow units. At the same time, sufficient irrigation rates constantly keep saddles clear of potential sludge buildup. Thereby, continuous, non-clogging operation at a proper rate of intermixing turbulence between liquid and fumes is achieved for 99+% efficiency.

LIQUID SUMP OPERATION

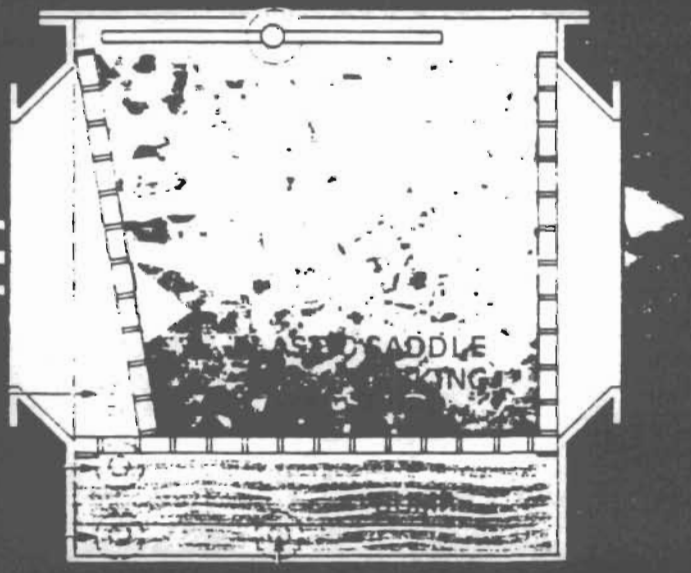
Harrison scrubbers employ an integral liquid recirculating sump which reduces amount of liquid consumption required by 90 to 95% in most applications. Therefore, considerably less effluent must be handled and treated. The sump reservoir is contained within the scrubber itself. Harrison recommends optimum rate of effluent removal. When effluent is acidic only, additional liquid conservation can be obtained with either scrubber design with the simple optional recovery system shown with the vertical scrubber drawing on page 4. If central treating facilities exist, no sump, recirculation, or independent recovery is needed. In this case, treated liquid would be directed over the packing in a single pass, then treated, then returned to the scrubber, etc. In both instances where effluent is treated, liquid consumption would be reduced to only that amount lost by evaporation.

Harrison

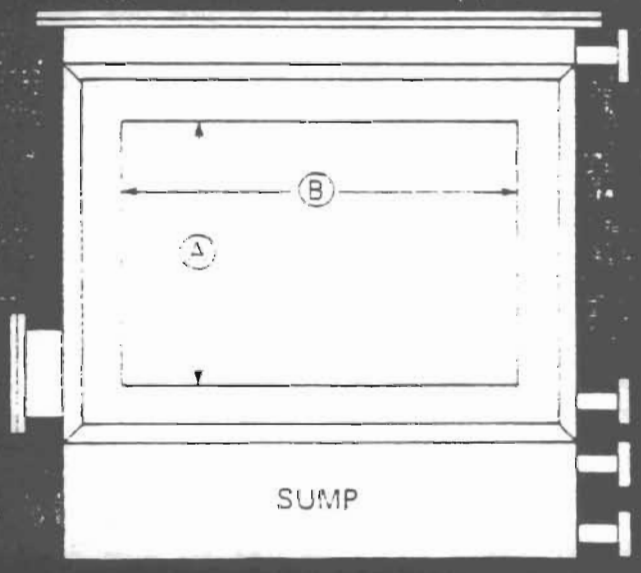




TOP VIEW



SIDE VIEW (CUT-A-WAY)



INLET SIDE VIEW

HORIZONTAL CROSS-FLOW

Model	CFM	Inlet & Outlet A x B In.	Length L Ft.	Width W In.	C In.	D In.	E In.	F In.	G In.	Sump Capacity Gal.	Rec. Liquid GPM	Overall Height In.	Ship* Wt. Lbs.	Operating Wt. Lbs.
HF-8	800	11x11	6	17	¾	1	1	1¼	1	58	17	35	182	646
HF-12	1,200	14x14	6	20	¾	1	1	1¼	1	69	21	38	224	781
HF-17	1,700	18x18	6	24	¾	1	1	1½	1¼	82	24	42	275	926
HF-21	2,100	21x21	6	27	¾	1	1	1½	1¼	92	28	45	316	1028
HF-25	2,500	24x24	6	30	¾	1½	1½	1½	1¼	102	32	48	357	1166
HF-31	3,100	27x27	6	33	¾	1½	1½	1½	1¼	113	35	51	419	1313
HF-37	3,700	30x30	6	36	¾	1½	1½	1½	1¼	125	39	54	481	1445
HF-45	4,500	33x33	6	39	¾	1½	1½	1½	1¼	134	42	57	563	1669
HF-50	5,000	36x36	6	42	¾	1½	1½	1½	1¼	144	45	5.0 ft.	615	1733
HF-67	6,700	36x36	6	48	1	2	2	1½	1¼	165	51	5.5	690	1980
HF-85	8,500	42x42	6	54	1	2	2	2	1½	186	56	6.0	824	2276
HF-106	[illegible]	[illegible]	[illegible]	60	1	2	2	2	1½	206	60	6.5	1035	2639
HF-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	1½	[illegible]	[illegible]	7.0	1242	2890
HF-150	15,000	[illegible]	[illegible]	72	1	[illegible]	2	2½	2	247	[illegible]	7.5	[illegible]	[illegible]
HF-176	17,600	66x66	[illegible]	78	[illegible]	[illegible]	2	2½	2	[illegible]	[illegible]	8.0	1751	[illegible]
HF-[illegible]	19,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HF-[illegible]	22,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	24,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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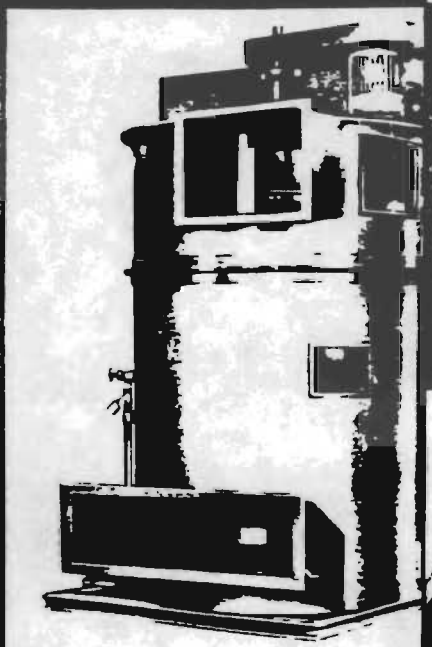
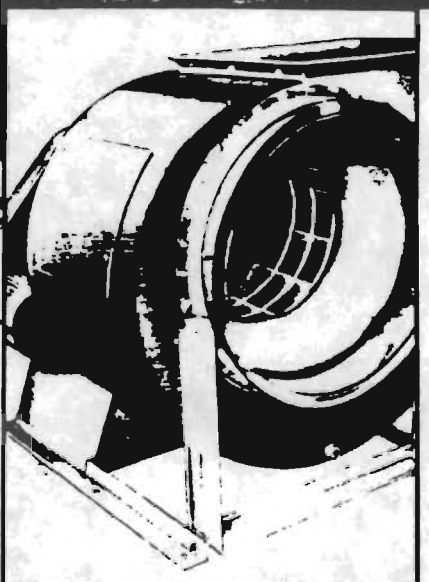
HF-327	32,700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

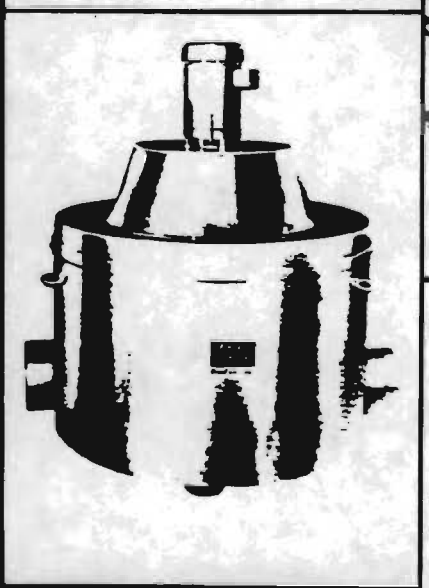
M..ET YOUR
POLLUTION CONTROL
REQUIREMENTS
WITH THE LEADER IN
PVC FABRICATIONS



Duall



CONTROLLED ENVIRONMENTS FOR INDUSTRY
P. O. BOX 10428 – 904/396-7733
JACKSONVILLE, FLORIDA 32247-0428
DANIEL J. KLOS



PVC CONSTRUCTED
FUME SCRUBBERS
CENTRIFUGAL FANS
DUCTING and HOODS
OIL MIST COLLECTORS
COMPLETE SYSTEMS

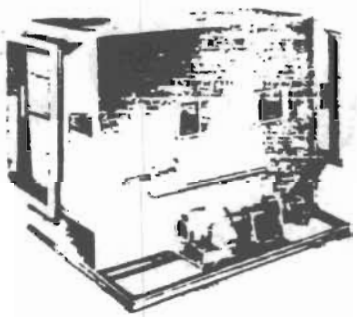
Duall
INDUSTRIES, INC.
700 S. McMillan Street • Owosso, Michigan 488

Duall

Fume Scrubbers in 6 Types

F-101 SERIES

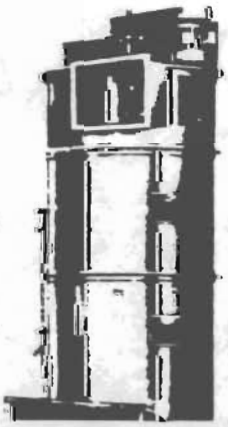
Single Pack



Double Pack

FW-300 SERIES

Single Pack



Double Pack

Duall Single Pack (four Stage) Fume Scrubbers solve most industrial air pollution problems. They are especially effective on water soluble fumes and odors, or with pH control on many low soluble contaminants.

Some typical proven applications are:

- Acid fumes.
- Plating fumes.
- Cleaning fumes.
- Lab hood fumes.
- Anodizing fumes.
- Pickling fumes.
- Rust-proofing fumes.
- Die-casting fumes.
- Water soluble odors.

Duall Single Pack Fume Scrubbers incorporate these advantages:

- Low cost.
- Low maintenance.
- Low water consumption.
- Low static pressure drop.
- 100% corrosion resistant.

Duall Double Pack (six stage) Fume Scrubbers offer the broadest range of answers to industrial air pollution problems. By double scrubbing the air these scrubbers provide maximum efficiency on tough fumes and odors which can not be completely absorbed in a single pack type scrubber.

Duall's Double Pack Scrubbers have proven effective on the following typical applications:

- Bright dip fumes.
- Strip tank fumes.
- Etching fumes.
- Most low solubility fumes and odors.

Our Double Pack Fume Scrubbers offer all the advantages of the Single Pack units as well as the broadest range of applications.

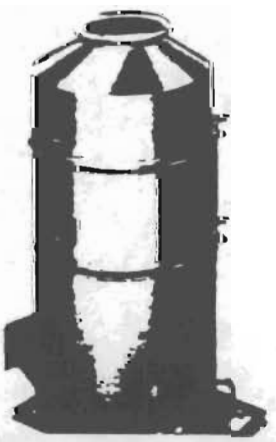
All Duall Fume Scrubbers can be modified for custom installation with multiple packs or extended depth packs. Multiple modular units are available for capacities larger than standard.

See page 6 for complete specs and performance data.

PT-500 SERIES

Single Pack

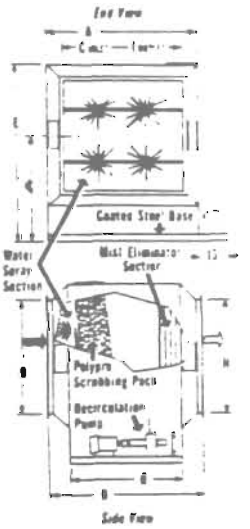
Double Pack



F-101 HORIZONTAL SINGLE FILTER PACK

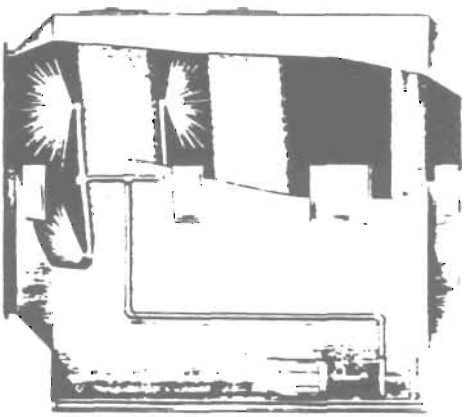
Being our most popular scrubber design, this compact 100% corrosion resistant P.V.C. unit has proven its efficiency nationwide. The Duall F-101 incorporates high efficiency, low maintenance filter media and the open orifice type spray nozzles, for the assurance of a thoroughly saturated collection chamber. Our mist eliminator outlet section gives four air direction changes to properly remove the entrained moisture. Where a horizontal installation is preferred, the F-101 should be your choice.

CFM in 000's	DIMENSIONS IN INCHES A	B	C	D	E	H	I	Q	℄	CFM in 000's	A	B	C	D	E	H	I	Q	℄
0.5	18	10	10	49	30	10	10	37	21	20	88	61	72	66	87	61	72	46	52½
1	22	14	14	50	34	14	14	38	23	22	97	61	81	66	87	61	81	46	52½
2	28	20	20	50	40	20	20	38	26	24	104	61	88	66	87	61	88	46	52½
3	32	24	24	51	44	24	24	39	28	26	112	61	96	66	87	61	96	46	52½
4	37	29	29	52	49	29	29	40	30½	28	123	61	107	66	87	61	107	46	52½
5	41	33	33	52	53	33	33	40	32½	30	135	61	119	66	87	61	119	46	52½
6	45	37	37	53	58	37	37	41	35½	35	157	61	141	66	87	61	141	46	52½
8	52	44	44	54	65	44	44	42	39	40	179	61	163	66	87	61	163	46	52½
10	58	46	46	59	71	46	46	43	42	45	102	61	186	66	87	61	186	46	52½
12	64	52	52	60	77	52	52	44	45	50	224	61	208	66	87	61	208	46	52½
14	69	57	57	60	82	57	57	44	47½	55	247	61	231	66	87	61	231	46	52½
16	74	62	62	61	87	62	62	45	50	60	269	61	253	66	87	61	253	46	52½
18	81	65	69	61	91	65	69	45	52½	0	Larger sizes on request								

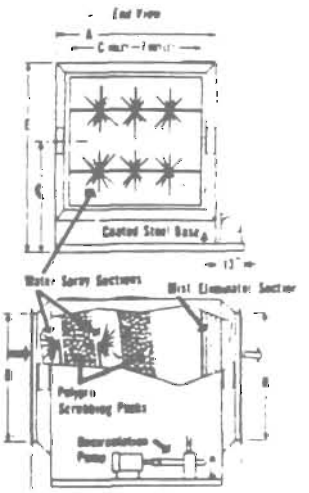


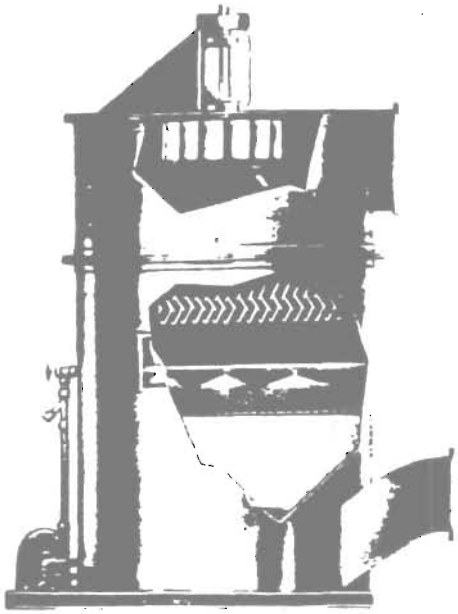
F-101D HORIZONTAL DOUBLE FILTER PACK

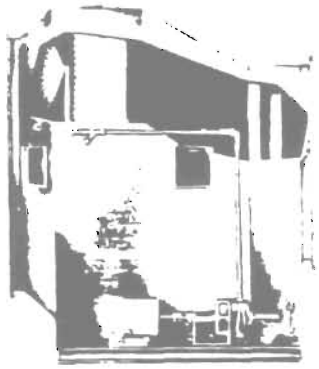
An extra heavy duty scrubber for real "tuffies". It incorporates *two* filter packs with *two* sets of sprays for more thorough scrubbing . . . plus an effective mist eliminator at the air outlet. Serious concentrations of rough fumes, such as nitric, hydrofluoric, and hydrochloric acid are double scrubbed through six stages for maximum efficiency. Use this high efficiency fume scrubber, at only a small increase in price.

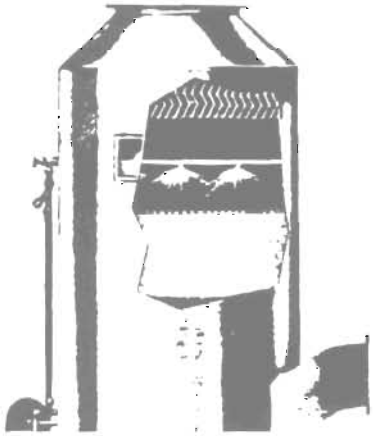


CFM in 000's	DIMENSIONS IN INCHES A	B	C	D	E	H	I	Q	℄	CFM in 000's	A	B	C	D	E	H	I	Q	℄
0.5	18	10	10	70	30	10	10	58	21	20	88	61	72	87	91	61	72	67	52½
1	22	14	14	71	34	14	14	59	23	22	97	61	81	87	91	61	81	67	52½
2	28	20	20	71	40	20	20	59	26	24	104	61	88	87	91	61	88	67	52½
3	32	24	24	72	44	24	24	60	28	26	112	61	96	87	91	61	96	67	52½
4	37	29	29	73	49	29	29	61	30½	28	123	61	107	87	91	61	107	67	52½
5	41	33	33	73	53	33	33	61	32½	30	135	61	119	87	91	61	119	67	52½
6	45	37	37	74	58	37	37	62	35½	35	157	61	141	87	91	61	141	67	52½
8	52	44	44	75	65	44	44	63	39	40	179	61	163	87	91	61	163	67	52½
10	58	46	46	80	71	46	46	64	42	45	202	61	186	87	91	61	186	67	52½
12	64	52	52	81	77	52	52	65	45	50	224	61	208	87	91	61	208	67	52½
14	69	57	57	81	82	57	57	65	47½	55	247	61	231	87	91	61	231	67	52½
16	74	62	62	82	87	62	62	66	50	60	269	61	253	87	91	61	253	67	52½
18	81	65	69	82	91	65	69	66	52½	0	Larger sizes on request								









Duall

PVC Constructed, 100% Corrosion Free

FUME SCRUBBERS

FW-300 Vertical Pack with Blower

500 TO 12,000 C.F.M. . . *plus multiple installations*

This packed tower type scrubber is not only a space saver, it's also a true economy model. It incorporates a built-in rugged fan with convenient exterior, belt driven, TEFCBB motor. During installation, the horizontal air discharge can be swivelled 360° before sealing into permanent position. Efficiency is equal to the F-101 and the PT-500. Compactness and versatility make it an unusually popular model. This FW-300 saves three ways . . . in initial cost, installation, and in space. Also available with double pack.

F-101 Horizontal Single Filter Pack

500 TO OVER 60,000 C.F.M. . . *plus multiple installations*

Being our most popular scrubber design, this compact 100% corrosion resistant P.V.C. unit has proven its efficiency in 46 states. The Duall F-101 incorporates high efficiency, low maintenance filter media and the open orifice type spray nozzles, for the assurance of a thoroughly saturated collection chamber. Our mist eliminator outlet section gives four air direction changes to properly remove the entrained moisture. Where a horizontal installation is preferred, the F-101 should be your choice.

F-101-D Horizontal Double Filter Pack

500 TO OVER 60,000 C.F.M. . . *plus multiple installations*

An extra heavy duty scrubber for real "tuffies". It incorporates *two* filter packs with *two* sets of sprays for more thorough scrubbing . . . plus an effective mist eliminator at the air outlet. Serious concentrations of rough fumes, such as nitric, hydrofluoric, and hydrochloric acid are double scrubbed through six stages for maximum efficiency. For such problems in your plant, use this high efficiency fume scrubber, at only a small increase in price.

PT-500 Vertical Pack

500 TO OVER 30,000 C.F.M. . . *plus multiple installations*

The upright PT-500 is the space saver. This scrubber is a vertical packed tower type designed to fit into restricted spaces where floor space is at a premium. Its efficiency is equal to the F-101, and also 100% corrosion-free. Air flow is up through a thoroughly water saturated bed of filter media. The mist eliminator pack near the top outlet assures properly dried air. If space is your problem, take a good look at the PT-500. Also available with double pack.

Duall FUME SCRUBBERS

SPECIFICATIONS and PERFORMANCE DATA

DESCRIPTIONS

F-101. Horizontal (cross-flow), four stage, wet scrubber. This model has maximum efficiency on water soluble contaminants and odors, but is also effective on low soluble contaminants with the use of chemical neutralizers.

F-101D. Horizontal (cross-flow), six stage, wet scrubber. The F-101D is especially designed for use on stubborn low solubility contaminants or where extremely high scrubbing efficiency is required on normal contaminants.

FW-300. Vertical (counter-flow), four stage, wet scrubber with integral blower. Efficency is equal to the F-101.

FW-300D. Vertical (counter-flow), six stage, wet scrubber with integral blower. Efficiency is equal to the F-101D.

PT-500. Vertical (counter-flow), four stage, wet scrubber. Efficiency is equal to the F-101.

PT-500D. Vertical (counter-flow), six stage, wet scrubber. Efficiency is equal to the F-101D.

All Duall Fume Scrubbers are constructed of P.V.C. and Polypropylene corrosion resistant materials and include a rugged coated steel base with lifting luggs. All above units are available with extended depth packing.

SCRUBBING PRINCIPLES

Contaminant removal is accomplished by first slowing the fumes to a velocity below 500 fpm and then passing the fumes through two scrubbing stages in the single pack models and four stages in the double pack types. The fumes first pass through a water spray or curtain during which a percentage of the larger contaminant particles drop out and the remaining fumes are saturated. The second stage consists of a 12" deep pack of polypropylene high surface, non-clogging, spherical plate packing media* which is continuously wetted by the spray nozzles. The saturated fumes are impinged upon the packing and the contaminants are absorbed and carried away in the wash water. The first and second stages are repeated in the double pack fume scrubbers.

*Several types of alternate packing media are available on request.

MIST ELIMINATION

After passing through the scrubbing sections, the air is moisture laden and must pass through a two stage gravity mist eliminator section. This final stage of P.V.C. eliminator blades provides four 30° changes in direction and eliminates entrained water.

WATER SUPPLY

All Duall Fume Scrubbers may be supplied with water either directly from your supply or from an integral or remote recirculation system supplied with the scrubber. It is generally recommended that a recirculation system be used to conserve water except on very low cfm units. **The actual fresh water consumption on the single pack series with recirculation is only 0.05 to 0.15 gpm/1000 cfm depending on the contaminant involved.** On the double pack models, water consumption ranges from 0.1 to 0.3 gpm/1000 cfm. This represents 5% of the water being recirculated. Duall scrubbers are self-draining and may be installed out-doors in sub-zero conditons without freeze-up. If these conditions exsist, a remote recirculation system should be specified for placement in a heated area.

All Duall Scrubbers come complete with fittings for the additon of chemical neutralizers, if required. A complete chemical metering and pumping system is available upon request.

MATERIALS

Every Duall Fume Scrubber is shipped complete with an integral coated steel base. No special mounting is required. Simply connect the duct, the water and power supply, and the unit is ready for operation. Complete installation and operating instructions are supplied with all Duall Scrubbers.

PRESSURE DROP

The following pressure drops are applicable for Scrubbers operated at design CFM:

F-101*	2.0" w.g.	FW-300D	3.0" w.g.
F-101D	3.0" w.g.	PT-500	2.0" w.g.
FW-300	2.0" w.g.	PT-500D	3.0" w.g.

On the FW-300 series, the blower is designed for 2.0" external

FW-300 BLOWER SECTION

The top section of the FW-300 Fume Scrubber consists of a Duall P.V.C. centrifugal blower complete with motor and OSHA belt guard and shaft cover. The blower section may be rotated through 360° to obtain any desired angle between scrubber inlet and blower outlet. This blower section is same low maintenance, guaranteed corrosion resistant blower described in Duall Brochure No. CI-131, and NH-151.

MAINTENANCE

All Duall Fume Scrubbers incorporate low maintenance components from front to back, including the packing, plumbing system and eliminators. Quick opening inspection doors are at all critical points.

DUALL FUME SCRUBBERS
Typical Average Fume Removal Efficiencies

MODELS ▶ / CONTAMINATES ▼	Single Pack Series: F-101 PT-500 FW-300	Double Pack Series: F-101D PT-500D FW-300D	Single Pack Series: with added Chemical Neutralizer (pH Control)	Double Pack Series: with added Chemical Neutralizer (pH Control)
Acetic Acid	95-98	98-99	—	—
Alkaline Cleaners	96-99	98-99	—	—
Aluminum Bright Dip *	80-85	85-90	—	—
Anodizing	96-99	98-99	—	—
Aqua Regia	80-85	85-90	85-90	90-95
Boric Acid	85-90	90-95	—	—
Caustic Cleaners	98-99	99	—	—
Caustic Soda	98-99	99	—	—
Chlorine	80-85	85-90	85-90	90-95
Chromic Acid	98-99	99	—	—
Copper Chloride	75-80	80-85	85-90	90-95
Cyanide Solutions	98-99	99	—	—
Ferric Chloride	80-85	83-88	—	—
Ferric Nitrate	96-98	98-99	—	—
Ferrous Chloride	90-95	95-98	—	—
Ferrous Sulfate	95-97	96-98	—	—
Fluosilicic Acid	95-98	98-99	—	—
Hydrochloric Acid	80-85	85-90	90-95	95-98
Hydrogen Cyanide	85-90	90-95	—	—
Hydrofluoric Acid	90-93	95-98	—	—
Hydrofluosilicic Acid	95-98	98-99	—	—
Hydrogen Peroxide	90-95	95-99	—	—
Hydrogen Sulfide	70-75	75-80	85-90	95-98
Nickel Chloride	80-85	85-90	90-95	95-98
Nickel Sulfate	80-85	85-90	90-95	95-98
Nitric Acid	75-80	85-90	—	—
Nitrogen Dioxide (NO_2)	45-50	50-60	65-70	70-75
Nitric — HF Acid	75-80	85-90	—	—
Perchloric Acid	95-98	96-99	—	—
Phosphoric Acid	96-99	98-99	—	—
Potassium Dichromate	96-98	98-99	—	—
Selenium Sulfide	96-98	98-99	—	—
Sodium Chloride	96-98	98-99	—	—
Sodium Fluoride	90-95	95-98	—	—
Sodium Glutenate	96-98	98-99	—	—
Sodium Hydroxide	98-99	99	—	—
Sulfur Dioxide	70-75	75-80	80-85	85-90
Sulfuric Acid	96-98	98-99	—	—
Tin Chlorides	75-80	80-85	85-90	90-95
Zinc Chloride	75-80	80-85	—	—
Zinc Nitrate	96-98	98-99	—	—
Zinc Sulfate	96-98	98-99	—	—

* These efficiencies are for the combined nitric and phosphoric fume. The efficiency for the NO_2 portion of the fume only will be as listed above.

● The above efficiencies are intended as guide representing

TECHNICAL BULLETIN

Duall Industries

No. 121-9

Duall Industries, Inc. 700 South McMillan St., Owosso, Michigan, 48867 Area Code 517/ 725-8184

DUALL SCRUBBERS
INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

1. AIR FLOW
Units are normally designed to be on the suction side of the fan. Air flow through units must be in the direction indicated. Too large a deviation from the design flow (CFM) will affect the efficiency of the scrubber.

2. SUPPORTING THE UNIT
The scrubber rests on a steel channel base making the unit self-supporting. This steel base may be suspended from overhead structure or rest on any media suitable to support the unit's weight.

3. CONNECTION TO VENTILATION DUCT
To eliminate the possibility of water running down the duct, there should be a minimum of 4 ft. of horizontal duct before the scrubber transition. This should be sloped slightly towards the bottom of the scrubber. The flanges should be field drilled on approximately 4"-5" centers. A soft foam type chemically compatible gasket material is recommended between the scrubber flange and the duct flange.

4. ELECTRICAL CONNECTION
Proper electrical connection complying with local codes should be made to the pump motor.

5. UNITS WITH INTERNAL RECIRCULATION SYSTEM
Units should be installed in heated areas or protected from freezing. Fresh water must be supplied by connecting the supply line to the flowmeter provided. This flowmeter is mounted on the side of the scrubber. The make-up water line should be valved to provide a maximum of 5% of the recirculation rate as shown on the side of the scrubber. The scrubber drain is connected to customer's waste drain line. If this line must go to a sump, it must be submerged 6"-8" below the lowest expected level, or a plumber's "P" trap should be installed. This will prevent air from flowing into the drain line and interfering with proper drainage of the scrubber. Liquid build-up in the scrubber can interfere seriously with the proper operation of the scrubber.

BEFORE START-UP, INSPECT THE INSIDE OF THE SCRUBBER AND REMOVE ANY FOREIGN MATERIAL FROM THE UNIT. SHUT THE WASTE DRAIN VALVE AND FILL THE SCRUBBER BASE SUMP WITH WATER UNTIL WATER FLOWS FROM THE OVERFLOW DRAIN. WATER IS INTRODUCED THRU THE FLOWMETER AND CAN ALSO BE INTRODUCED BY A HOSE PLACED THRU THE INSPECTION DOORS. When the water reaches the overflow level, the pump and fan may be started.

6. UNITS DESIGNED WITH REMOTE RECIRCULATION TANK AND PUMP

All units designed for remote recirculation require a separate recirculation tank with an adequately sized overflow and waste drain. The use of the remote recirculation tank will permit the installation of self-draining scrubber outside the building and the recirculation tank inside the building. The scrubber must be elevated for proper drain return to the recirculation tank. The scrubber drain pipe must be submerged 6" to 8" below the lowest expected liquid level in the tank and on the opposite side from the pump suction. The pipe end should be cut on a 60° angle with the long opening facing the tank side. For information on start-up and make-up water, please refer to Section 5 above. Make-up water may be introduced into the recirculation tank through the separate flowmeter provided for installation into water line.

7. PUMPS

Pumps should be operated in accordance with the enclosed manufacturer's instructions. Pumps with mechanical seals should be given particularly special attention to assure operation as directed. Pump motor should be electrically bumped to check for proper rotation. Motors and pumps are aligned and checked for proper operation before shipment. Customer is cautioned that misalignment may occur during shipment. Check for misalignment by manually rotating the shaft while observing coupling alignment using a straight edge or a dial indicator. Pumps provided with a packing gland are pre-adjusted to drip approximately 30 drops per minute. Drain fittings are provided on the pump or on a collection pan which should be plumbed to the waste drain. Pump motor should be interlocked with fan to provide approximately two (2) minutes pump operation before fan may be started. Pumps should not be started until the scrubber base or remote recirculation tank are filled to the overflow level. During the early break-in period, the pump packing gland should be checked for proper weeping. If incorrect, check pump manufacturer's instructions for correction procedure.

8. CHEMICAL ADDITIONS

In some cases, liquid caustic (sodium hydroxide solution) or an acid solution may be metered into the recirculation system to increase scrubber efficiency. A threaded coupling is provided in the side of the self-contained recirculation scrubbers for introduction of this chemical addition. Chemical addition for scrubbers provided with remote recirculation tanks is made by adding the solution to the recirculation tank. When using solid caustic, care should be taken in mixing to assure that no solid material is pumped into the scrubber or recirculation tank which may cause a build-up. The pH of the recirculation tank should be maintained in a range that will achieve the desired scrubber efficiency while preventing the appearance of a build-up on the packing. A pH control package may be purchased from Duall to provide a chemical feed pump and pH control to maintain the recirculation solution in the satisfactory range.

Duall Industries, Inc. 700 South McMillan St., Owosso, Michigan, 48867 Area Code 517/ 725-8184

9. PERIODIC MAINTENANCE SCHEDULE

Inspection doors are provided in all scrubber units for periodic inspection. While it is not expected that maintenance will be required, periodic inspection on a monthly basis is suggested. This inspection should include the following:

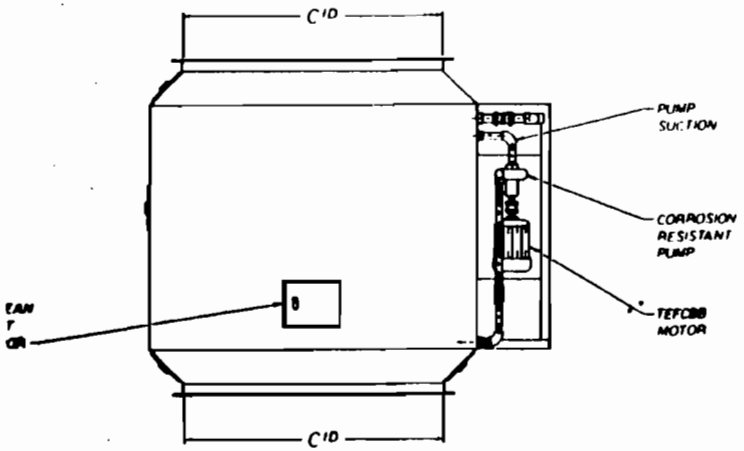
A. Check spray nozzles with the pump and fan in operation. All nozzles should produce a full 360° spray pattern. If any nozzles are found to be spraying incorrectly, the pump should be stopped, the header pipe removed, and each nozzle cleaned individually. When the cleaned header system has been replaced, the pump may be restarted.

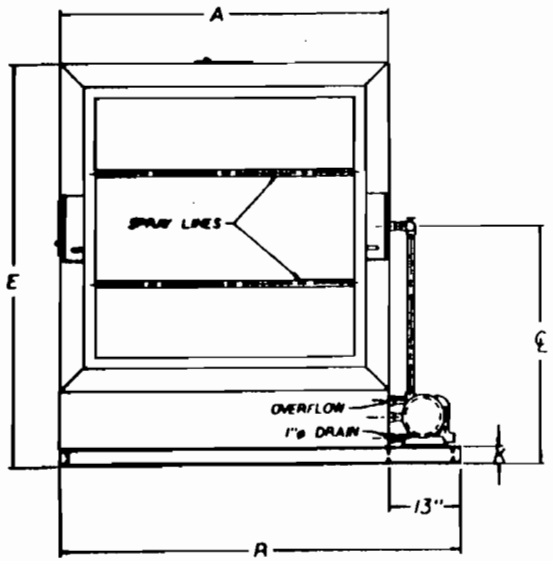
B. Check the face of the scrubber and the spray nozzles for any indication of a build-up of solids. If a surface build-up has occurred, it may be removed by spraying the pack with high pressure water, by chemical treatment of the scrubbing solution to dissolve the scale, or by manually removing the surface build-up. An analysis of the material build-up can be made to determine its nature. A dissolving additive, compatible with P.V.C. then could be added to the recycling reservoir for closed loop cleaning. During this type of cleaning, the drain and make-up water valves should be closed. During this operation, someone should frequently check the operation of the nozzles, and solution level to prevent pump damage. Prior to putting the system back in service, the cleaning solution should be drained and the scrubber refilled with fresh water. Steam should not be used to clean the scrubber.

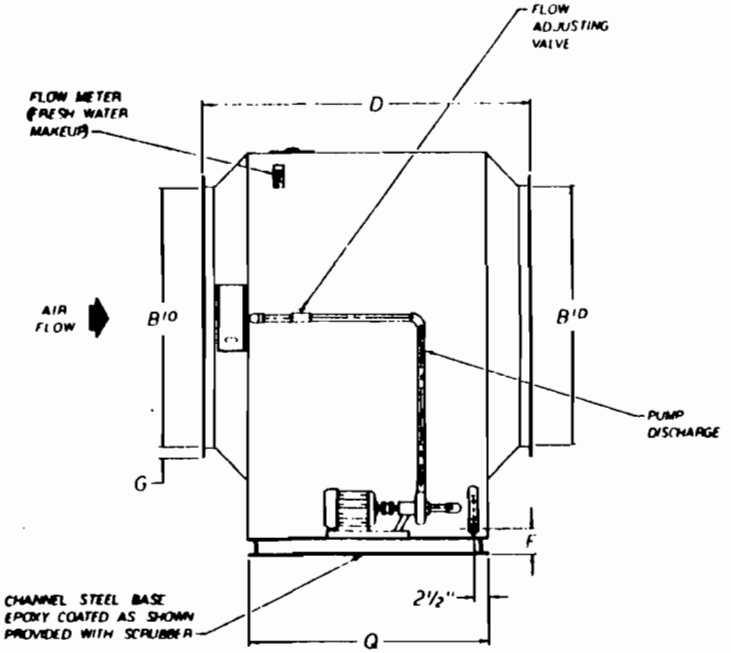
C. Check the water level in the scrubber. While the scrubber is in operation, it should maintain a solution of approximately 3"-6" in the bottom of the scrubber on a remote recirculation system and to the overflow on others.

CFM	0.5	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60
A	18	22	28	32	37	41	45	52	58	64	69	74	81	88	97	104	112	123	135	157	179	202	224	247	269
B	10	14	20	24	29	33	37	44	46	52	57	62	65	61	61	61	61	61	61	61	61	61	61	61	61
C	10	14	20	24	29	33	37	44	46	52	57	62	69	72	81	88	95	107	119	141	163	186	208	231	253
D	49	50	50	51	52	52	53	54	59	60	60	61	61	66	66	66	66	66	66	66	66	66	66	66	66
E	30	34	40	44	49	53	58	65	71	77	82	87	91	91	91	91	91	91	91	91	91	91	91	91	91
F	3½	3½	3½	3½	3½	3½	4½	4½	4½	4½	4½	4½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½
G	1½	1½	1½	1½	1½	1½	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
K	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
Q	37	38	38	39	40	40	41	42	43	44	44	45	45	46	46	46	46	46	46	46	46	46	46	46	46
R	31	35	41	45	50	54	58	65	71	77	82	87	94	101	110	117	125	136	148	170	192	215	237	260	282
S	21	23	26	28	30½	32½	35½	39	42	45	47½	50	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½
OVERFLOW	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
PUMP SUCTION	1	1	1	1	1	1	1	1¼	1¼	1½	1½	2	2	2	2	2	3	3	3	3	3	3	3	3	3
PUMP DISCHARGE	¾	¾	¾	¾	¾	¾	1	1	1	1¼	1¼	1¼	1½	1½	1½	2	2	2	2	2	3	3	3	3	3
LIQUID RATE GPM	15	3	6	9	12	15	18	24	30	36	42	48	54	60	66	72	78	84	90	105	120	135	150	165	180

NOTE CFM IN THOUSANDS







F-101 FUME SCRUBBER WITH SELF CONTAINED RECIRCULATION			
DUALL INDUSTRIES, INC OWOSSO, MI			
DATE	DUALL JOB NO		
PURCHASER			
PURCHASER PO NO			
PURCHASER LOCATION			
JOB NAME			
JOB LOCATION			
SPECIFICATION NO		ITEM NO	
CAPACITY			CFM
PRESSURE DROP			W G
LIQUID RECIRCULATION RATE			GPM
LIQUID PRESSURE			TDH
MAKEUP RATE			GPM
RECIRCULATION PUMP			
PUMP CAPACITY	GPM		TDH
PUMP HP			
PUMP VOLTAGE	V	PH	HZ

TAG

D-101-1015

F101 FUME SCRUBBER WITH SELF CONTAINED RECIRCULATION		
		G.L.
		J.P.
SCALE	SHEET OF	DATE
		PUR.

D-101-1017

F101 FUME SCRUBBER
WITH REMOTE RECIRCULATION

DUALL INDUSTRIES Inc. Owosso, Mich.

CFM	0.5	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50	55	60
A	18	22	28	32	37	41	45	52	58	64	69	74	81	88	97	104	112	123	135	147	179	202	224	247	269
B ID	10	14	20	24	29	33	37	44	46	52	57	62	69	61	61	61	61	61	61	61	61	61	61	61	61
C ID	10	14	20	24	29	33	37	44	46	52	57	62	69	72	81	88	96	107	119	141	181	186	208	231	253
D	49	50	50	51	52	52	53	54	59	60	60	61	61	66	66	66	66	66	66	66	66	66	66	66	66
E	30	34	40	44	49	53	58	65	71	77	82	87	91	91	91	91	91	91	91	91	91	91	91	91	91
F	3½	3½	3½	3½	3½	3½	4½	4½	4½	4½	4½	4½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½	5½
G	1½	1½	1½	1½	1½	1½	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
H	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
Q	37	38	38	39	40	40	41	42	43	44	44	45	45	46	46	46	46	46	46	46	46	46	46	46	46
R	18	22	28	32	37	41	45	52	58	64	69	74	81	88	97	104	112	123	135	147	179	202	224	247	269
U DIA	19½	19½	22½	22½	22½	22½	22½	30	30	30	30	30	30	30	30	30	36	36	36	36	36	36	36	36	36
V	62	62	62	62	62	62	62	62	62	62	62	54	54	54	54	54	66	66	66	66	66	66	66	66	66
W	21	23	26	28	30½	32½	35½	39	42	45	47½	50	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½	52½
OVERFLOW DRAIN	1½	1½	1½	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4
PUMP SUCTION	1	1	1	1	1	1	1	1½	1½	1½	1½	2	2	2	2	2	3	3	3	3	3	3	3	3	3
PUMP DISCHARGE	¾	¾	¾	¾	¾	1	1	1	1½	1½	1½	1½	1½	2	2	2	2	2	2	3	3	3	3	3	3
LIQUID RATE GPM	15	3	6	9	12	15	18	24	30	36	42	48	54	60	66	72	78	84	90	105	120	135	150	165	180

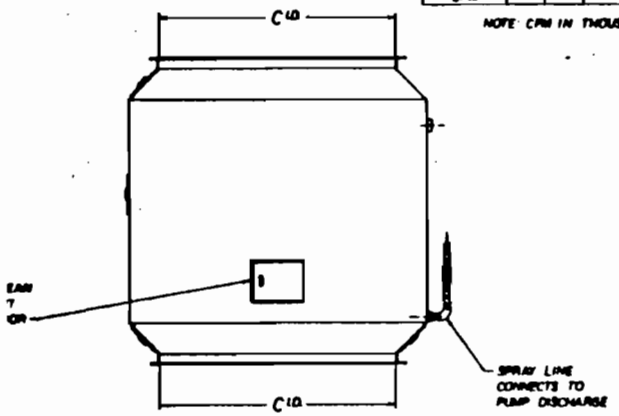
NOTE: CFM IN THOUSANDS

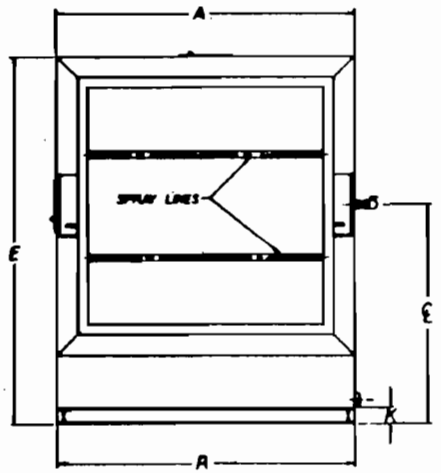
F-101 FUME SCRUBBER
WITH REMOTE RECIRCULATION

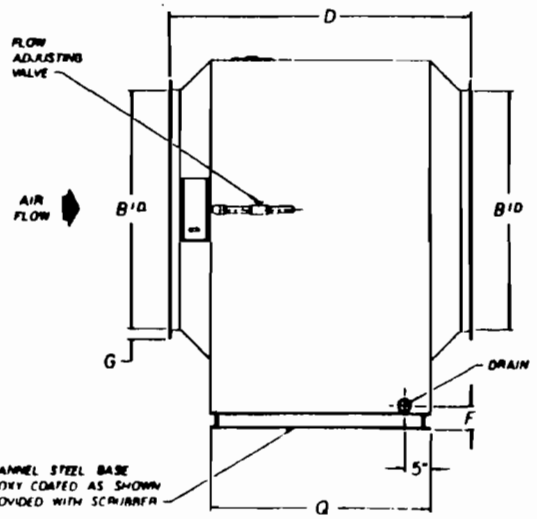
DUALL INDUSTRIES, INC. OWOSSO, MI

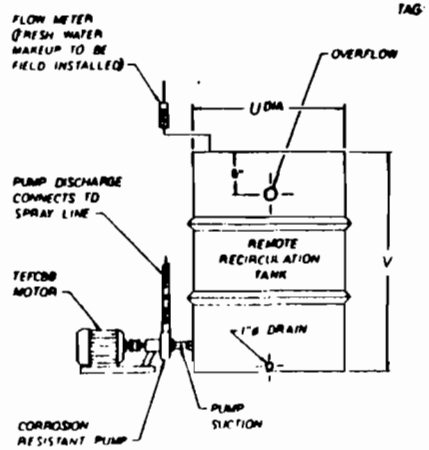
DATE	DUALL JOB NO		
PURCHASER			
PURCHASER PO NO.			
PURCHASER LOCATION			
JOB NAME			
JOB LOCATION			
SPECIFICATION NO.	ITEM NO.		
CAPACITY			CFM
PRESSURE DROP			W.G.
LIQUID RECIRCULATION RATE			GPM
LIQUID PRESSURE			PSIG
MAKEUP RATE			GPM
RECIRCULATION PUMP			
PUMP CAPACITY	GPM		PSIG
PUMP HP			
PUMP VOLTAGE	V	PH	HZ

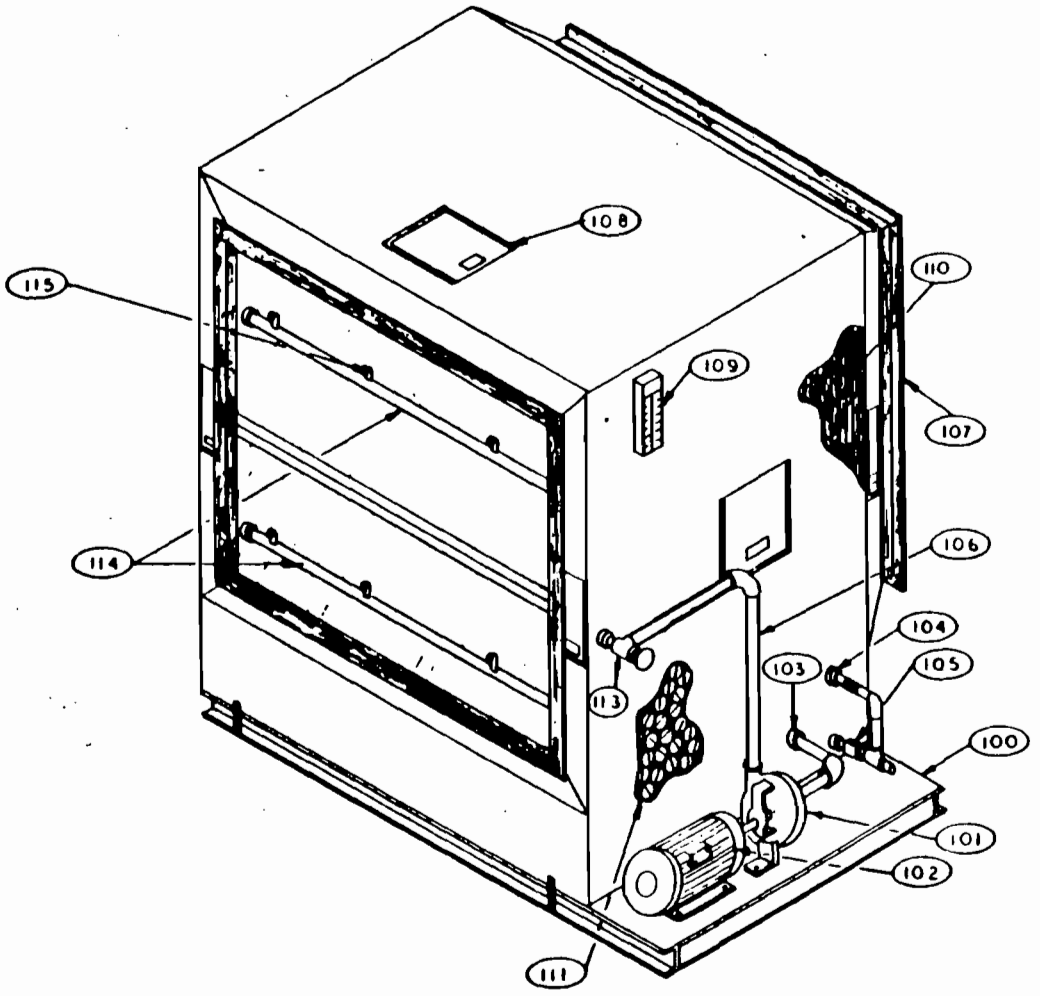
TAG



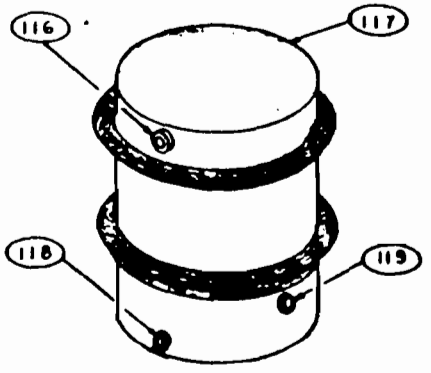






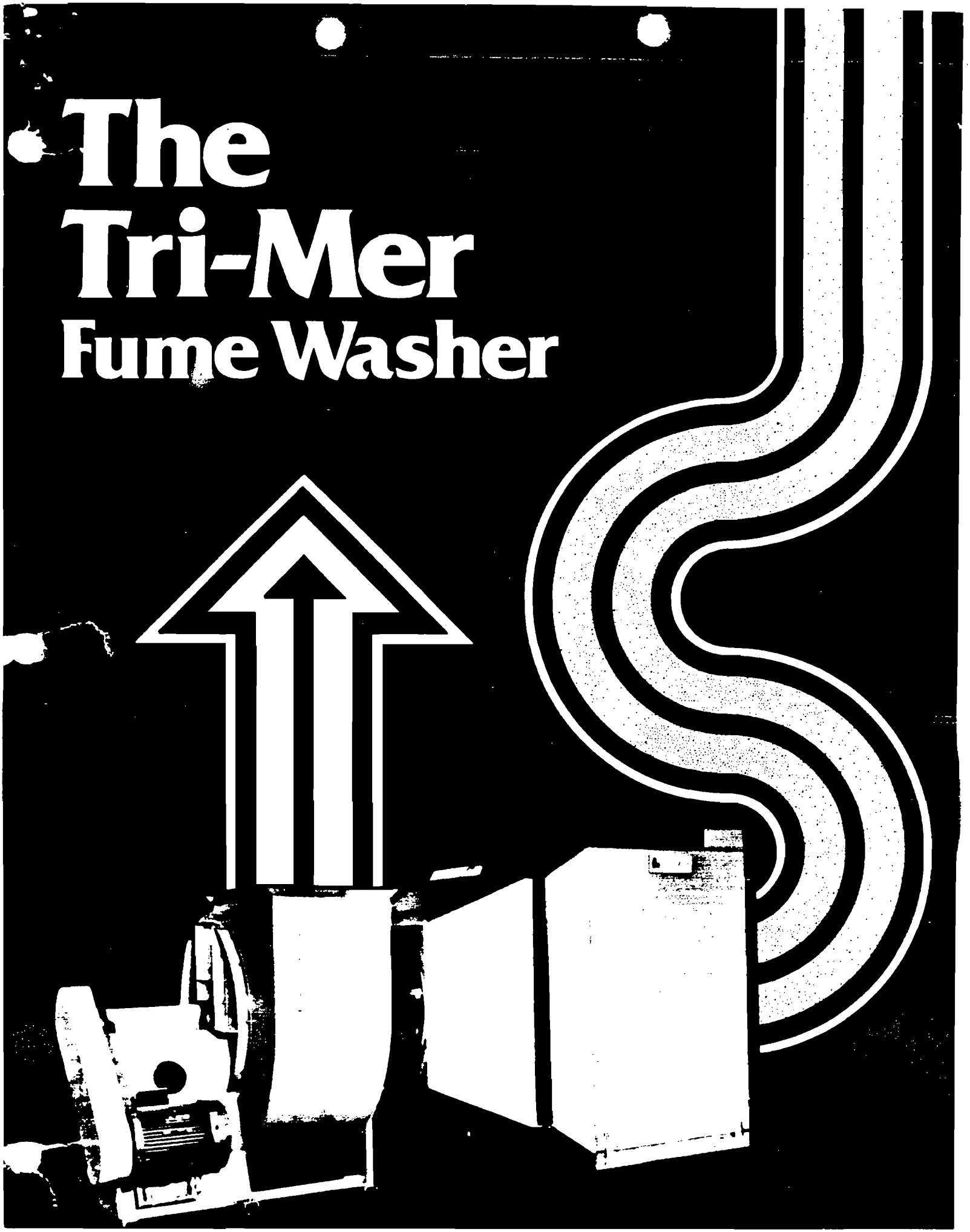


DUALL F-101 FUME SCRUBBER PARTS LIST	
NO:	PART
100	EPOXY COATED STEEL BASE
101	CORROSION RESISTANT PUMP
102	TEFCBB MOTOR ___ ___V./ PH./ ___CY. ___H.P. ___R.P.M.
103	PUMP SUCTION COUPLING (P.V.C.)
104	OVERFLOW COUPLING (P.V.C.)
105	DRAIN VALVE (P.V.C.)
106	PUMP DISCHARGE LINE (P.V.C.)
107	FLANGE (P.V.C.)
108	CLEAR OR P.V.C. CLEANOUT DOORS
109	FLOW METER ___ ___ ___.
110	ELIMINATOR SECTION (P.V.C.)
111	POLYPROPYLENE PACKING
113	SPRAY HEADER VALVE (P.V.C.)
114	SPRAY HEADER (P.V.C.)
115	SPRAY NOZZLES



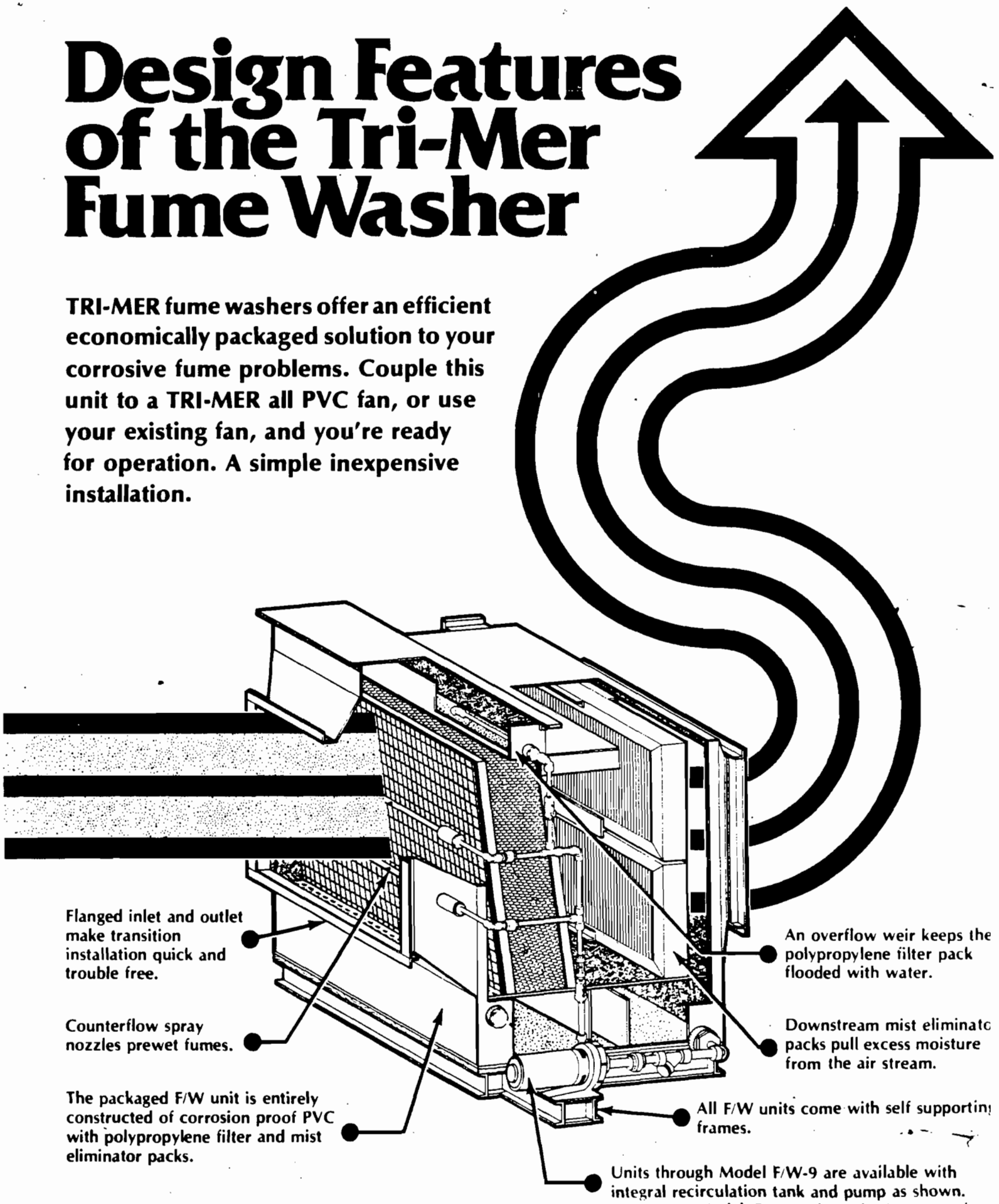
PARTS LIST FOR REMOTE RECIRCULATION TANK	
116	OVERFLOW (P.V.C.)
117	REMOTE TANK (P.V.C.)
118	DRAIN (P.V.C.)
119	PUMP SUCTION COUPLING (P.V.C.)

The Tri-Mer Fume Washer



Design Features of the Tri-Mer Fume Washer

TRI-MER fume washers offer an efficient economically packaged solution to your corrosive fume problems. Couple this unit to a TRI-MER all PVC fan, or use your existing fan, and you're ready for operation. A simple inexpensive installation.

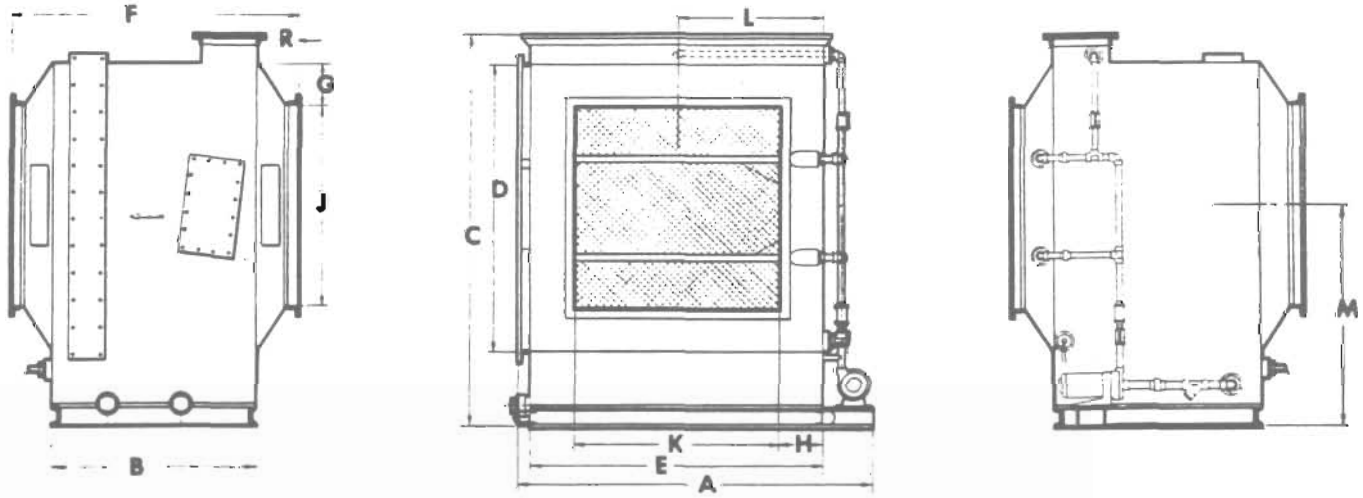


F/W with integral recirculation tank.

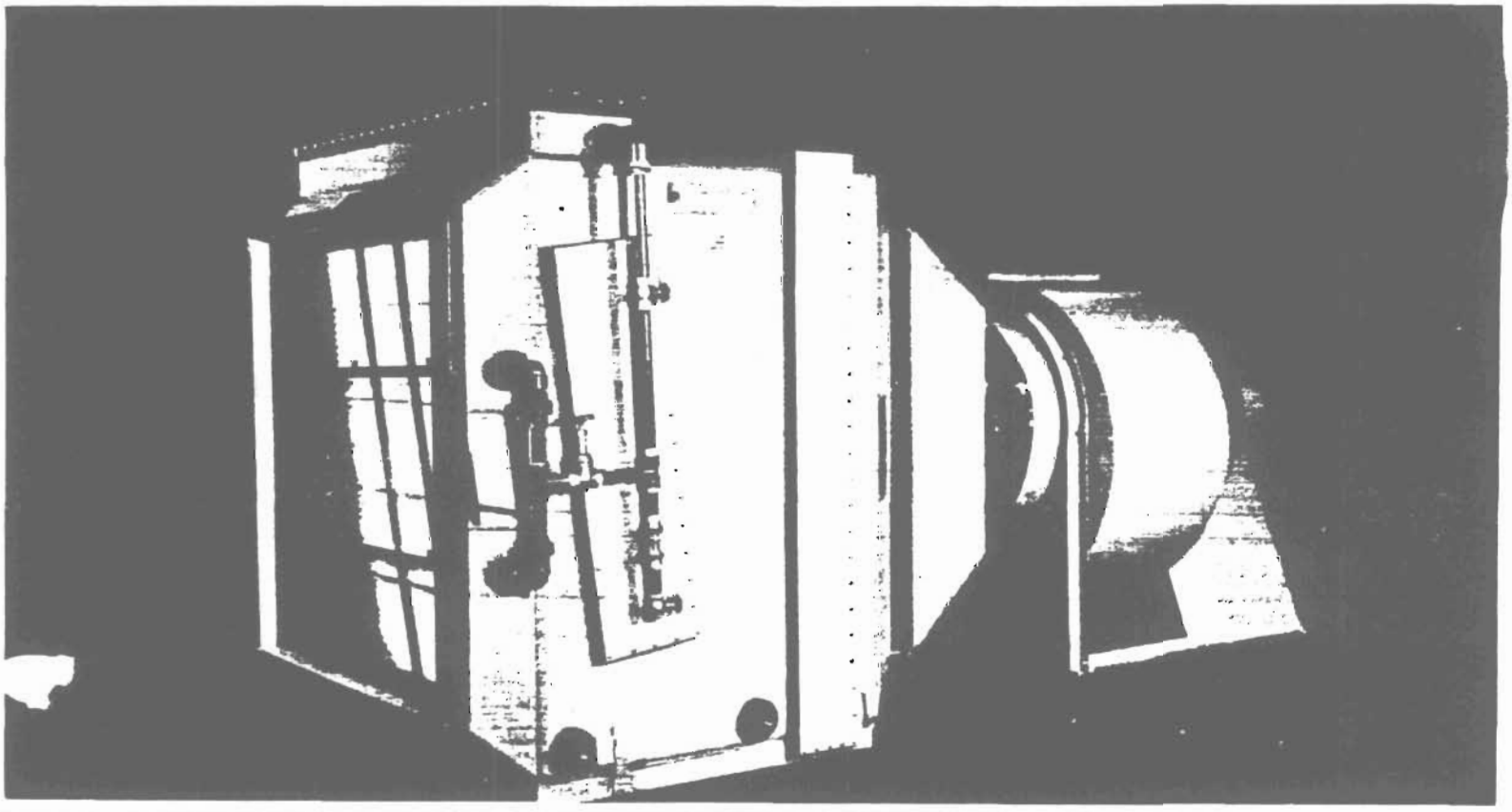
F/W	A	B	C	D	E	F	G	H	J	K	L	M	R	CHANNEL	ANGLE	DRAIN	G P M	No. OF HEADERS	PIPE	CFM CAPACITY
1	3'-11½"	4'-4½"	3'-6"	4'-3"	5'-3"	3'-4"	3'-4"	4'-10"	6"	6"	28°	28°	1'-8"	2'-0¾"	3'-0¾"	8"	4"@5.4#	1½"x1½"x3/16"	3"	8	2	¾"	3,000 to 5,500
2	4'-3½"	4'-8½"	3'-10"	4'-6¾"	5'-6¾"	3'-8"	3'-4"	5'-2"	4½"	4½"	35°	35°	1'-10"	2'-2¾"	3'-2¾"	8"	4"@5.4#	1½"x1½"x3/16"	3"	9	2	¾"	5,500 to 7,000
3	5'-0½"	5'-5½"	3'-6"	5'-3¾"	6'-3¾"	4'-5"	4'-6"	4'-10"	8"	8"	37°	37°	2'-4½"	2'-7½"	3'-7½"	8"	4"@5.4#	1½"x1½"x3/16"	3"	12	2	¾"	7,000 to 9,500
4	5'-6"	5'-11"	4'-0"	5'-8¾"	6'-8¾"	4'-10"	4'-10"	5'-6"	6½"	6½"	45°	45°	2'-5"	2'-9¾"	3'-9¾"	9"	4"@5.4#	2"x2"x¼"	3"	14	2	¾"	9,500 to 11,500
5	6'-0"	6'-5"	3'-8½"	6'-2¾"	7'-2¾"	5'-4"	5'-4"	5'-2½"	9½"	9½"	45°	45°	2'-8"	3'-0¾"	4'-0¾"	9"	4"@5.4#	2"x2"x¼"	3"	16	2	¾"	11,500 to 14,000
6	6'-8"	7'-1"	4'-1½"	6'-10¾"	7'-10¾"	6'-0"	6'-0"	6'-1½"	11"	11"	50°	50°	3'-0"	3'-4¾"	4'-4¾"	1'-0"	4"@5.4#	2"x2"x¼"	3"	19	2	¾"	14,000 to 17,000
7	6'-11"	7'-5"	3'-10¾"	7'-3"	8'-3"	6'-4"	6'-4"	5'-10¾"	11"	11"	54°	54°	3'-2"	3'-6¾"	4'-6¾"	1'-0"	4"@5.4#	2"x2"x¼"	3"	22	2	¾"	17,000 to 20,000
8	7'-8"	8'-1"	4'-3"	7'-10¾"	8'-10¾"	7'-0"	7'-0"	6'-3"	1'-0½"	1'-0½"	59°	59°	3'-6"	3'-9¾"	3'-9¾"	1'-0"	4"@5.4#	2"x2"x¼"	3"	28	2	¾"	20,000 to 24,000
9	8'-5"	9'-0"	4'-0¾"	8'-8"	9'-8"	7'-9"	7'-9"	6'-0¾"	1'-1½"	1'-1½"	66°	66°	3'-10½"	4'-2¾"	5'-2¾"	1'-0"	4"@5.4#	2"x2"x¼"	3"	34	3	¾"	24,000 to 30,000
10	9'-7"		4'-5"	9'-11¾"		8'-11"	8'-11"	6'-5"	1'-3½"	1'-3½"	76°	76°	4'-5½"	5'-0¼"		1'-0"	6"@8.2#	2"x2"x¼"	3"	44	3	1"	30,000 to 40,000
11	12'-1"		4'-2½"	9'-9¾"		8'-9"	11'-5"	6'-2½"	10"	2'-2"	85°	85°	5'-8"	4'-11¼"		1'-0"	6"@8.2#	2"x2"x¼"	3"	56	3	1"	40,000 to 50,000
12	14'-5"		4'-5½"	9'-9¾"		8'-9"	13'-9"	8'-5½"	10"	2'-7½"	85°	102°	6'-10½"	4'-11¼"		2'-0"	6"@8.2#	2"x2"x¼"	3"	66	3	1"	50,000 to 60,000
14	17'-9"		4'-5½"	9'-9¾"		8'-9"	17'-1"	8'-5½"	10"	3'-2½"	85°	128°	8'-5½"	4'-11¼"		2'-0"	6"@8.2#	2"x2"x¼"	3"	81	3	1"	60,000 to 75,000
15	20'-8"		4'-2½"	9'-9¾"		8'-9"	19'-10"	8'-2½"	10"	3'-9½"	85°	147°	9'-11"	4'-11¼"		2'-0"	6"@8.2#	2"x2"x¼"	3"	93	3	1½"	75,000 to 87,000
16	20'-8"		4'-7"	11'-0¾"		10'-0"	20'-0"	8'-7"	1'-5½"	3'-0"	85°	240°	10'-0"	5'-6¾"		2'-0"	6"@8.2#	2"x2"x¼"	3"	106	3	1½"	87,000 to 100,000

* NOTE — For exact unit weight check with manufacturers.

* NOTE — Double pack models are available where particularly heavy loadings exist. Check with manufacturer for dimensional changes.

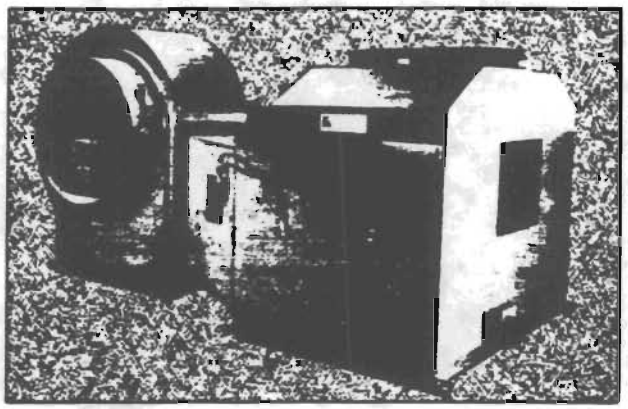


Typical three view drawing of units with integral recirculation tanks.

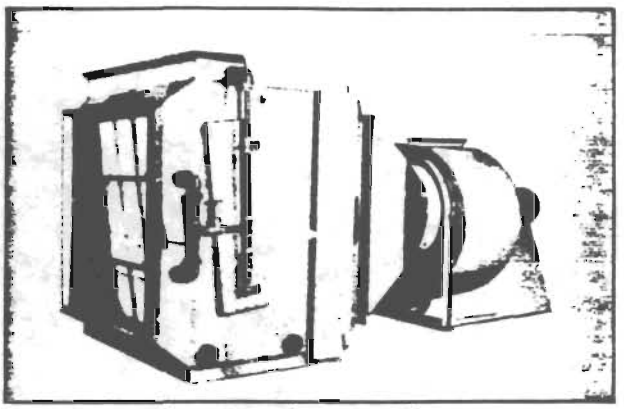


Other TRI-MER PVC Equipment

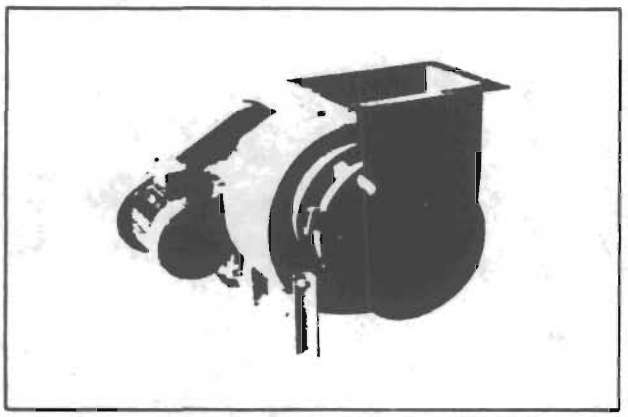
As long time specialists in designing corrosive fume control systems, TRI-MER offers a complete line of PVC air movers and associated equipment. This includes the patented fan/separator (fume scrubber), fume washers (crossflow scrubbers), PVC centrifugal fans, an *all PVC* stack fan, as well as PVC hoods and duct. Special fabrications such as consoles, tanks, and small plating lines are available.



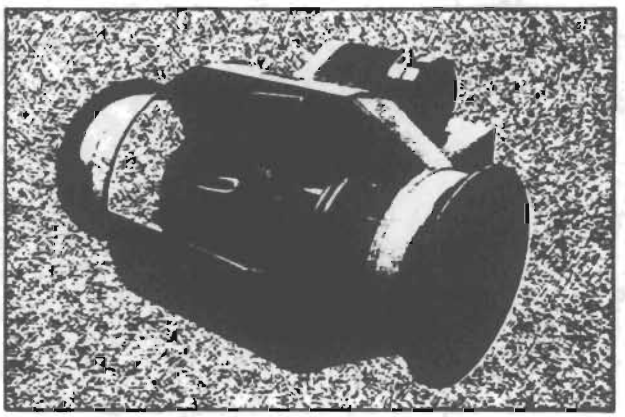
Fan/Separator



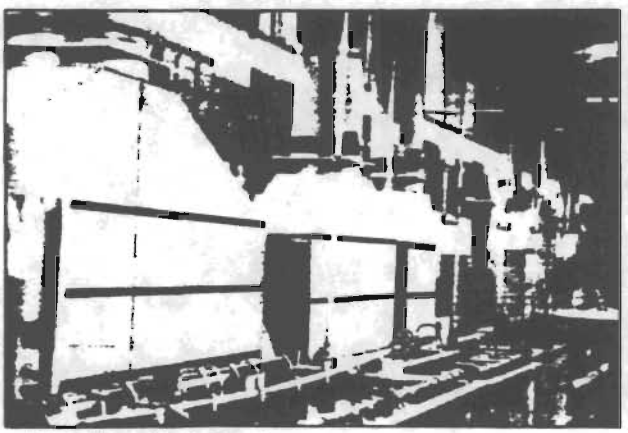
Fume/Washer (Crossflow Scrubber)



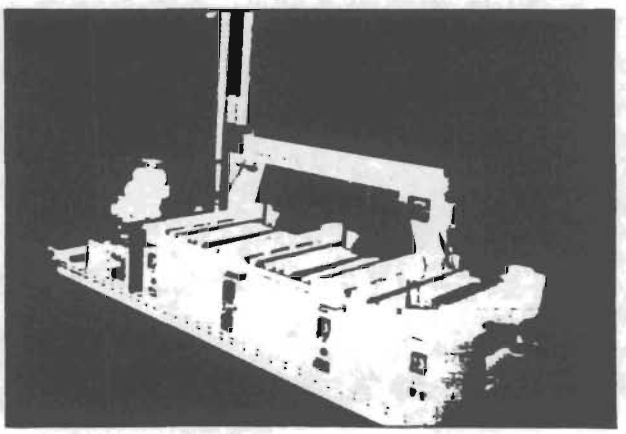
PVC Centrifugal Fan



PVC Stack Fan (Cutaway View)



PVC Hoods & Duct



Special Fabrications

Tri-Mer Corporation
Factory and Main Offices
1400 Monroe, Owosso, Michigan 48867
Phone (517) 723-7838 Telex 228545

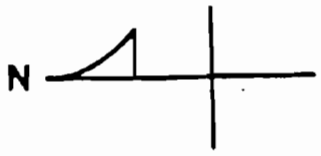
Tri-Mer Corporation
California Sales Offices
P.O. Box 1152, Costa Mesa, California 92626
Phone: (714) 548-5853

EUROPEAN REPRESENTATIVE
JAEGER K. G.
D. BRAUNSCHWEIG, WEST GERMANY

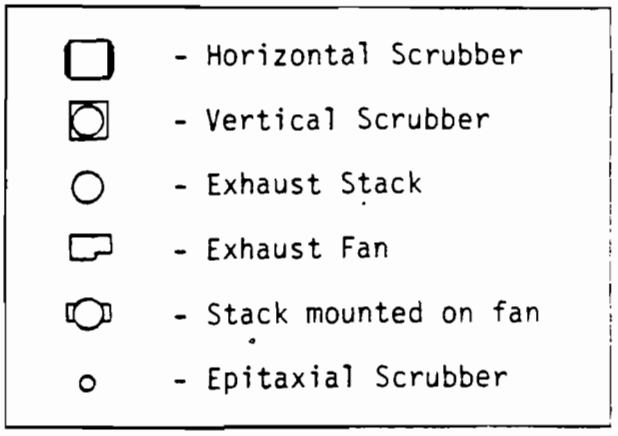
ATTACHMENT E.

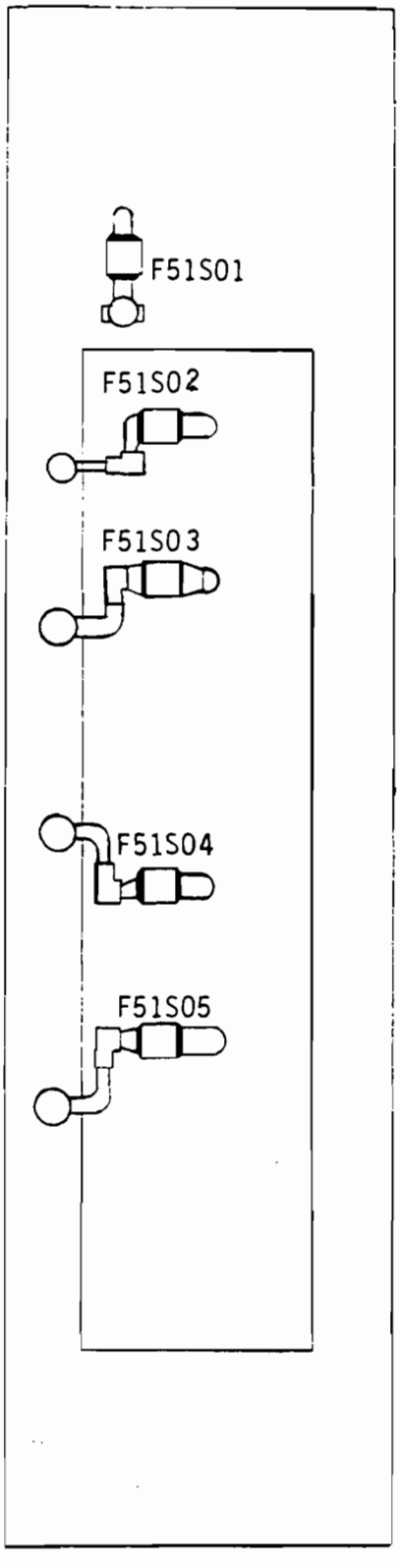
LOCATION MAPS

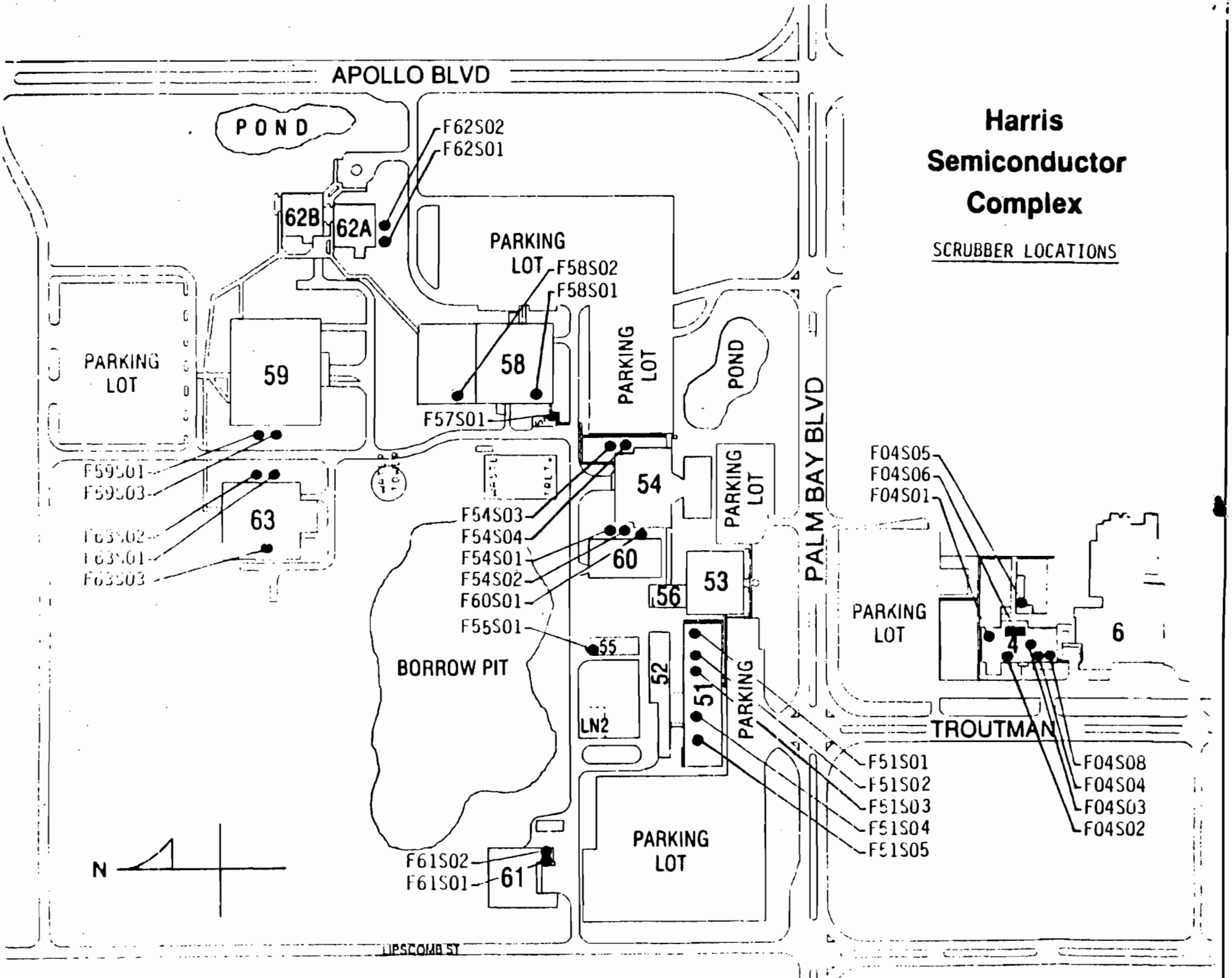
HARRIS SEMICONDUCTOR
SCRUBBER LOCATIONS
BUILDING 51



LEGEND






Harris
Semiconductor
Complex
SCRUBBER LOCATIONS
APOLLO BLVD
POND
F62S02
F62S01
62B
62A
PARKING
LOT
F58S02
F58S01
PARKING
LOT
59
58
PARKING
LOT
POND
PALM BAY BLVD
F57S01
F59S01
F59S03
63
F63S02
F63S01
F63S03
F54S03
F54S04
F54S01
F54S02
F60S01
F55S01
54
PARKING
LOT
60
53
56
55
BORROW PIT
52
51
LN2
PARKING
F04S05
F04S06
F04S01
PARKING
LOT
4
6
TROUTMAN
F51S01
F51S02
F51S03
F51S04
F51S05
F04S08
F04S04
F04S03
F04S02
PARKING
LOT
F61S02
F61S01
61
N
TIPSCOMB ST