KBN

May 4, 1993

Dr. Richard D. Garrity, Director
Florida Department of Environmental Regulation
Southwest District Office
3804 Coconut Palm Drive
Tampa, FL 33619-8218

RECEIVED
MAY 05 1993
Division of Air
Resources Management

Re: Central Florida Power Limited Partnership
Tiger Bay Cogeneration Plant
Wastewater Treatment System for Proposed Cogeneration Facility

Attention: Mr. Bill Thomas

Dear Bill:

Enclosed please find four copies of an air construction permit application for a minor source associated with the wastewater treatment plant for the proposed 206-MW cogeneration facility. The cogeneration facility, which consists of one combustion turbine and an associated duct-burner-fired heat recovery steam generator, has received an air construction permit number and undergone prevention of significant deterioration (PSD) review (AC 53-214903, PSD-FL-190). The wastewater treatment system, which is based on zero liquid discharge, will consist of a single spray dryer unit processing the concentrated waste blowdown from two falling-film evaporator units. A baghouse, with removal efficiency greater than 99.9 percent, will be used to reduce particulate matter emissions. This minor source was not originally designed as part of the cogeneration facility but evolved as a result of the wastewater treatment plant design. The wastewater treatment plant has undergone review by the Florida Department of Environmental Regulation (FDER) which is expected to issue a final permit by next week.

After discussions with FDER staff in the Southwest District and Tallahassee, it appears appropriate that the District process this permit since it is a minor source, PSD applicability for the facility does not change, and the District is issuing the wastewater permit.

This application includes the necessary information to process the permit, including a flow diagram of the zero liquid discharge system (Attachment 1), emission rate bases and estimates for the spray dryer and evaporator units (Attachment 2), an air quality impact assessment (Attachment 3), and letter of authorization (Attachment 4). A check in the amount of $250.00 is enclosed to cover the appropriate permit fees for this source (construction permit for a source having potential emissions of less than 5 tons per year of each pollutant). Disk and paper copies of the air quality modeling results are being sent under separate cover.

I will be contacting you within the next week to review the initial comments your staff may have. We appreciate the assistance of you and your staff in processing this permit for an anticipated construction

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KBN ENGINEERING AND APPLIED SCIENCES, INC.
1034 Northwest 57th Street Gainesville, Florida 32605 904/331-9000 FAX: 904/332-4189

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date in August 1993. If you have questions or comments that would expedite this effort, please do not hesitate to call me or Robert Chatham, Destec Energy, Inc. [(713) 735-4087].

Sincerely,

Kennard F. Kosky, P.E.
President

Enclosure

KFK/ehj

cc: Robert I. Taylor, Central Florida Power, L.P.
Robert Chatham, Destec Energy, Inc.
Teresa Heron, FDER, Tallahassee
File (2)

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: *Cogeneration Plant* [*X*] New[1] [ ] Existing[1]

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

COMPANY NAME: *Central Florida Power Limited Partnership* COUNTY: *Polk*

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) *Wastewater treatment/ Spray dryer unit with baghouse*

SOURCE LOCATION: Street *County Road 630* City *5 miles west of Ft. Meade*

UTM: East *416.28 km* *Zone 17* North *3069.29 km*

Latitude *27* ° *44* ' *50* "N Longitude *81* ° *50* ' *57* "W

APPLICANT NAME AND TITLE: *Robert I. Taylor, Project Manager*

APPLICANT ADDRESS: *Suite 150, 2500 City West Blvd., Houston, Texas 77042*

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of *Central Florida Power Limited Partnership*

I certify that the statements made in this application for an *air construction* 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 control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I 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: ____________________

Robert I. Taylor, Project Manager
Name and Title (Please Type)

Date: ____________ Telephone No. *(713) 735-4330*

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 have been ~~designed/~~examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

[1]See Florida Administration 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 [signature]

Kennard F. Kosky
Name (Please Type)

KBN Engineering and Applied Sciences, Inc.
Company Name (Please Type)

1034 NW 57th Street, Gainesville, FL 32605
Mailing Address (Please Type)

Florida Registration No. *14996* Date: 5/4/93 Telephone No. *(904) 331-9000*

SECTION II: GENERAL PROJECT INFORMATION

A. 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.

A spray dryer and baghouse associated with wastewater treatment system for operation of cogeneration facility. The system, based on zero liquid discharge, consists of a single natural-gas-fired spray dryer unit processing the concentrated waste blowdown from two falling-film evaporator units. A baghouse with removal efficiency greater than 99.9 percent will be used to reduce particulate matter emissions.

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

Start of Construction *8/1/93* Completion of Construction *1/1/95*

C. 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.)

A baghouse, with removal efficiency greater than 99.9 percent, will be used to reduce particulate matter emissions. The spray dryer and baghouse cost is approximately $600,000.

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

No previous DER permits

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 Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. _No[a]_
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.

[a] *Air quality review analyses attached to determine predicted impacts relative to significance impact levels and air quality standards (see Attachment 3). Although PSD regulations apply to the facility, the emissions associated with the spray dryer do not change the PSD applicability for any pollutant (i.e., no additional pollutants are required to undergo PSD review). The air quality impact analyses were performed to ensure that the impacts due to this minor source added to those from the combustion turbine and duct-burner-fired heat recovery steam generator (AC 53-214903, PSD-FL-190) comply with applicable ambient standards.*

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		
Wastewater Brine	*Particulate*	*17.75*	*1,029 (average)/ 1,552 (design)*	*See Attachment 1*

B. Process Rate, if applicable: (See Section V, Item 1) *Not applicable*

1. Total Process Input Rate (lbs/hr):
2. Product Weight (lbs/hr):

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

Name of Contaminant	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/hr	T/yr	
Particulate Matter	*0.021*	*0.041*	*3.1 lb/hr**	*3.1 lb/hr**	*0.021*	*0.041*	*See*
Carbon Monoxide	*0.061*	*0.12*			*0.061*	*0.12*	*Attachment 1*
Nitrogen Dioxide	*0.322*	*0.64*			*0.322*	*0.64*	
Sulfur Dioxide	*0.0086*	*0.017*			*0.0086*	*0.017*	
VOCs	*0.018*	*0.037*			*0.018*	*0.037*	

**Rule 17-296.310(1)(b), General Particulate Emission Limiting Standards;* $E = 3.59\ P^{0.62}$, *where P is process weight, tons per hour.*

[1]See Section V, Item 2. *Actual emission based on operating at design conditions for 200 hours and at average conditions for 8,560 hours.*

[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 with~~out~~ control (See Section V, Item 3).

D. 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)
*Baghouse**	*Particulate matter*	*>99.9*	*<10 microns*	*Vendor guarantee*

**See Attachment 2 for typical baghouse description.*

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Natural gas	*0.001321 MMcf/hr*	*0.003000 MMcf/hr*	*1.35 (avg)/3.066 (design)*

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

Fuel Analysis:

Percent Sulfur: *1 gr/100 cf* Percent Ash: *Negligible*

Density: *Not applicable* lbs/gal Typical Percent Nitrogen: *Negligible*

Heat Capacity: *1,022 Btu/cf (HHV)* BTU/lb *Not applicable* BTU/gal

Other Fuel Contaminants (which may cause air pollution): *Negligible*

F. If applicable, indicate the percent of fuel used for space heating. *Not Applicable*

Annual Average ______ Maximum ______

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

Solid waste will be disposed of in an approved manner; has been accepted by the Polk County landfill. No liquid waste will be generated.

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

Stack Height: *73.5* ft. Stack Diameter: *1.3* ft.

Gas Flow Rate: *5,050 (design)* ACFM *2,666 (design)* DSCFM Gas Exit Temperature: *340* °F.

Water Vapor Content: *20* % Velocity: *63.4 (design)* FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type O (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 Diameter: ______ 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 devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) ______

Brief description of operating characteristics of control devices: ______

______

______

______

Ultimate disposal of any effluent other than 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)]
   See Attachment 1.
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed 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 used 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 was made.
   See Attachment 2.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   Manufacturer's guarantees for PM/PM10, NO_2, CO, and VOC; sulfur content of natural gas for SO_2. See Attachment 2.
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.)
   Cloth-to-air ratio: 2.0 (average)/4.0 design. See Attachment 2.
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). *Manufacturer's guarantees form the basis of emission estimates for PM/PM10, NO_2, CO, and VOC; sulfur content of natural gas for SO_2. See Attachment 2.*
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained. *See Attachment 1.*
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   See Attachment 3.
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   See Attachment 3.

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

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. ***Not Applicable***

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY ***Not Applicable***

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 Devices:

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 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:

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 locations 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

See Attachment 3

A. Company Monitored Data *Not Applicable*

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 *See Section 2, Attachment 3*

1. ______ Year(s) of data from ______/______/______ to ______/______/______
(month / day / year to 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 *See Section 2, Attachment 3*

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	*(PM/PM10)* *0.0026*	grams/sec
SO_2	*0.0011*	grams/sec

E. Emission Data Used in Modeling *See Section 2, Attachment 3*

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. *See Attachment 3*

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. *See Section 3, Attachment 3*

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. *Not Applicable*

ATTACHMENT 1

FLOW DIAGRAM OF THE ZERO LIQUID DISCHARGE SYSTEM

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RECEIVED

MAY 24 1993

Division of Air
Resources Management

May 20, 1993

Dr. Richard D. Garrity, Director
Florida Department of Environmental Regulation
Southwest District Office
3804 Coconut Palm Drive
Tampa, FL 33619-8218

Re: Central Florida Power Limited Partnership
Tiger Bay Cogeneration Plant
Wastewater Treatment System for Proposed Cogeneration Facility

Attention: Mr. David Zell

Dear David:

Based on our recent discussions, additional information has been requested to process the air construction permit application for the minor source associated with the wastewater treatment plant for the proposed facility (application submittal date of May 4, 1993). Specifically, information was requested concerning the estimated maximum emissions from the natural-gas-fired spray dryer operating at maximum (design) capacity and a description of gases venting to the atmosphere from the pressure deaerator.

<u>Maximum Emissions</u>

The maximum emissions for the natural-gas-fired spray dryer were based on the expected operation of this system: 8,560 hours at average conditions and 200 hours at design conditions. The maximum emissions for this operation are presented in Table 2 of Attachment 2 in the permit application. If the unit were to operate at design capacity for the entire year, the maximum emissions would be:

1. Particulate matter--0.092 ton per year (TPY);
2. Sulfur dioxide--0.038 TPY;
3. Nitrogen dioxide--1.41 TPY;
4. Carbon monoxide--0.27 TPY; and
5. Volatile organic compounds--0.081 TPY.

A summary of these emissions is presented in the attached Table 2A. These emissions, which represent an increase of less than 1 TPY above those presented in the permit application, would still classify the source as a minor source having potential emissions of less than 5 TPY. It should be noted that, as a very conservative estimate of air quality impacts, the air modeling analysis presented in Attachment 3 of the permit application was based on the unit operating at design conditions for every hour in the year. Based on these results, the maximum impacts were less than significant impact levels and well below applicable ambient air quality standards.

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1034 Northwest 57th Street Gainesville, Florida 32605 904/331-9000 FAX: 904/332-4189

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Deaerator

The gases venting to the atmosphere from the deaerator consists mainly of carbon dioxide gas, oxygen, and water vapor. These gases are scrubbed out of the wastewater by using excess steam from the evaporator which acts as a stripping agent. These gases are scrubbed in order to reduce or eliminate the formation of calcium carbonate scale which would inhibit the evaporator from operating properly.

Please note that one of the flow streams (No. 11) in the process flow diagram of the zero liquid discharge system, presented in Attachment 1 of the permit application, is shown as exiting the deaerator and entering the falling-film evaporator. Flow stream No. 11, a steam line, should be shown as entering the deaerator.

If you have questions or comments, please call me or Robert Chatham, Destec Energy, Inc. (713 735-4087), at your earliest convenience.

Sincerely,

Robert G. McCann for

Kennard F. Kosky, P.E.
President

KFK/tyf

Enclosure

cc: Robert I. Taylor, Central Florida Power, L.P.
Robert Chatham, Destec Energy, Inc.
Teresa Heron, FDER, Tallahassee
File (2)

Table 2A. Maximum Emissions of Criteria Pollutants for the Tiger Bay Cogeneration Facility- Zero Liquid Discharge System- Spray Dryer/ Evaporator (Design Conditions)

Pollutant	Average Operating Conditions	Design Operating Conditions	Total Emissions (Design)
Hours of Operation	0	8760	
Particulate (lb/hr)= Emission rate (lb/hr) from manufacturer			
Basis, lb/hr (vendor guarantee)	0.009	0.021	
lb/hr	0.009	0.021	0.021
TPY	0.000	0.092	0.092
Sulfur Dioxide (lb/hr)= Sulfur Content (gr/100 cf) x Fuel Consumption (cf/hr) x 1 lb/7000 gr x (lb SO2/lb S) + 100			
Sulfur content basis, gr/100 cf	1.0	1.0	
Fuel Consumption (cf/hr)	1,321	3,000	
lb SO2/lb S (64/32)	2.0	2.0	
lb/hr	0.0038	0.0086	0.0086
TPY	0.000	0.038	0.038
Nitrogen Oxides (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.105	0.105	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.142	0.322	0.322
TPY	0.000	1.410	1.410
Carbon Monoxide (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.020	0.020	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.027	0.061	0.061
TPY	0.000	0.269	0.269
Volatile Organic Compounds (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.006	0.006	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.008	0.018	0.018
TPY	0.000	0.081	0.081

Addendum to: Central Florida Power Limited Partnership
Air Construction Permit Application- 5/4/93
Spray Dryer Unit with Baghouse
Attachment 2, Emission Rates and Estimates for the Spray Dryer and Evaporator Units

ATTACHMENT 2

EMISSION RATE BASES AND ESTIMATES FOR THE SPRAY DRYER AND EVAPORATOR UNITS

Table 1. Design Information and Stack Parameters for Tiger Bay Cogeneration Facility- Zero Liquid Discharge System- Spray Dryer/ Evaporator

Data	Average Operating Conditions	Design Operating Conditions
General		
Heat Input Rate (MMBtu/hr)	1.35	3.066
Hours of Operation	8560	200
Exhaust Flow Conditions		
Flow rate (acfm)	2,120	5,050
Temperature (°F)	340	340
Moisture Content (% Vol.)	20.00	20.00
Natural Gas Consumption (cf/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu ÷ Fuel Heat Content, HHV (Btu/cf)		
Heat Content, HHV (Btu/cf)	1,022	1,022
Natural Gas Consumption (cf/hr)	1,321	3,000
Natural Gas Consumption (MMcf/hr)	0.001321	0.003000
Volume Flow (dscfm)= Volume flow (acfm) x [(68°F + 460°F)÷(Exhaust Temperature(°F) + 460°F)] x [(100-(Moisture Content(%)) ÷ 100]		
Volume Flow (acfm)	2,120	5,050
Exhaust Temperature (°F)	340	340
Moisture Content (%)	20.00	20.00
Volume Flow (dscfm)	1,119	2,666
Stack Data		
Stack Height (ft)	73	73
Diameter (ft)	1.3	1.3
Operating Data		
Velocity (ft/sec)= Volume flow (acfm) ÷ [((diameter)^2÷ 4) x 3.14159] ÷ 60 sec/min		
Volume Flow (acfm)	2,120	5,050
Diameter (ft)	1.3	1.3
Velocity (ft/sec)	26.6	63.4

Table 2. Maximum Emissions of Criteria Pollutants for the Tiger Bay Cogeneration Facility- Zero Liquid Discharge System- Spray Dryer/ Evaporator

Pollutant	Average Operating Conditions	Design Operating Conditions	Total Emissions (Maximum)
Hours of Operation	8560	200	
Particulate (lb/hr)= Emission rate (lb/hr) from manufacturer			
Basis, lb/hr (vendor guarantee)	0.009	0.021	
lb/hr	0.009	0.021	0.021
TPY	0.039	0.0021	0.041
Sulfur Dioxide (lb/hr)= Sulfur Content (gr/100 cf) x Fuel Consumption (cf/hr) x 1 lb/7000 gr x (lb SO2/lb S) ÷ 100			
Sulfur content basis, gr/100 cf	1.0	1.0	
Fuel Consumption (cf/hr)	1,321	3,000	
lb SO2/lb S (64/32)	2.0	2.0	
lb/hr	0.0038	0.0086	0.0086
TPY	0.016	0.001	0.017
Nitrogen Oxides (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.105	0.105	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.142	0.322	0.322
TPY	0.607	0.032	0.639
Carbon Monoxide (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.020	0.020	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.027	0.061	0.061
TPY	0.116	0.006	0.122
Volatile Organic Compounds (lb/hr)= Emission Factor (lb/MMBtu) x Heat Input Rate (MMBtu/hr)			
Emission Factor (lb/MMBtu) [vendor guarantee]	0.006	0.006	
Heat Input Rate (MMBtu/hr)	1.35	3.066	
lb/hr	0.008	0.018	0.018
TPY	0.035	0.002	0.037

SPECIFICATION NO. 1253.08-M-023.14
REVISION 0
MARCH 1, 1993

STACK DRYER EMISSIONS DATA SHEETS

Stack Data

Diameter		
Elevation of Stack Exit (referenced from grade)	73'-6"	
	Normal	~~Design~~ MAX.
Stack Exit Temperature, °F		
(1) Stack Gas Flow, ACFM		
(1) Stack Gas Velocity, fps		
(2) PM / PM_{10}, lb/hr	0.009	0.021

✓

Air Heater Emissions Data

Emissions due to Natural Gas Combustion

	Normal	~~Design~~ MAX.
Heated Gas Flow, ACFM		
(3) Heated Gas Velocity, fps		
(3) Heated Gas Temperature, °F		
(2) NO_x, lb/hr	0.142	0.323
(2) CO, lb/hr	0.0284	0.065
(4) PM / PM_{10}, lb/hr	—	—
(4) SO_2, lb/hr	—	—
(2) VOC, lb/hr	0.0075	0.017

(1) AT STACK EXIT.

(2) GUARANTEE REQUIRED AT NORMAL AND MAX. CONDITIONS. "NORMAL" AND "MAX." REFER TO FEED FLOWRATES OF BRINE TO DATE.

(3) AT AIR HEATER EXIT.

(4) EQUAL TO AMOUNT ENTERING WITH FUEL GAS AND AMBIENT AIR.

PROCESS COMBUSTION CORPORATION

PO Box 12866, Pittsburgh, PA 15241 • Phone 412-655-0955 • Telex 81-2389, Fax 412/655-0961

4/13/93
PCR-0493-11-E
Proposal Page 2

3.0 Air Heater Data

Capacity	
Design heat release	3.066×10^6 BTU/hr
Heated Air (Process)	
Flow rate (Normal)	11,430 lb/hr (7470 acfm)
Inlet temp	-20 deg F to 100 deg F
Inlet pressure	Ambient
Outlet temp	1100 deg F
Process stream pressure outlet	Neg. 8" to 10" w.c.
Combustion Air	
Flow rate, max	1020 scfm
Inlet temp	-20 deg F to 100 deg F
Available pressure	6" w.c.
Natural gas	
Pressure	5 psig regulated by others
Heat value (HHV)	1022 BTU/scf
Flow rate	3,000 scfh
Temperature	70 deg F
Pilot Gas (Natural Gas)	
Pressure	5 psig
Heat value	1022 BTU/scf
Flow rate	100 scfh

Fuel pressure to be regulated as specified by others unless otherwise quoted.

<u>Guarantees</u>:

NOx emissions based on 3.066 MM BTU/HR air heater burner firing to 1100 deg F:

		Total for 3.066 MM BTU/Hr
Estimated:	0.09 #/MM BTU/Hr	
Guaranteed:	0.105 #/MM BTU/Hr	0.323 #/Hr

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4/13/93
PCR-0493-11-3
Proposal Page 3

CO emissions:

		Total for 3,066 MM BTU/Hr
Estimated:	0.019 #/MM BTU	
Guaranteed:	0.02 #/MM BTU	0.065

SO_2 emissions are a direct result of the sulfur loading that enters the system. This loading is by others in the form of fuel, and is out of PCC's control. All sulfur (this includes #ZS) entering the system will result in SO_2 out (with a small percentage of the SO_2 in the form of SO_3).

VOC NOx emissions:

		Total for 3,068 MM BTU/Hr
Estimated:	0.005 #/MM BTU	
Guaranteed:	0.006 #/MM BTU	0.017 #/Hr

4.0 EQUIPMENT

Each heater will include:

4.1 Item No. 1 ... Quantity 1
PCC burner suitable for a maximum heat release of 3.068 MM BTU/hr when burning natural gas complete with spark ignited natural gas pilot. Burner furnished complete with refractory, observation and scanner viewing ports. Burner pressure drop is 8" w.c.

4.2 Item No. 2 ... Quantity 1
PCC spark ignited natural gas pilot (100,000 BTU/hr) for intermittent duty, comprising:

1 - PCC pilot, burner and spark plug
1 - Pressure gauge, Ashcroft 4-1/2" dial
1 - Gas Asco solenoid shutoff valves
1 - Gas trim valve
1 - Gas ratio regulator
1 - Gas isolating cock
1 - Air valve
1 - Ignition transformer

GAS FUEL SPECIFICATION DATA SHEET

Gaseous Fuel Properties

Type:	Natural Gas
Higher Heating Value, Btu/Std. $ft.^3$	1022
Lower Heating Value, Btu/Std. $ft.^3$	Later
Chemical Analysis, % by Volume	
CH_4	96.637%
C_2H_6	1.993%
C_3H_8	0.175%
C_4H_{10}	0.011%
C_5H_{12}	0.0004%
C_6H_{14}	0.023%
H_2	0
N_2	0.392
O_2	0
CO	0
CO_2	0.751
NH_3	0
Contaminants:	
Total Sulfur	0.33 gr/CCF
H_2S	0.05 gr/CCF
H_2O	1.0 lb/MCF

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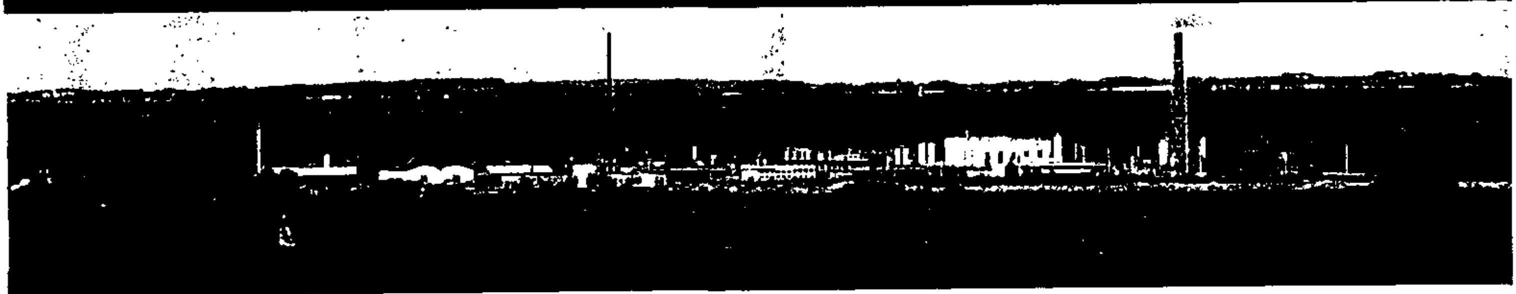
NIRO ATOMIZER

Powdered chemicals



by spray drying

Spray drying chemicals

Spray drying is a one-step process converting a liquid feed to powder. Acceptable feeds include slurries, solutions, pastes and suspensions/emulsions which may be aqueous or non-aqueous. The main advantage to chemical producers is the ability to control powder form. Once constant operating conditions have been established, powder qualities are easily and consistently reproduced. The process is designed to produce the desired powder properties including particle size, bulk density, moisture content, flow characteristics, and degree of fines.

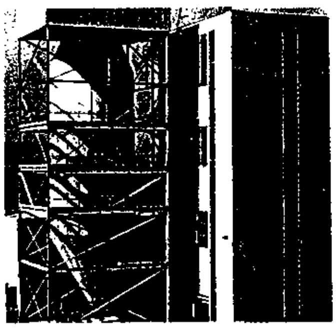
What products can be spray dried?

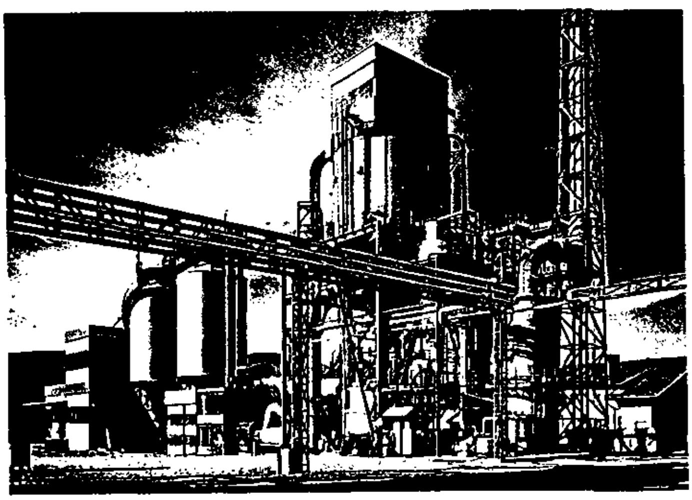
Hundreds of organic and inorganic chemicals ranging from aluminium and amino to zinc compounds are spray dried.

High inlet temperatures are used for drying non-heat sensitive products for maximum dryer capacity and energy utilization. By the nature of the process, spray drying is also suitable for handling heat sensitive products in special layouts at optimum energy economy. The process is recommended for many products which exhibit thermoplastic and hygroscopic tendencies.

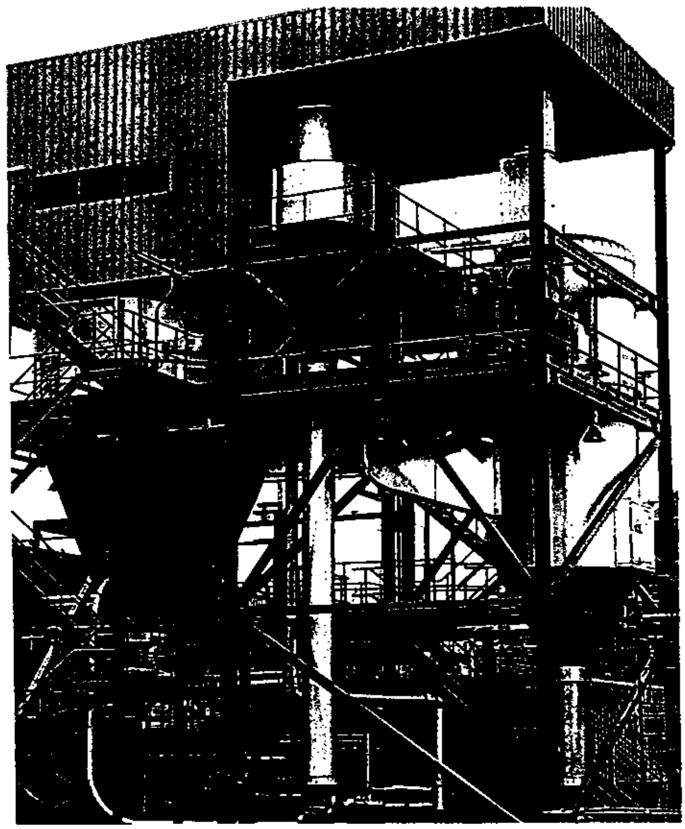
Materials posing explosion hazards can be accommodated by the use of pressure shock resistant drying chambers with explosion venting or suppression systems. Closed cycle and semi-closed cycle spray drying processes are available for materials which require an inert or non-oxidizing atmosphere.

Tall form spray dryer with nozzle atomizer





Spray dryer with rotary atomizer



Fluidized spray dryer

The spray drying process

Pumpable feedstocks are atomized into sprays of droplets using either rotary (wheel) atomizers or nozzles. The sprays are contacted with a heated drying medium (air or inert gas) to promote evaporation of volatiles from each droplet resulting in the formation of a dry particle. The process is completed with the recovery of the airborne particles which are discharged from the spray dryer as a constant flow of powder.

The desired properties of the powder are met through selection of the atomizer, process conditions, and drying chamber design. Rotary (wheel) atomizers produce fine to medium coarse powders, low pressure nozzles produce coarse.

▶

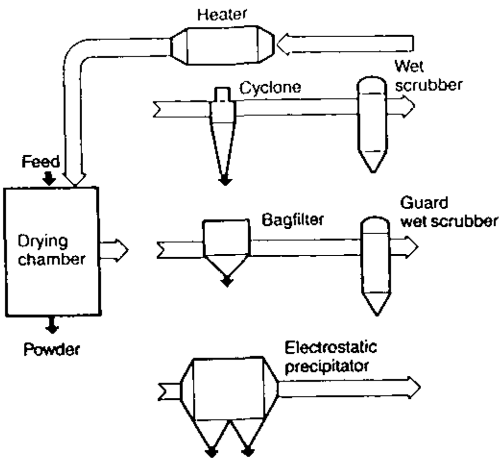
System selection

The properties of the chemical together with safety and emission requirements decide the choice.

Open cycle

The standard layout where drying air is drawn from atmosphere and, after passing through the drying chamber and air cleaning equipment, discharged to atmosphere. This system is used with aqueous feedstocks. Emission standards require the appropriate choice of air cleaning equipment where cyclone/bag filter/scrubber combinations are selected in accordance with the maximum permitted particulate emission levels. Preventing odour emissions can require special systems, e.g. exhaust air incineration with heat recovery or chemical scrubbing.

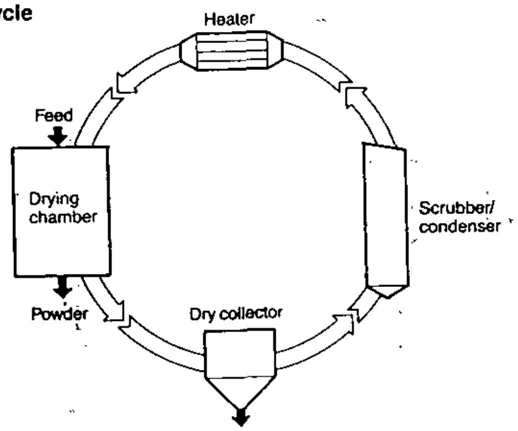
Open cycle



Closed cycle

A gas- and dust-tight layout, where inert gas is the drying medium. The system is used for drying feedstocks containing organic solvents. The scrubber/condenser gives complete recovery of evaporated solvent and conditions the recycling drying medium to achieve optimum spray drying chamber performance.

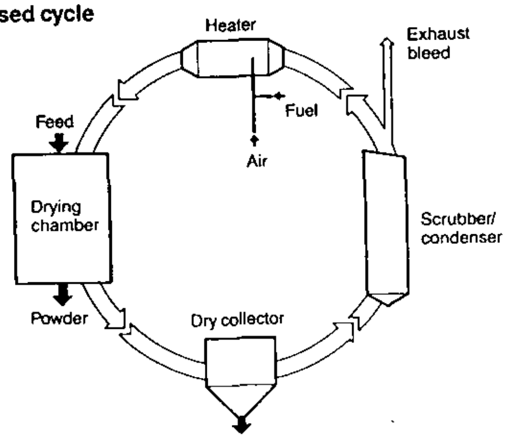
Closed cycle



Semi-closed cycle

The recycle self-inertizing layout generates a low oxygen drying atmosphere. It is used when powders resulting from aqueous feeds can form explosive mixtures in air. Direct fired heaters provide the low oxygen condition, and the only bleed from the spray dryer is the volume equivalent to that generated in the heater combustion process. Semi-closed processing is an attractive alternative where odour is created during drying, since the air volume requiring incineration is much reduced.

Semi-closed cycle



Four types of Niro Atomizer drying chambers feature prominently in the chemical industry:

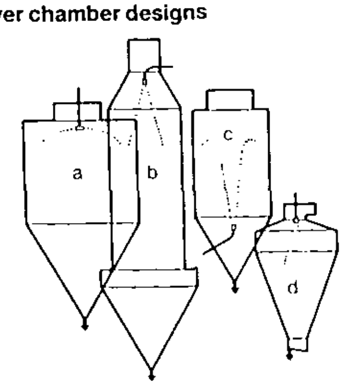
a) *R-series:* conical based chambers with rotary atomizer for standard powders (50-150 micron)

b) *TFD-series:* tall form nozzle towers for coarse, heat sensitive powders

c) *N-series:* fountain nozzle chambers for coarse, non-heat sensitive powders

d) *FSD-series:* fluidized spray drying chambers with integrated fluid bed for agglomerated, readily dispersable, free-flowing, low dust powders

Common dryer chamber designs



Areas of Niro Atomizer Technology

Drying

Spray dryers:	powders from fluid feeds
Fluid bed dryers:	powders from semi-wet solids

Concentration

Falling film evaporators:	preparing high solid feeds for spray drying
Rotary thin-film evaporators:	concentrating feeds that tend to foam or crystallize

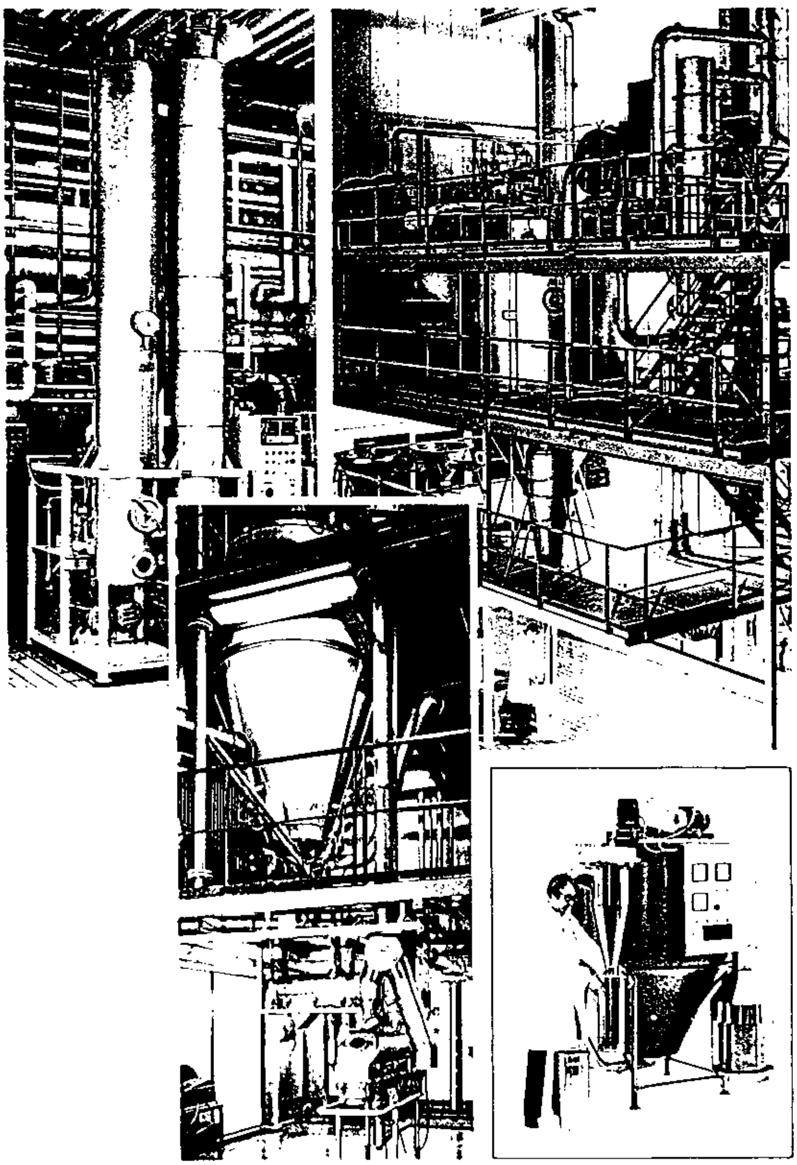
Extraction

Batch or continuous extractors (atmospheric or pressurized):	preparing feeds for spray drying by liquid-solid extraction

Associated Processing

Flash dryers:	for semi-wet dispersable solids – often operating with fluid bed dryers
Swirl fluidizers:	powders from selected wet cakes
Spray fluidizers:	granulated powders from fluid feeds
Fluid bed coolers:	cooling powders from spray and fluid bed dryers
Spray dryer absorbers *:	dry scrubbing of toxic gases

* supplied on licence basis



The Company

Niro Atomizer is an international engineering company, based in Copenhagen, Denmark. The company has installed over 3500 industrial spray dryers worldwide in addition to another 2000 plants for laboratory and pilot scale production.

The extent of delivery ranges from individual spray dryer supply to fully engineered process lines that include spray drying and other areas of Niro Atomizer technology.

The Niro Atomizer service includes front end engineering, process design, mechanical design, in-house fabrication, erection, commissioning, and a comprehensive after-sales service. Plant performance is guaranteed based upon the experience and know-how gained from the range of operating industrial plants together with the back-up from test stations located worldwide and extensive R & D facilities in Copenhagen.

Many of the world's leading manufacturing companies produce powders on Niro Atomizer plants – products such as catalysts, ceramics, coffee/tea (instant), dairy products, detergents, dyestuffs, food products, inorganic chemicals, minerals, organic chemicals, pesticides, pharmaceuticals, pigments, polymers, tannins.

Product development and process evaluation

One of Niro Atomizer's many services to industry is the test station facilities available in Denmark, Brazil, Mexico, Japan, and the USA.

These facilities represent the most comprehensive offered by any company in the spray drying business. Here feasibility of spray drying can be established and testwork carried out to optimize processing conditions and even provide powder for marketing analyses.

The main test station in Copenhagen features conventional, tall form, and integrated fluid bed spray dryers with possibilities to operate in open, semi-closed, and closed cycle.

NIRO

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[illegible]

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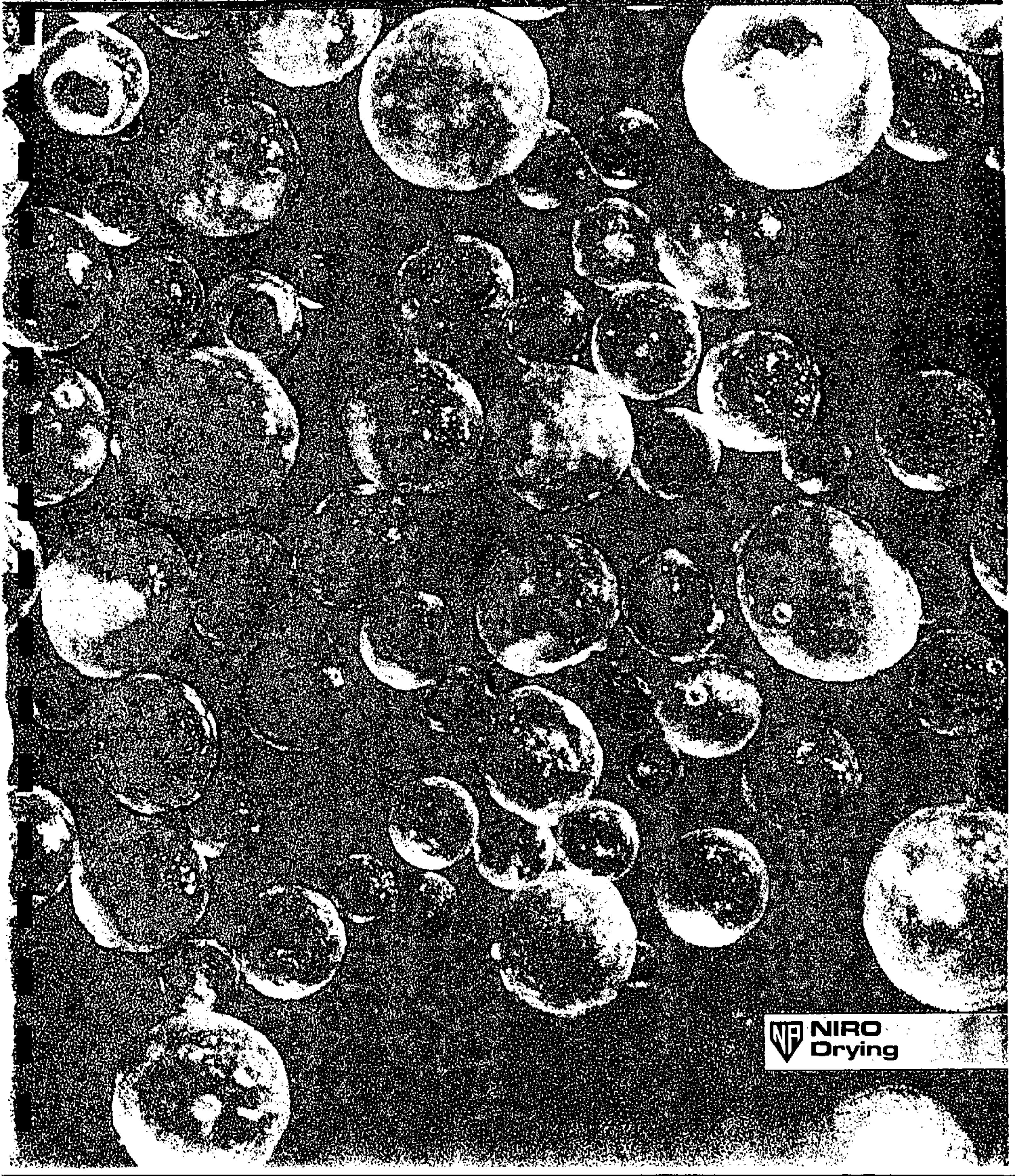
Spray Drying



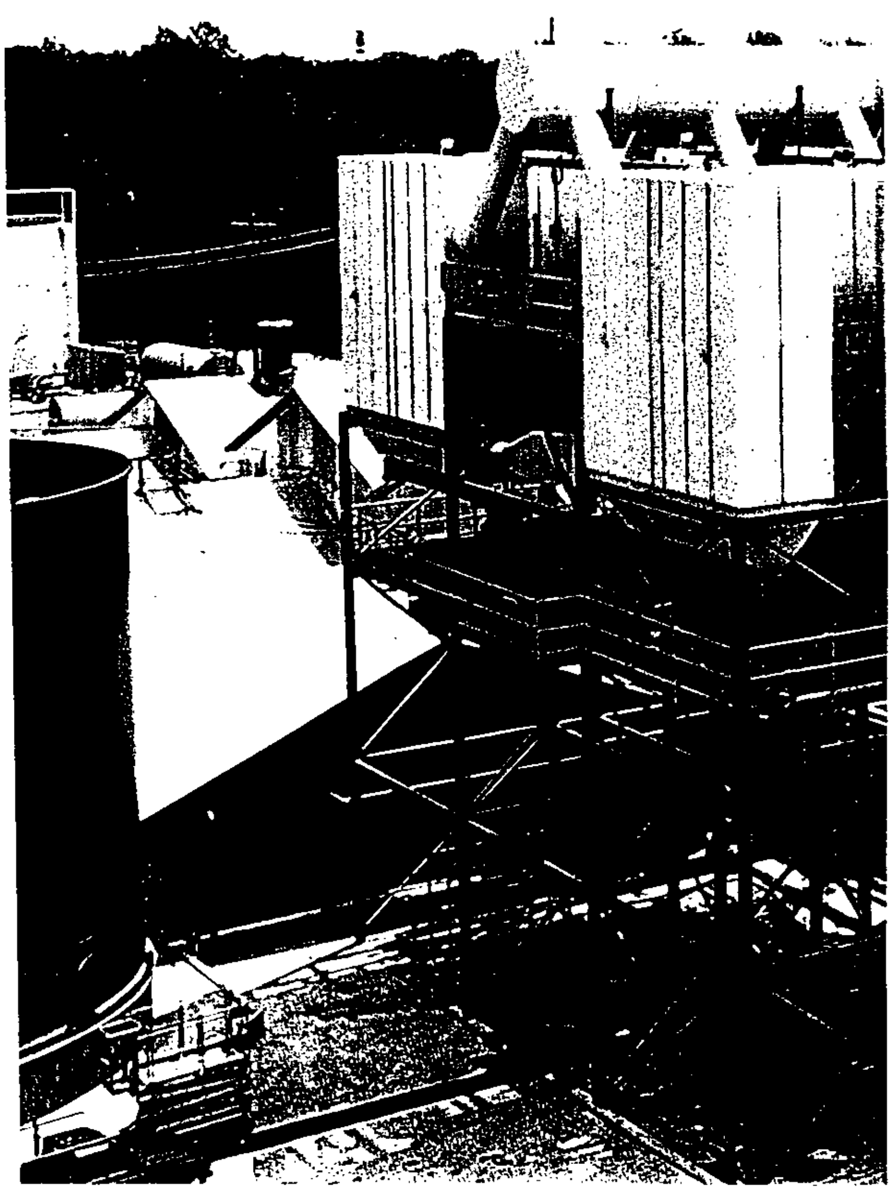
NIRO Drying

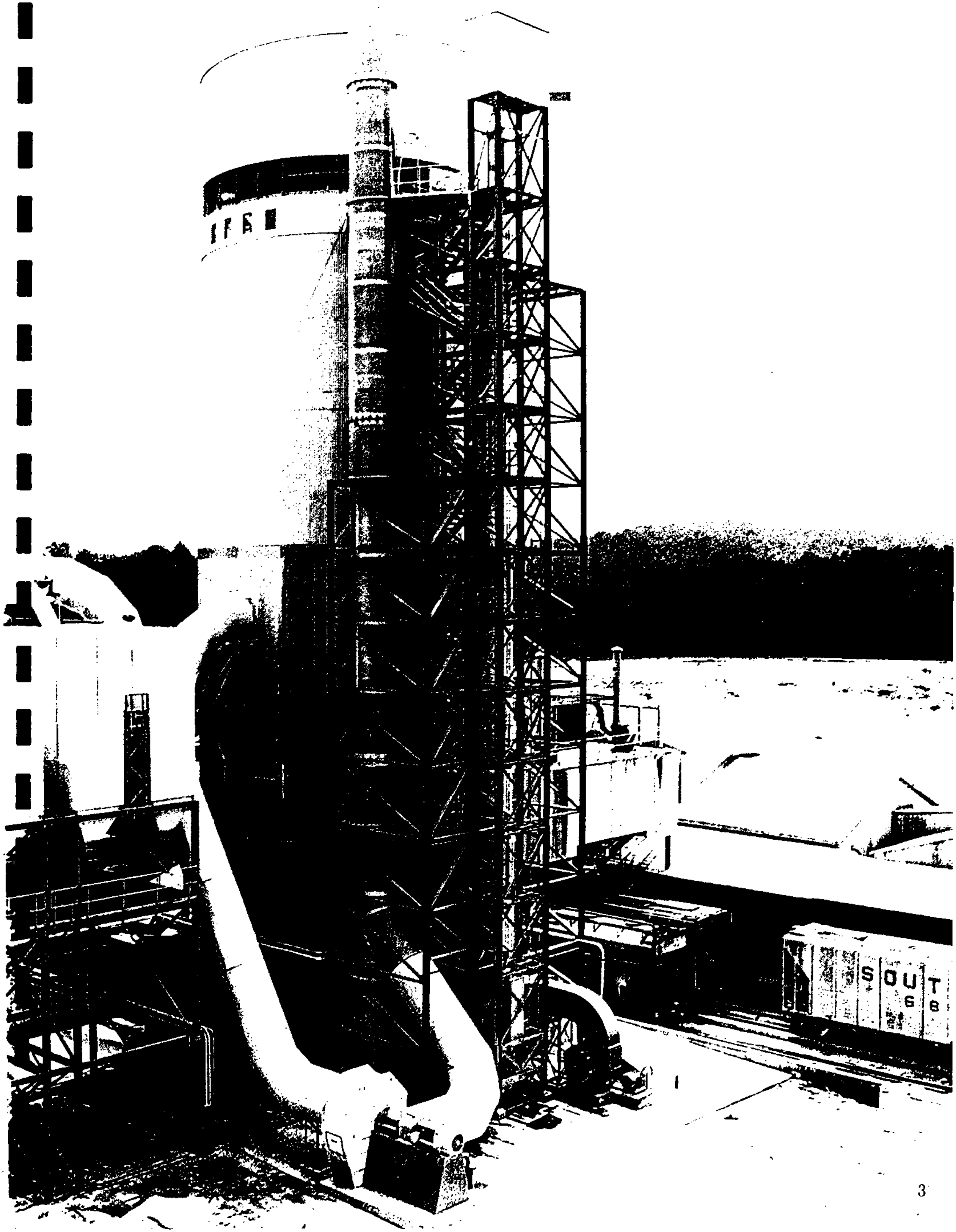
NIRO is an international company specializing in the development, design and engineering of liquid and powder processing equipment for the manufacture of products in powder, granular or agglomerate form.
Spray dryers and coolers, fluid bed systems, solid/liquid extractors, evaporators, homogenizers, membrane filtration systems, agglomerators, granulators, and coating units feature in a comprehensive delivery program marketed world-wide through an extensive network of subsidiaries and representatives.
Today's plants are designed for operational and environmental safety, featuring concepts that give the lowest energy consumption, while achieving the highest product qualities. Many of the world's leading manufacturers are NIRO customers.
Substantial product and process know-how, commitment to customers, a qualified staff, and a flexible organization have been important elements in establishing a good international reputation. With this strategy, the company has achieved an important world market presence with more than 7000 spray dryer installations supplied to many industries.
A major objective of NIRO is not only to expand its activities through internal research and development, but also to identify and participate in the development of technology in associated fields.
NIRO is a member of the Danisco Group, one of Denmark's largest industrial concerns.

Spray dryers for the production of

- Foodstuffs
- Dairy products
- Coffee
- Flavors
- Pharmaceuticals
- Biochemicals
- Proteins
- Enzymes
- Agro-chemicals
- Dyestuffs
- Ceramics
- Polymers
- Mineral concentrates
- Detergents
- Fine/bulk chemicals
- Catalysts

in powder, granular or agglomerate form.

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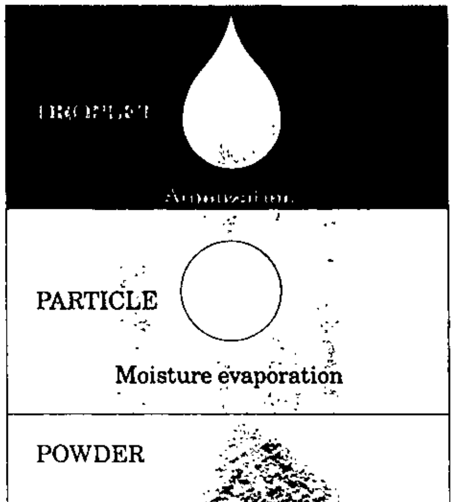
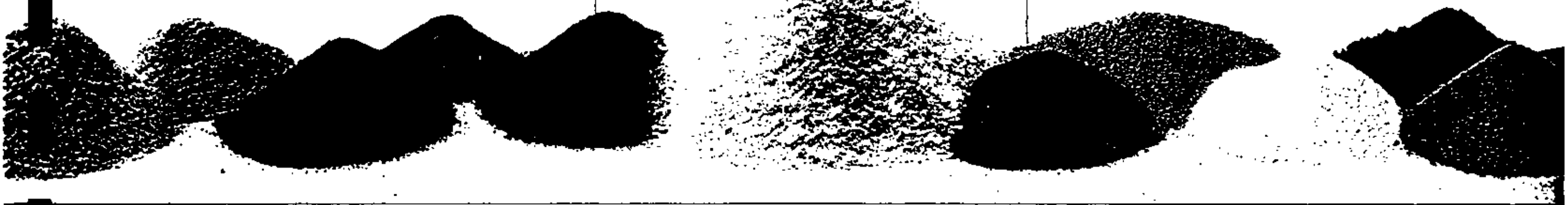
Process

Spray drying is the most widely used particle formation process. It is used for the continuous production of dry solids in powder, granulate or agglomerate form from liquid feedstocks as solutions, emulsions, and pumpable suspensions. Spray drying is an ideal process where the end-product must comply to precise quality standards regarding particle size distribution, residual moisture content, bulk density, and particle shape.
Spray drying involves the atomization of a liquid feedstock into a spray of droplets and contacting the droplets with hot air in a drying chamber. The sprays are produced by either rotary (wheel) or nozzle atomizers. Evaporation of moisture from the droplets and formation of dry particles proceed under controlled temperature and airflow conditions. Powder is discharged continuously from the drying chamber. Operating conditions and dryer design are selected according to the drying characteristics of the product and powder specification.





Principles

Every spray dryer consists of feed pump, atomizer, air heater, air disperser, drying chamber, and systems for exhaust air cleaning and powder recovery.
Widely varying drying characteristics and quality requirements of the thousands of products spray dried determine the selection of the atomizer, the most suitable airflow pattern, and the drying chamber design.

Atomization

The formation of sprays having the required droplet size distribution is vital to any successful spray dryer operation.
Atomization is a high technology area, where Niro has played a central role in the development with a range of rotary atomizers handling feedstocks up to 200 t/h.

Airflow

The initial contact between spray droplets and drying air controls evaporation rates and product temperatures in the dryer. There are three modes of contact:

Co-current

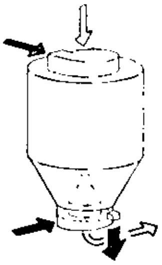
Drying air and particles move through the drying chamber in the same direction. Product temperatures on discharge from the dryer are lower than the exhaust air temperature, and hence this is an ideal mode for drying heat sensitive products. When operating with rotary atomizer, the air disperser creates a high degree of air rotation, giving uniform temperatures throughout the drying chamber. However, an alternative non-rotating airflow is often used in tower-type spray dryers using nozzle atomizers.

Counter-current

Drying air and particles move through the drying chamber in opposite directions. This mode is suitable for products which require a degree of heat treatment during drying. The temperature of the powder leaving the dryer is usually higher than the exhaust air temperature.

Mixed flow

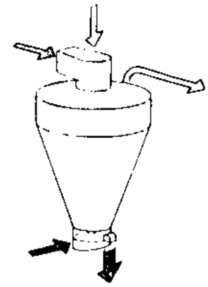
Particle movement through the drying chamber experiences both co-current and counter-current phases. This mode is suitable for heat stable products where coarse powder requirements necessitate the use of nozzle atomizers, spraying upwards into an incoming airflow. The new fluidized spray dryer design (FSD) also uses the mixed flow mode, where the atomizer sprays droplets downwards towards the integrated fluid bed and the air inlet and outlet are located at the top of the drying chamber.



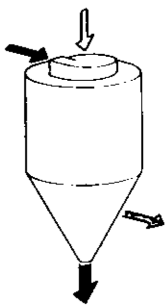
Co-current, with integrated fluid bed, rotary or nozzle atomizer, for dairy/food products.

Spray Dryer Chamber Design

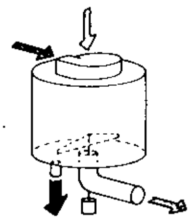
As drying characteristics and product specifications vary from product to product, there is no one spray drying chamber design suitable for all applications.
By offering a full range of designs, Niro impartially selects the most suitable type of plant.



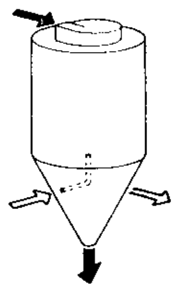
Mixed flow, with integrated fluid bed, rotary or nozzle atomizer, for non-dusty, free-flowing products.



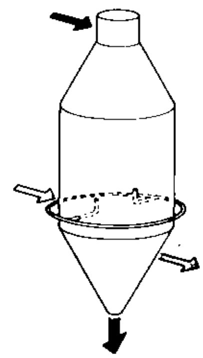
Co-current, conical base, with rotary atomizer, for both heat sensitive and stable products.



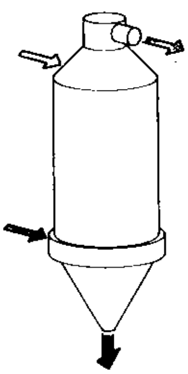
Co-current, flat base, with rotary atomizer, for special products. Also suitable for spray cooling.



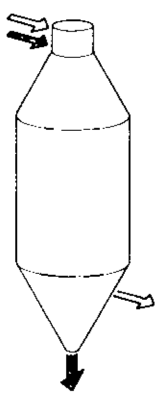
Mixed flow, with nozzle atomizer, for coarse powders of heat stable products.



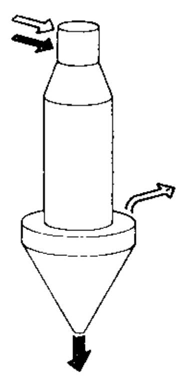
Mixed flow, with nozzle atomizer, for ceramic products.



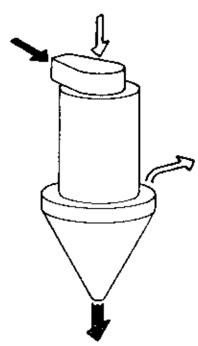
Counter-current, with nozzle atomizer, for products requiring heat treatment.



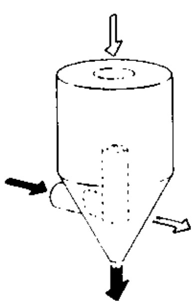
Co-current, with nozzle atomizer, for chemicals.



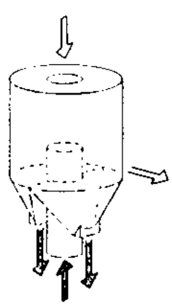
Co-current, with nozzle atomizer, for instant coffee.



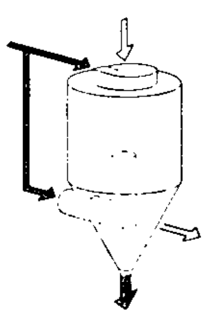
Co-current, with nozzle atomizer, for dairy/food products.



Co-current, with rotary atomizer, for drying chemicals at high inlet air temperatures.



Co-current, with rotary atomizer, for drying mineral concentrates at ultra-high inlet air temperatures.



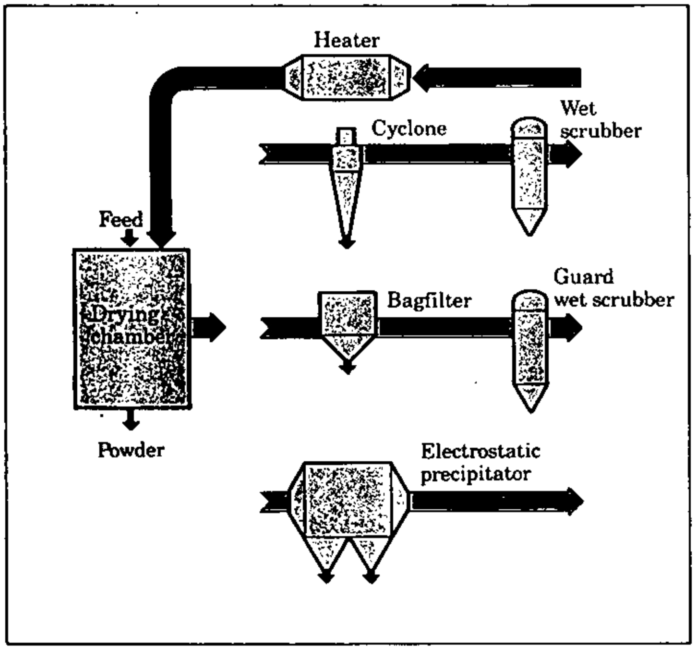
Co-current, compound air disperser with rotary atomizer, for very large volumes of low inlet air temperatures.

▬ Drying air
▭ Feed to atomizer
▬ Powder discharge
▭ Exhaust air

Spray Drying Systems

The essential elements of the spray dryer: atomizer, air disperser, drying chamber, inlet and exhaust air handling are combined into a system that meets individual operational safety, environmental protection, and powder handling requirements. All systems can be provided with post-treatment equipment: fluid bed dryer/cooler and conveyor.

Open

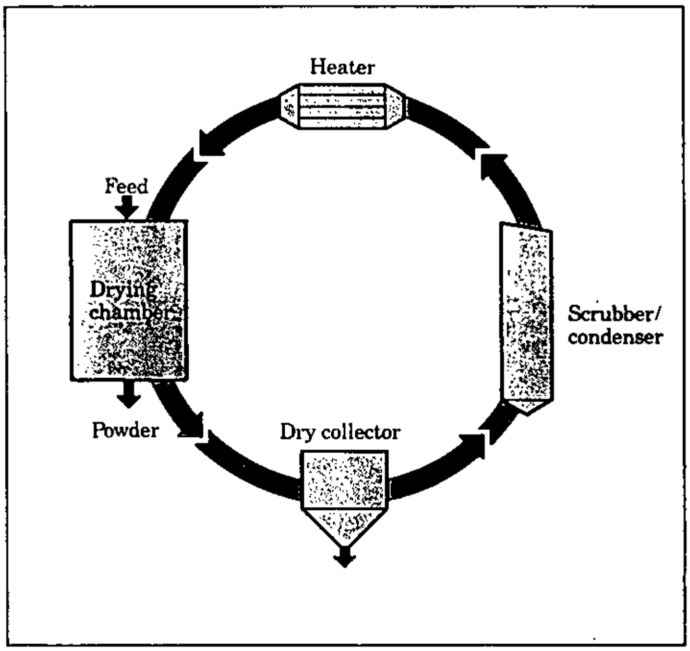


Featuring once-through airflow with exhaust to atmosphere.
The majority of industrial spray dryers handle aqueous feedstocks and use this system. Both direct and indirect airheating are applicable. Exhaust air cleaning in cyclones, bag filters, electrostatic precipitators, and scrubbers.

Special features

- Air dispersers for rotary and nozzle atomizer assemblies
- Pressure shock resistant drying chambers with venting or suppression for explosion protection
- Semi- or fully automatic cleaning systems (CIP)
- Biological wet scrubbers for odor removal from exhaust air
- Conventional or computerized control systems
- Air/air or air/liquid/air waste heat recovery units
- Air-broom and air-sweep attachments for drying chamber
- Noise attenuation of components
- Weatherproof finish for outdoor installations

Closed cycle



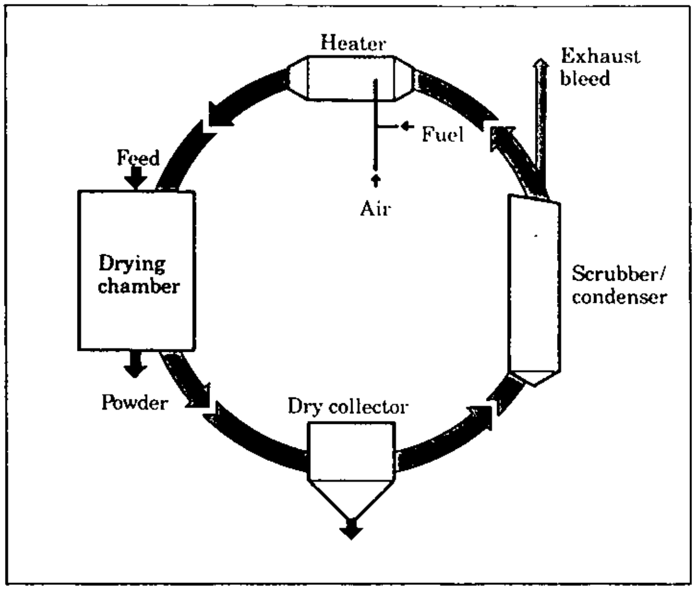
Featuring drying in an inert gas atmosphere where nitrogen recycles within the dryer. This system must be used for the spray drying of feedstocks containing organic solvents or where the product must not contact oxygen during drying. Closed cycle plants are gas and powder tight, and are designed to the strictest safety standards. The inflammable solvent vapors are fully recovered in liquid form.

Special features

- Rotary atomizers with inert gas purging
- Semi- or fully automatic solvent cleaning systems
- Package plant – test erected prior to shipment
- Available with cyclones or bag filters
- Condenser systems to ÷22° F

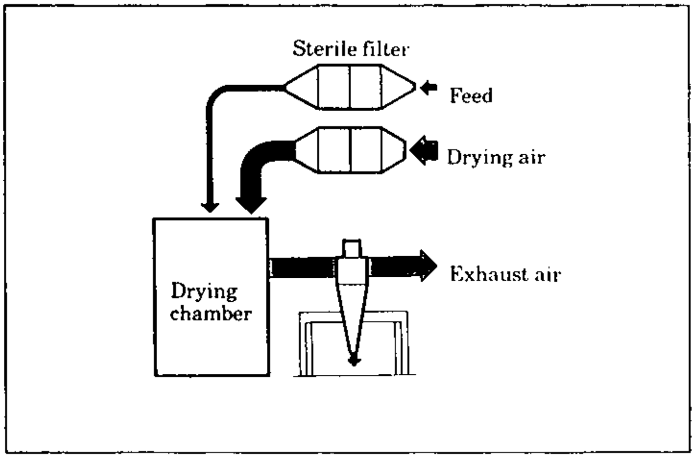
Atomizers

Semi-closed cycle

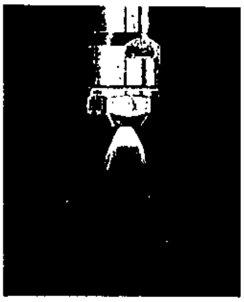


Featuring either the partial recycle mode (recycle of up to 60% of the exhaust air as inlet air to the dryer, for effective waste heat utilization) or the self-inertizing mode, where direct air heating and a minimal air bleed create the low oxygen atmosphere necessary for drying aqueous feedstocks that form explosive powder-air mixtures. If odor is generated during drying, the small volumes of air vented from the system can be effectively and economically incinerated.

Aseptic



Featuring sterile feed atomization and air filtering systems. These dryers are used where any form of powder contamination must be avoided. They are fabricated to special standards of finish and operate under a slight pressure. Fully automatic cleaning and sterilization systems are available. Plant layout is integrated with the laminar flow packing room.



Three types of atomizers are used in industrial drying:

Rotary
Atomization by centrifugal energy

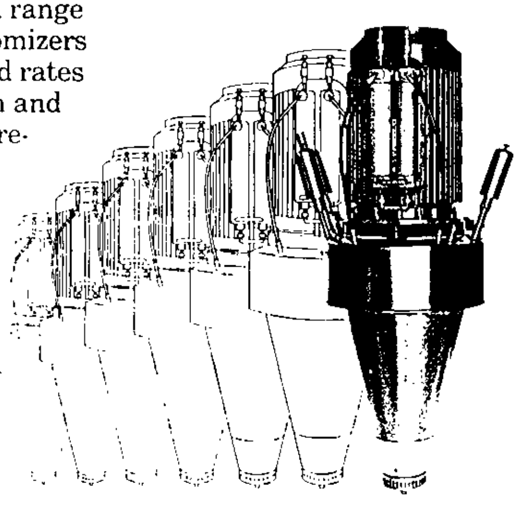
Pressure nozzle
Atomization by pressure energy

Two-fluid nozzle
Atomization by kinetic energy

The choice of atomizer depends upon the properties of the feed and the dried product specification. In cases where more than one atomizer type is suitable, the rotary atomizer is generally preferred due to its greater flexibility and ease of operation. The advantages include:

- Handling of high feed rates without need for atomizer duplication
- Handling of abrasive feeds
- No blockage problems
- Low pressure feed system
- Ease of droplet size control through wheel speed adjustment

Niro offers a range of rotary atomizers covering feed rates up to 200 t/h and power requirements up to 800 kW.



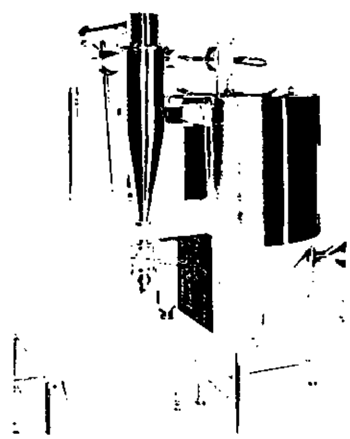
Spray Dryers for Industrial Production

Pharmaceutical Industry

Pharmaceuticals in powder or agglomerate form:

- Analgesics
- Antibiotics
- Enzymes
- Plasma/plasma substitutes
- Vaccines
- Vitamins
- Yeasts

Spray dryers designed specially for integrating into batch or continuous operations under sanitary or aseptic conditions. Systems also available for taste masking and encapsulation.
The new FSD dryer is ideal for producing non-dusty powders for perfect tabletting. Other equipment in Niro's supply to the pharmaceutical processing industries includes concentrators, tablet coaters, powder blenders, and deodorizing bioscrubbers.

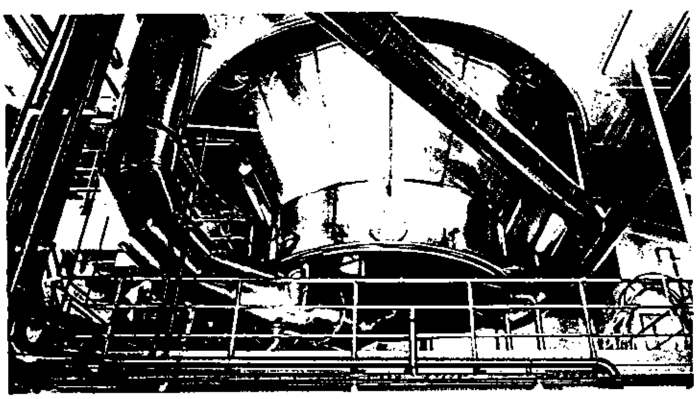


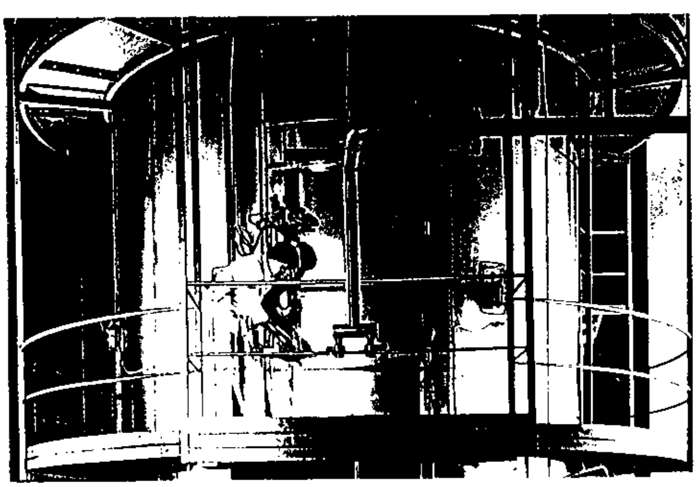
Food and Dairy Industry

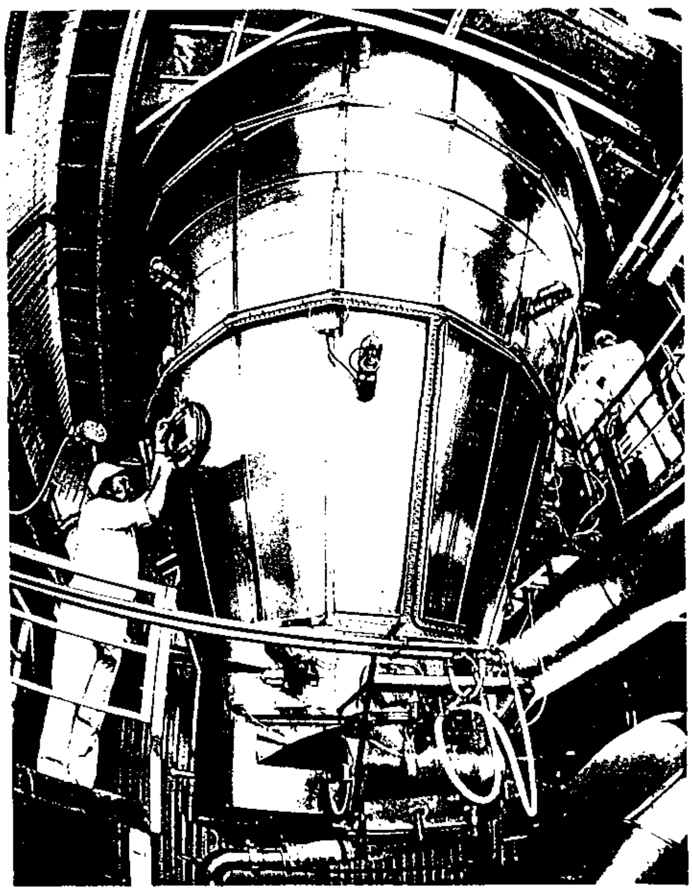
Foodstuffs and dairy products in powder or agglomerate form:

- Milk
- Baby food
- Cheese/whey products
- Coffee whiteners
- Eggs
- Tomato
- Spices/herb extracts
- Soup mixes
- Coffee/coffee substitutes
- Coconut milk
- Flavors
- Soy-based food

Spray drying is ideal for these heat sensitive products, where selection of system and operation is the key to high nutritive and quality powders of precise specification. "Instant", highly soluble powders are a speciality of spray dryers featuring fluid beds. All components in contact with product comply with hygienic processing standards. Today's plants have special features as automatic cleaning (CIP) and bagging-off systems. Associated equipment includes evaporators, powder blenders, agglomerators, lecithination units, and deodorizing bioscrubbers. Complete processing lines for instant coffee and dairy products are part of the Niro delivery program.







Chemical Industry

Speciality chemicals

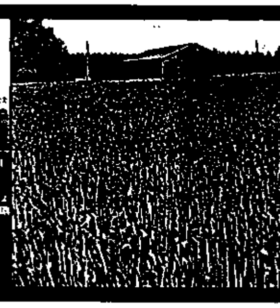
- Catalysts
- Dyestuffs/pigments
- Detergents
- Tannins
- Fine organic/ inorganic grades

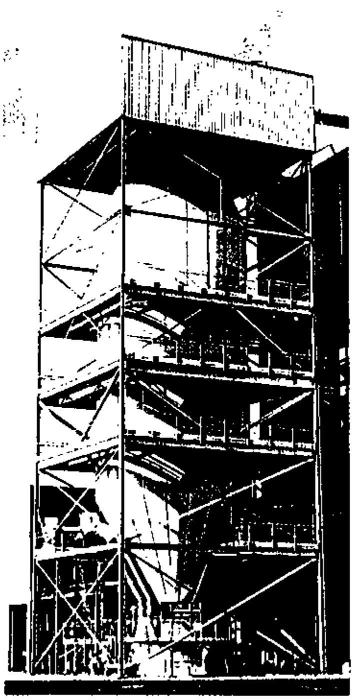
Agro-chemicals

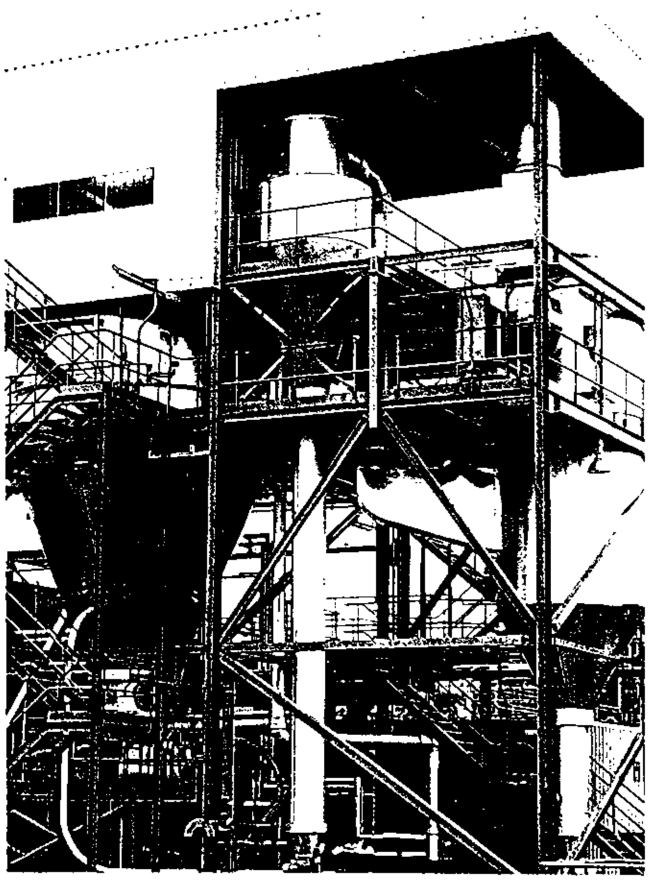
- Fungicides
- Insecticides
- Herbicides
- Fertilizers
- Chelates

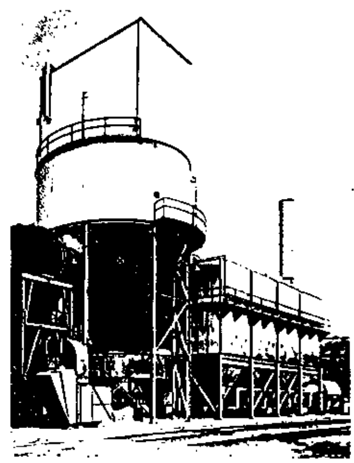
Spray dryers for the chemical industries produce powdered, granulated, and agglomerated products in systems that minimize formation of gaseous particulate and liquid effluent.

High efficiency scrubber systems and high performance bag filters prevent powder emission, while recycle systems eliminate problems of handling solvents, product toxicity, and fire explosion risks. Special component designs (e.g. atomizers) are available for abrasive and corrosive feedstocks. High thermal efficiencies, low maintenance costs, full environmental protection, computerized control, dust-free working area are some of the features of today's spray dryers.









Polymer Industry

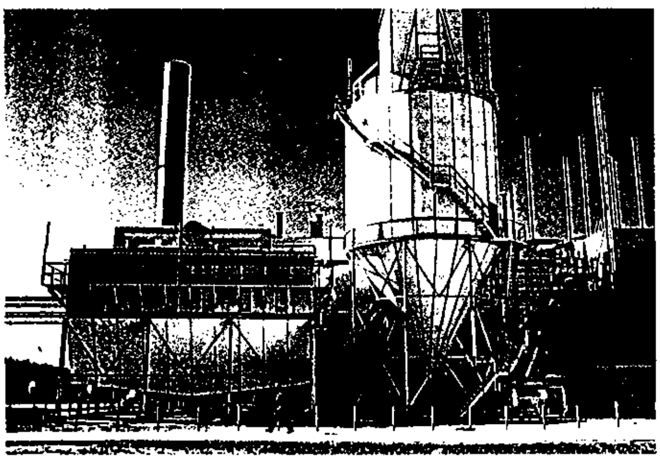
- e-PVC
- UF/MF resins
- ABS
- PMMA

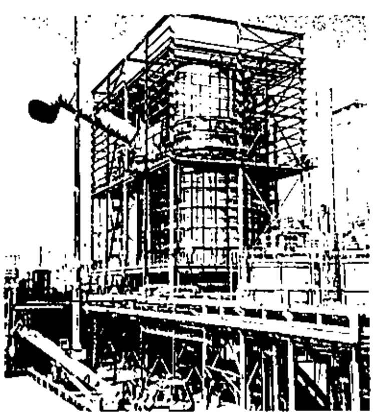
Polymer dispersions and solutions in water or organic solvents are spray dried under closely controlled operating conditions, producing powders to precise particle size, heat treatment, and redispersibility specifications. Low softening point products are produced continuously in plants with air-brooms, air-sweeps or integrated fluid beds. For drying moist polymer powders, Niro offers fluid beds.

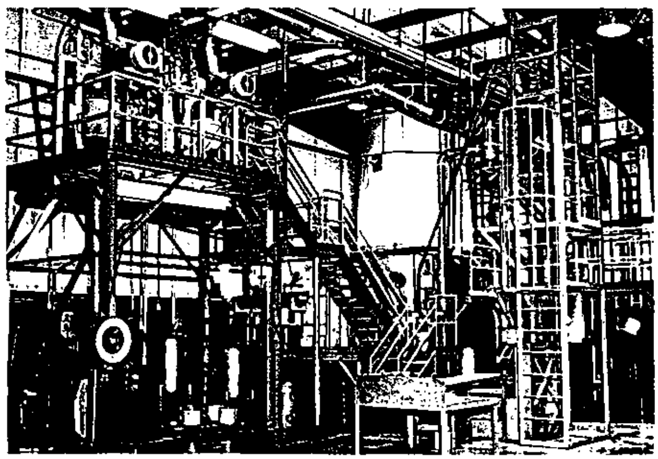
Ceramic Industry

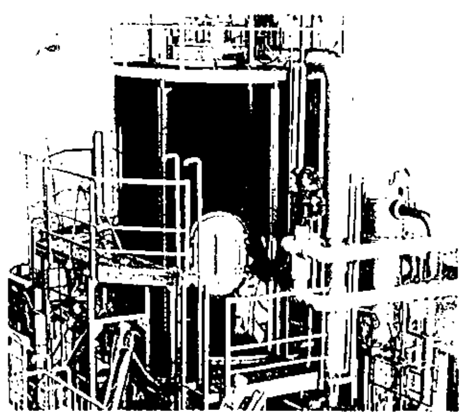
- Carbides
- Ferrites
- Nitrides
- Oxides
- Silicates
- Steatites
- Titanates

Spray drying is applicable to tile and electronic press powders, and plays an important role in the industrial development of high performance (advanced) ceramics. The ability to meet particle size distribution requirements, produce a spherical particle form, and handle abrasive feedstocks is an important reason for the widespread use of spray dryers in the ceramic industries.









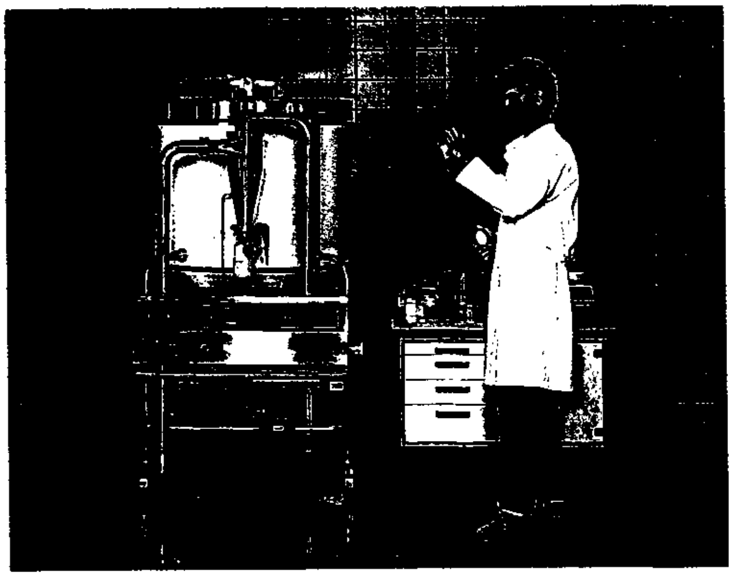
Spray dryers for testing and

– comprehensive range of series produced and package units available

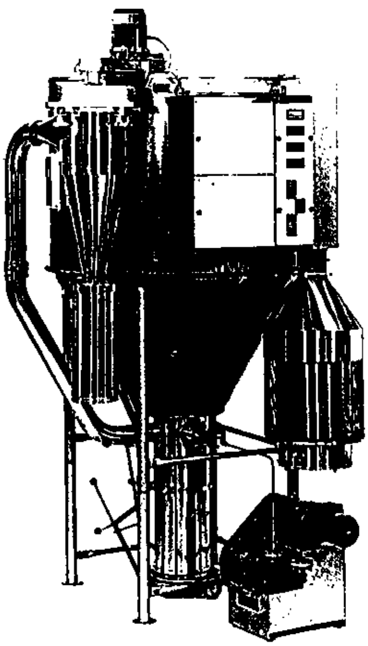
The Portable unit is the smallest dryer, and a special Type HT model handles organic solvent feedstocks. The Utility unit and the P-6.3 spray dryer are the next larger sizes, offering choice of atomizers, heating systems, and powder discharge. Closed cycle versions are custom designed.

The FSD pilot plant is the only small scale integrated fluid bed spray dryer on the market. It produces dustless and agglomerated powders representative of powders produced on large industrial installations.

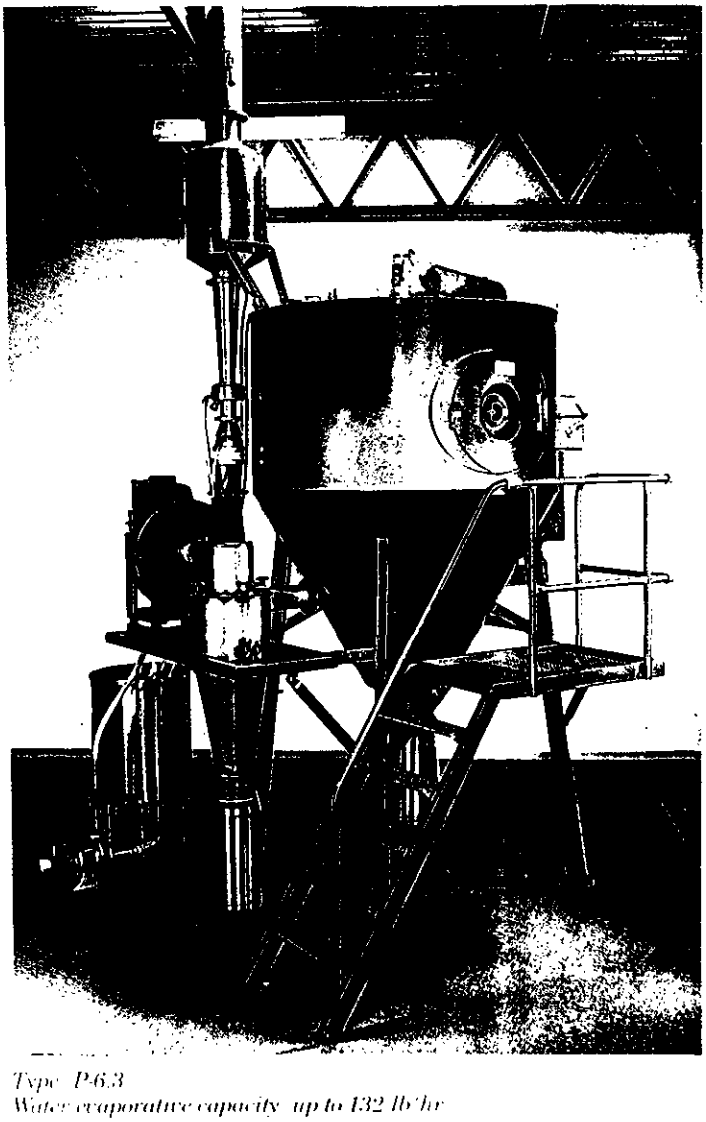
All industrial size package units have a fixed layout and are supplied complete with supporting structure. Available with rotary or nozzle atomizers, cyclones, bag filters, or scrubbers. A range of package closed cycle plants is also available.



Type: Portable unit
Water evaporative capacity: up to 15 lb/hr

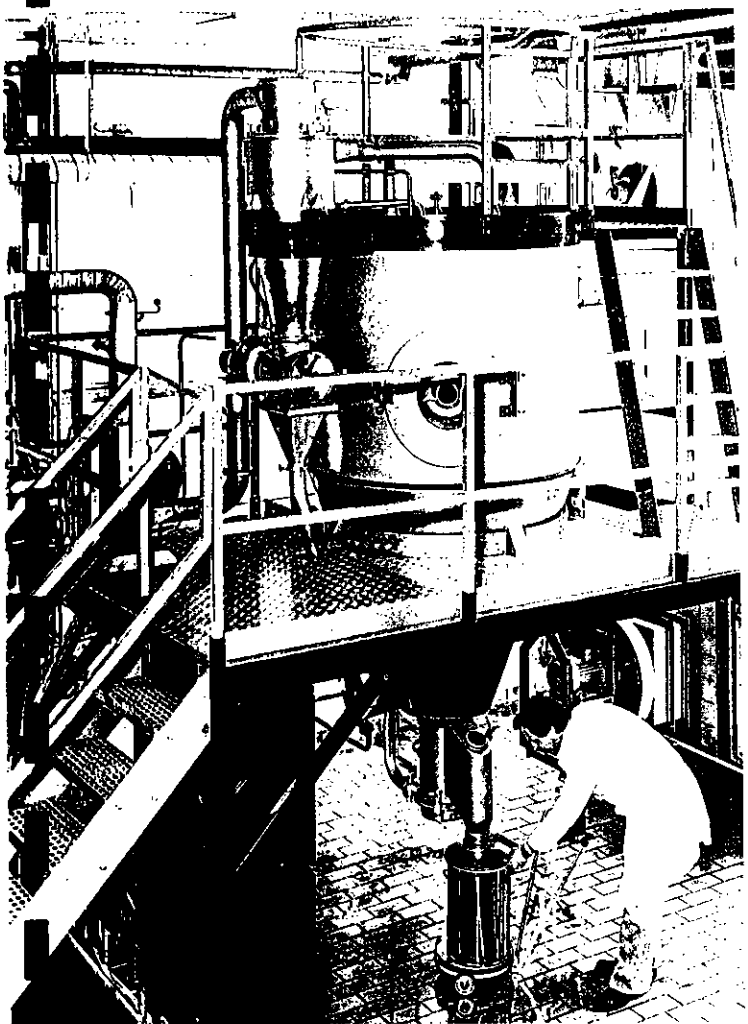


Type: Utility unit
Water evaporative capacity: up to 77 lb/hr

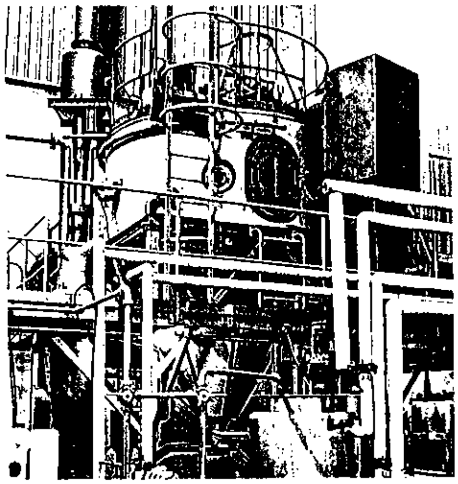


Type: P-6.3
Water evaporative capacity: up to 132 lb/hr

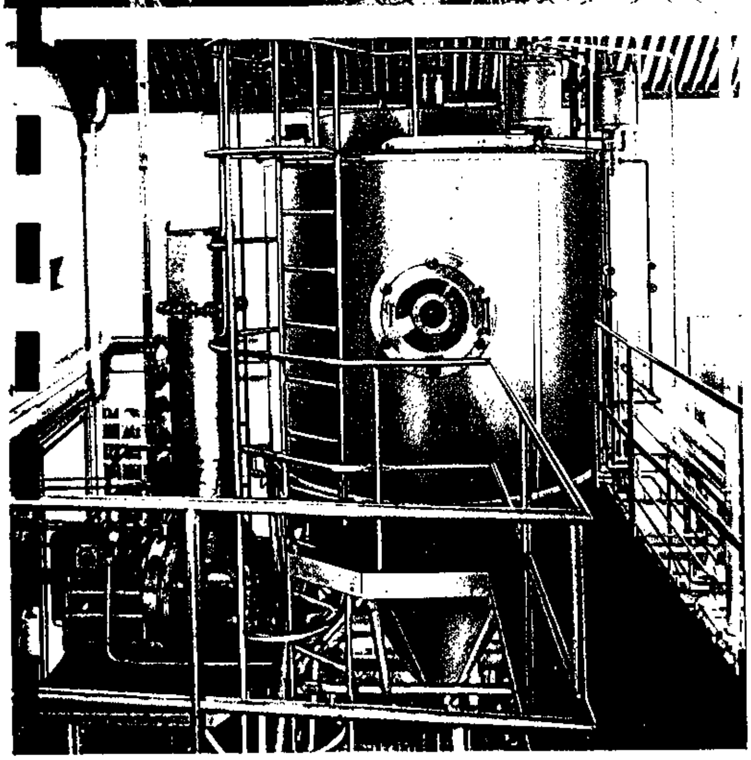
Small scale industrial production

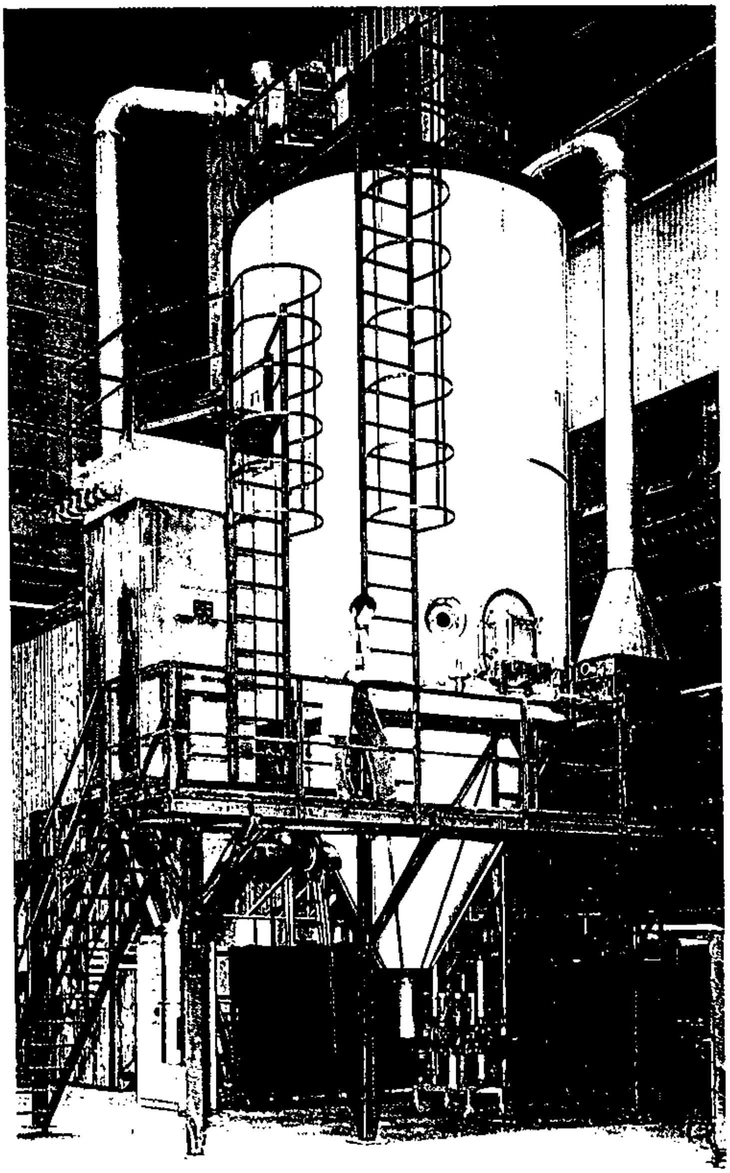


Type: FSD Pilot
Water evaporative capacity: up to 93 lb/hr



Type: SD-12.5-R
Water evaporative capacity:
up to 352 lb/hr





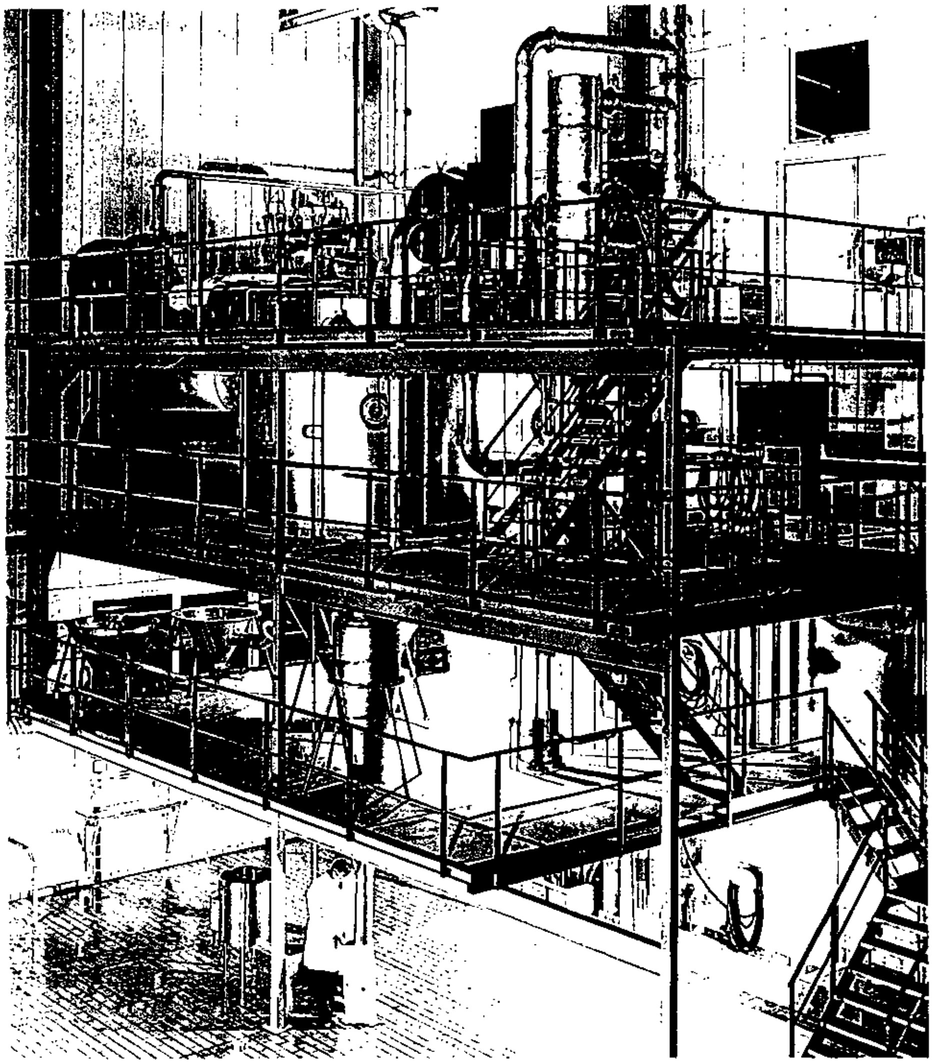
Spray dryer for solvent based feedstocks operating in closed cycle.

Spray dryer, type SD-25-N, bag filter version, after test erection prior shipment

Service to Industry

- Product testing and process evaluation
- Design and engineering
- Plant delivery, erection, and commissioning

Establishing a close collaboration with customers secures successful spray dryer operation in the shortest possible time.

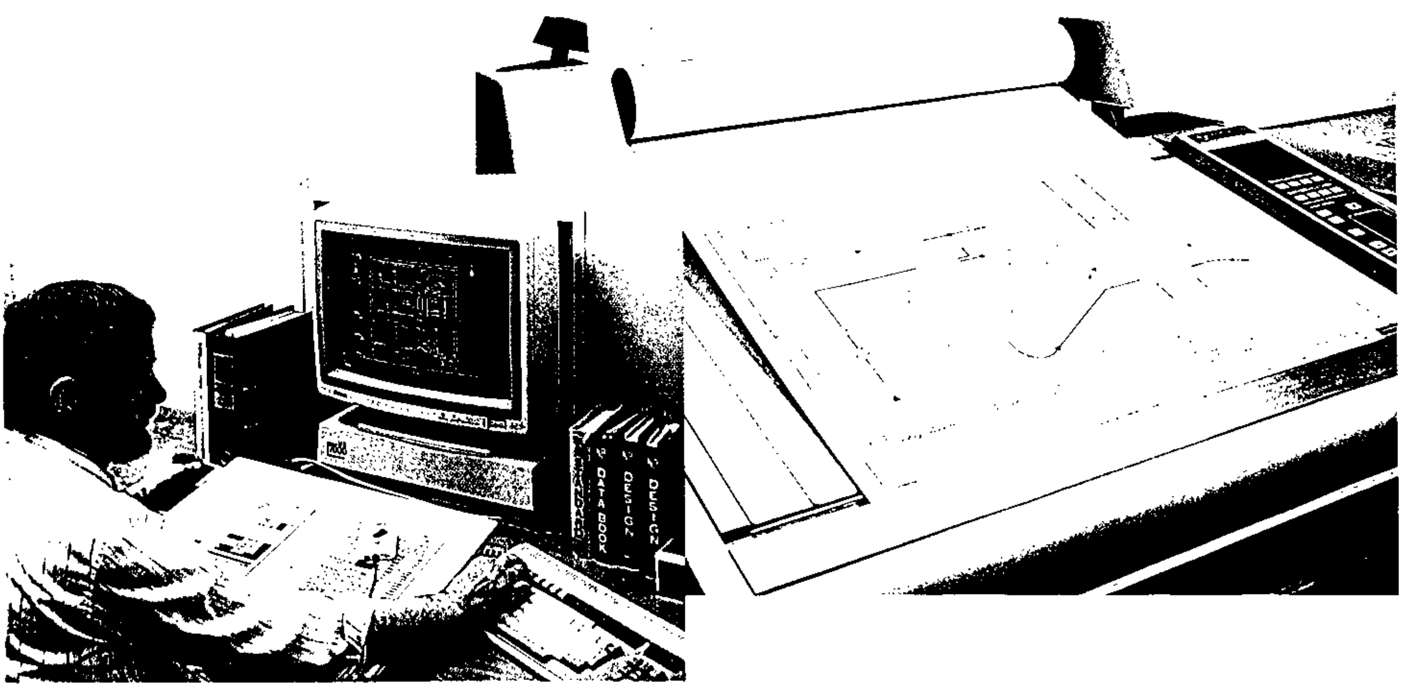


Product testing and process evaluation

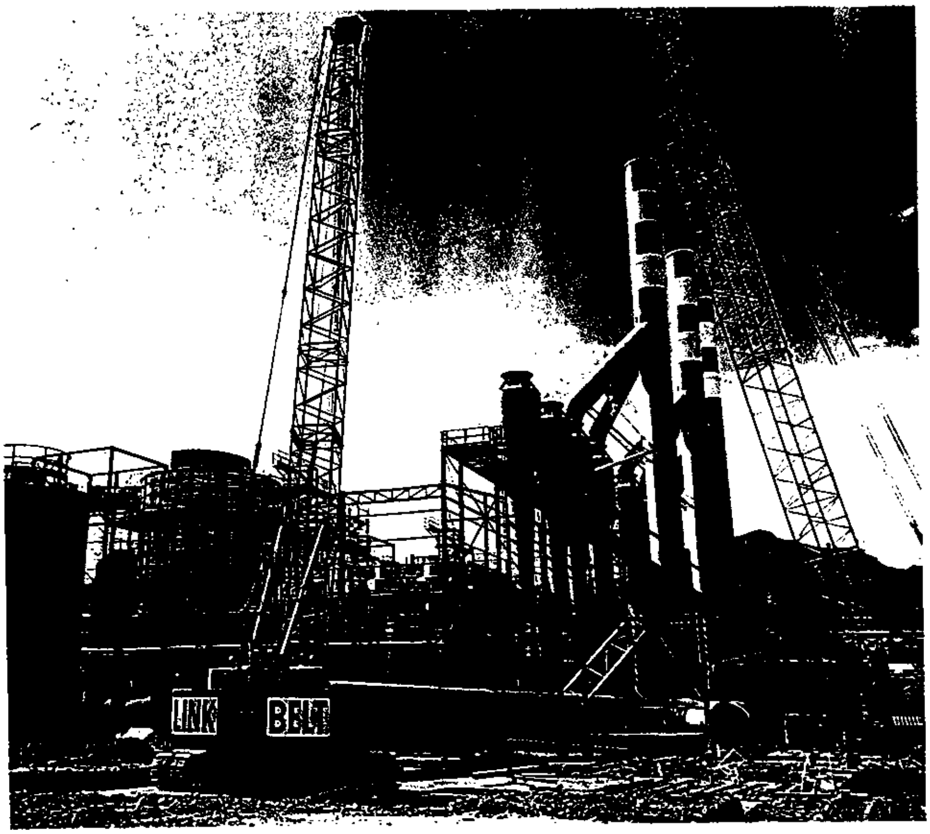
Pilot plant test facilities with accompanying analytical laboratories are available in Brazil, Denmark, United Kingdom, Mexico, Japan, and USA for establishing the feasibility of using Niro equipment, optimizing process conditions, and providing samples for market analyses.

Design and engineering

With process data confirmed during testwork, the spray dryer is specified and designed based upon the latest technology and industrial experience. The most modern design aids are used. Operation and maintenance manuals are individually prepared for each project.

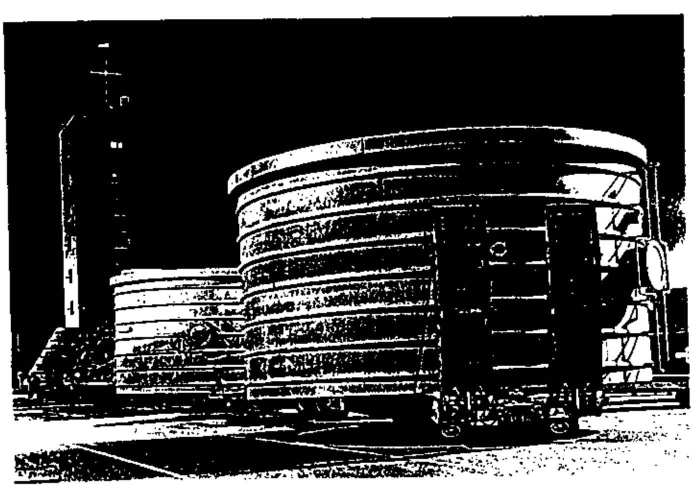


Fabrication
All components are fabricated in Niro's own workshop.



Plant delivery, erection, and commissioning
Punctuality of delivery is essential to today's business, and Niro is known for plant delivery on time. Responsibility for total plant erection is accepted, and site erection supervision can be supplied. The company's own engineers are present during the commissioning phase.

A round-the-clock spare parts service is maintained.



MikroPul

MIKROPUL CORPORATION • 10 Chatham Road, Summit, NJ 07901—(201) 273-6360

OWNER'S MANUAL

TR & TRH MIKRO- PULSAIRE DRY DUST COLLECTOR

(TOP REMOVAL AND WALK-IN PLENUM UNITS)

- INSTALLATION
- OPERATION
- MAINTENANCE
- TROUBLESHOOTING

STD. 0-06

TABLE OF CONTENTS

SECTION PAGE

LIST OF ILLUSTRATIONS

LIST OF TABLES

TABLE I. FILTER BAG MATERIAL COMPARISON

BAG MATERIAL	MAX. OPER. TEMP. [°F]	ACID RESIST	ALKALI RESISTANCE	NOTES
Polyester	275	Good	Good	1,2,3
Polypropylene	200	Excellent	Excellent	1,2,3
Nomex	400	Fair	Good	1,3
Acrylic	250	Good	Fair	1,3
Nylon	200	Poor	Good	1,3
Wool	180	Fair	Poor	1
Teflon	475	Excellent	Excellent	—
Glass ***	550	Good**	Poor	—

NOTES:

1. HCE II treatment available
2. Hi-Gloss or Eggshell finish available
3. Singed finish available

** Glass is destroyed by gaseous HF at dew point temperatures
*** Use of glass bags is severely limited by poor flex-abrasion qualities

II. SPECIFICATIONS

ARRANGEMENT:

Number of Bags .... PerSpec
Diameter of Bags.......... 4½ In.
Length of Bags .... 6,8, or 10 Ft.
Area of Cloth/Bag -6 Ft.......... 7.07 Sq. Ft.
-8 Ft.......... 9.42 Sq. Ft.
-10 Ft. .... 11.77 Sq. Ft.
Bag Material (Dependent on Temp., Product, Etc.).......... Per Spec
Air Pressure Requirement for Cleaning .... 90-110 (125 psig max.)

III. ASSEMBLY INSTRUCTIONS

A. General

Due to the construction of some Mikro-Pulsaire components, field assembly and installation is a necessity. This Section provides instructions covering installation and assembly required at the job site.

B. Unpacking

Remove all components from the packing and check against the shipping ticket. Report shortages to the carrier at once. Inspect all components for evidence of shipping damage. If damage exists it should be reported to the carrier at once and a damage claim filed.

C. Assembly of Parts

1a. Manometer

Connect the manometer to the couplings provided on the clean air plenum and the collector housing (Figure 9). Fill the manometer with the fluid supplied. Use of any other fluid is not recommended, since any change in fluid density will affect the accuracy.

b. Magnehelic

Connect the high pressure tap of the magnehelic gauge to the collector housing pressure tap. Connect the low pressure tap of the magnehelic gauge to the collector plenum pressure tap.

NOTE: The manometer or magnehelic gauge should be located where it can be easily read.

2. Timer

Connect electrically to the power source and the solenoid valves (Figure 2). See owner's manual for time supplied.

CAUTION: The timer is a rugged mechanism. However, timer failure will be minimized if the timer is mounted in a vibration-free environment remote from the collector. In addition, installation indoors is recommended to eliminate potential problems caused by temperature fluctuations.

3. Compressed Air

The compressed air supply (90-110 PSIG) shall be connected to the header supplied with the collector. Observe the following precautions:

a. Use a minimum size pipe of 1" inside diameter for the main air line. Larger systems will require an appropriately sized airline.

b. Before connecting to the collector, purge airline thoroughly to remove dirt, oil, moisture, and/or loose rust scale.

c. Air must be kept clean and dry to insure trouble-free operation of the solenoid and diaphram valves. An adequately sized filter must be installed in the line to remove moisture and oil. Air filters should be sized for 50 Micron particle removal. Oil content should not exceed 10ppm/wt. More elaborate instrument air dryers are required only when sensitive process conditions or severe freezing situations are encountered.

4. Filter Bags

a. Slip the filter bag over a wire retainer with the bag seam 180° from the slot in the top of the retainer (Figure 3). Pull the bag over the retainer until bottom of bag is against the bottom of the retainer.

b. Fold the top of the filter bag inside the retainer (Figure 4) and loosely install a bag clamp around the top of the bag/retainer assembly, with the clamp screw located approximately 90° off the bag seam.

c. Slip the bag/retainer assembly over a venturi collar with a gasket in place on the venturi (Figure 5), making sure that the retainer groove is aligned with the venturi collar groove.

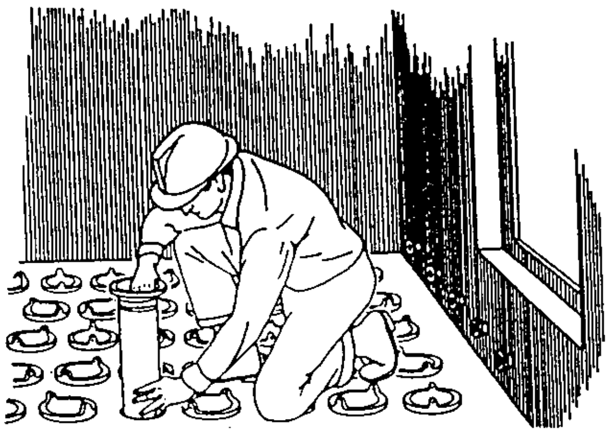
d. Using a 5/16" inch socket wrench, tighten the clamp securely. It is important to use a greater than usual torque on the clamp for this application (50-60 in-lbs.). It is very important that the axis through the venturi and that of the bag/retainer assembly coincide, so that the bag will be vertical once installed in the tubesheet.

CAUTION:

Relaxation of felt fibers, caused by the physical or chemical condition, could result in leakage or the filter bag slipping off the collar if the bag clamp is not tight and grooves engaged.

e. Install the bag/retainer/venturi assemblies in the tubesheet, making certain to lock the venturies in place with a twist clockwise.

f. Inspect collector to insure that bags are not touching each other or the collector walls.

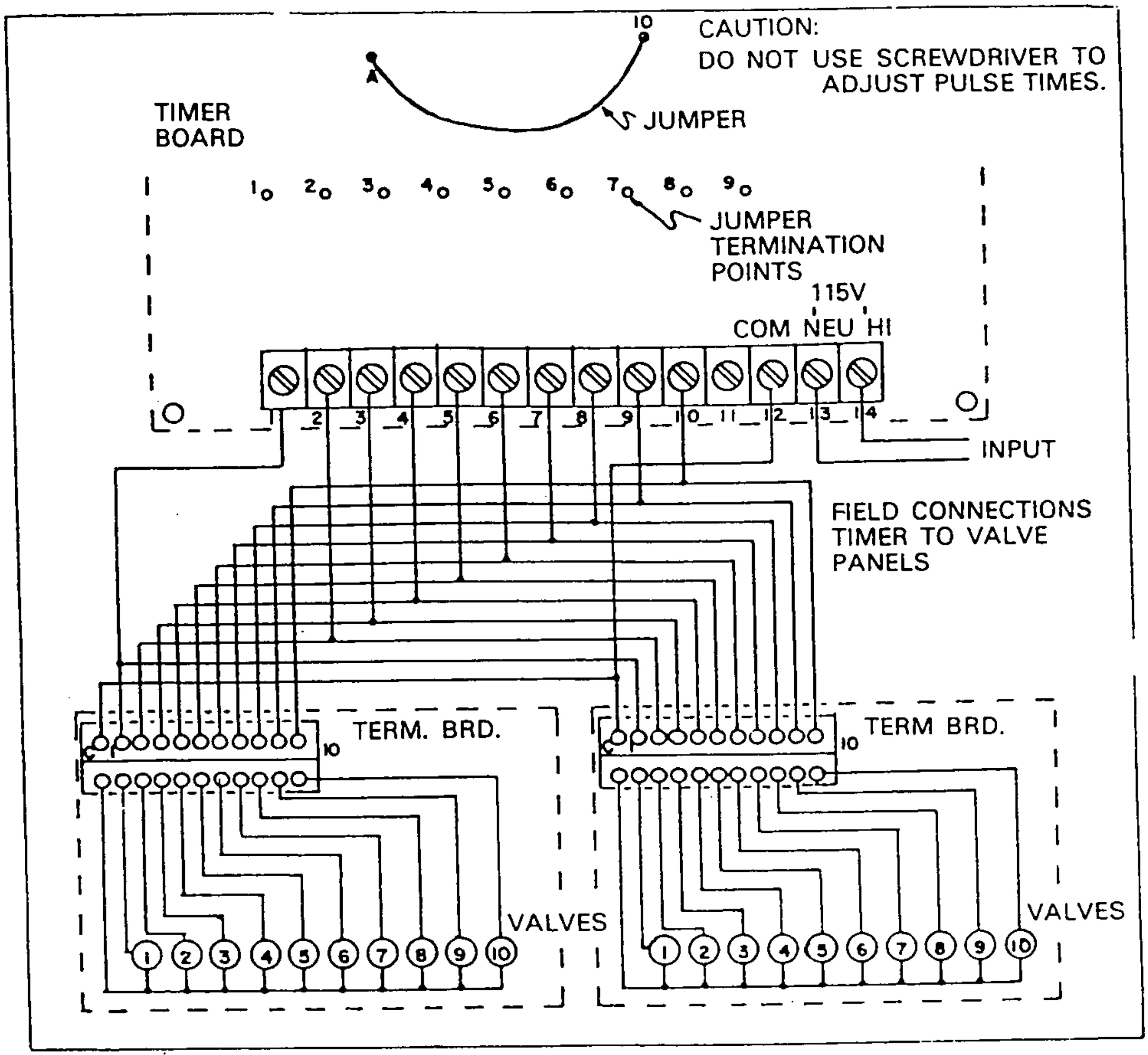


NOTE:

When installing fiberglass felt filter bags, extreme care is required during handling, assembling and installation.

The following recommendation and precautions will insure that you derive the maximum service from the fiberglass felt bags. As a general rule of thumb, handle the bags as if they are fragile glass tubes. Anything that would damage a glass tube will similarily affect the fiberglass felt. Every effort should be made to prevent creasing the bags. When received, the shipping carton should be handled so it is not crushed or allowed to get wet. It should be stored in a horizontal position with the top up. When it is time to install the bags a table should be set up to assemble the bag and retainer. The table should be somewhat longer than the bag and should be covered with heavy paper or other material to provide a smooth clean surface. The bags should be handled by at least two people at all times to avoid excessive bending. Work should be done in an area that is at least 70°F.

Figure 2. Timer - Solenoid Valve Wiring



Bag/Retainer Installation Technique

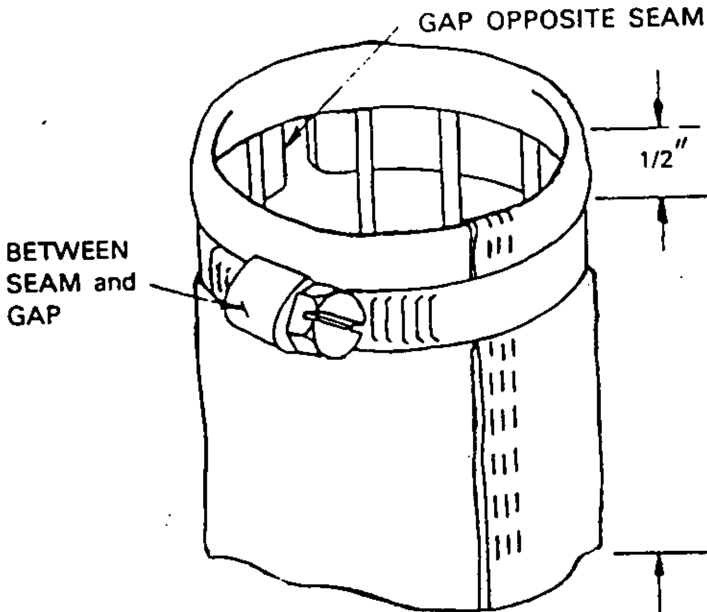


Figure 3

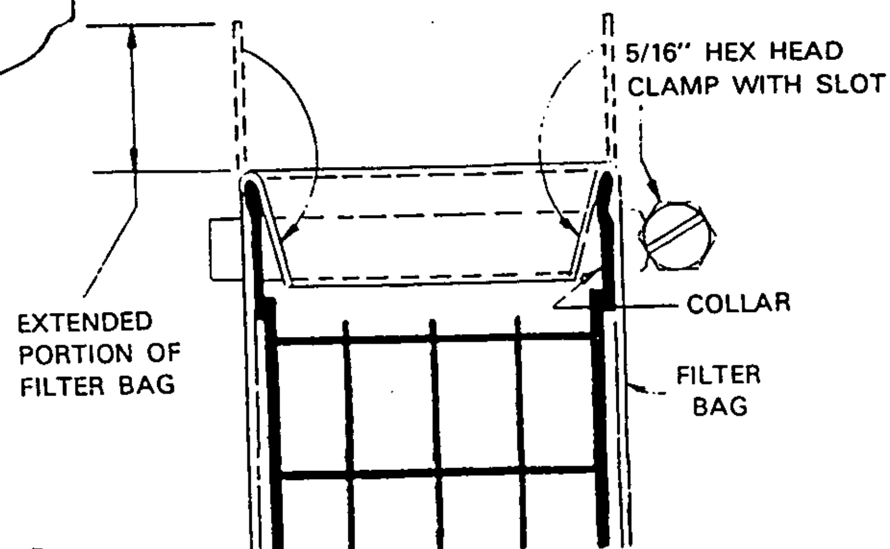


Figure 4

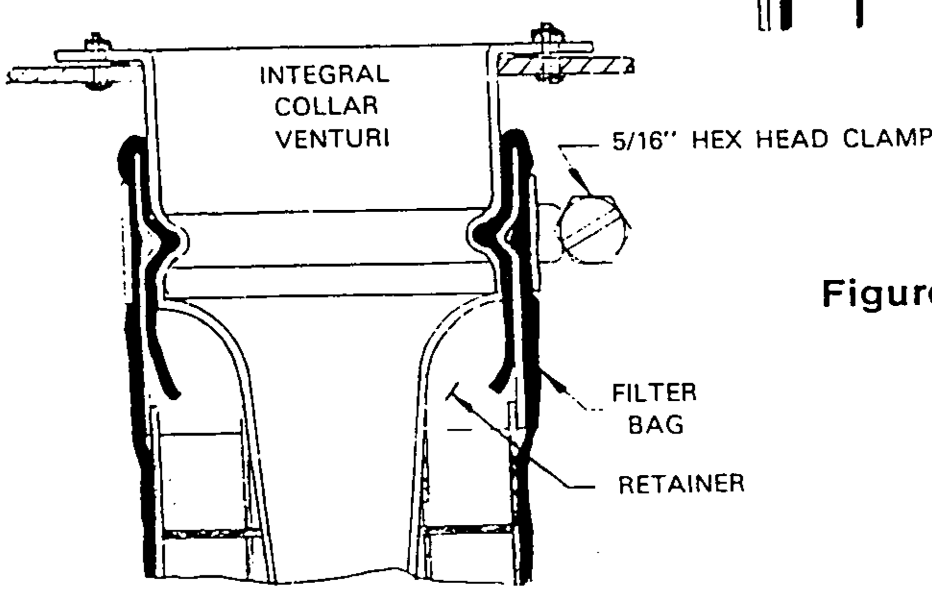
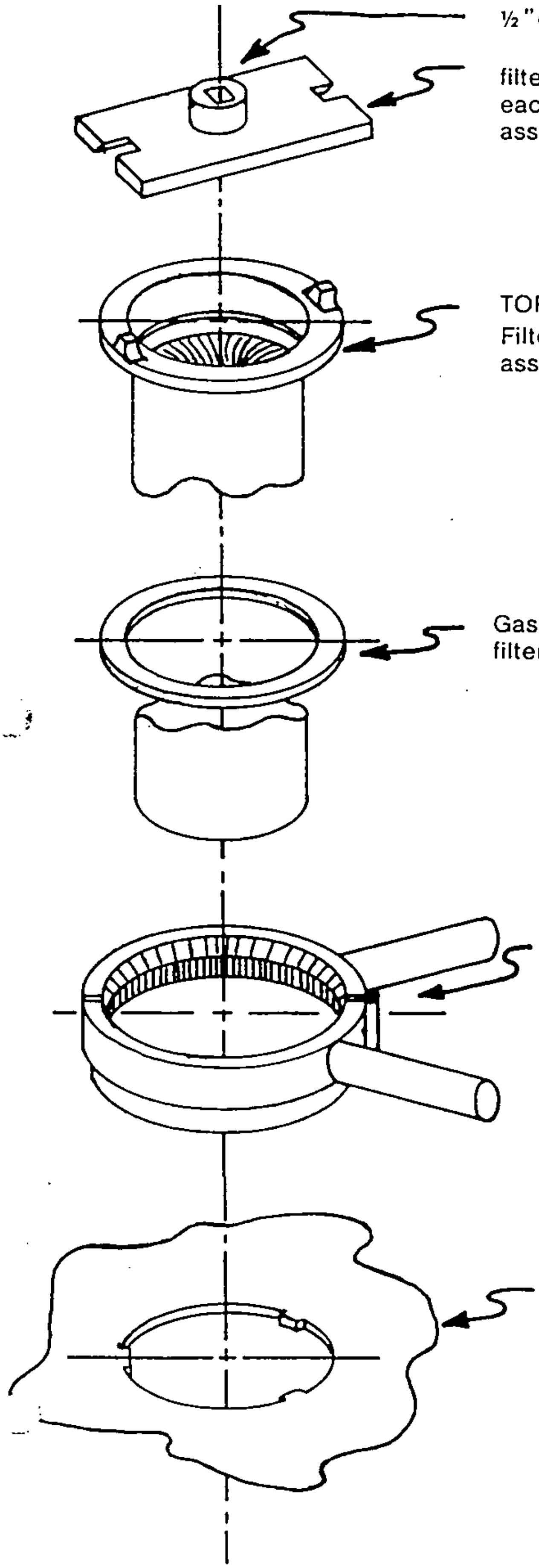


Figure 5

Figure 6 INSTALLATION OF TOP REMOVAL FILTER ELEMENTS



½" drive connection for torque wrench.

filter element venturi installation tool (P/N 391001) is supplied with each fabric filter. This tool is used to lock venturi and element assembly to the tubesheet.

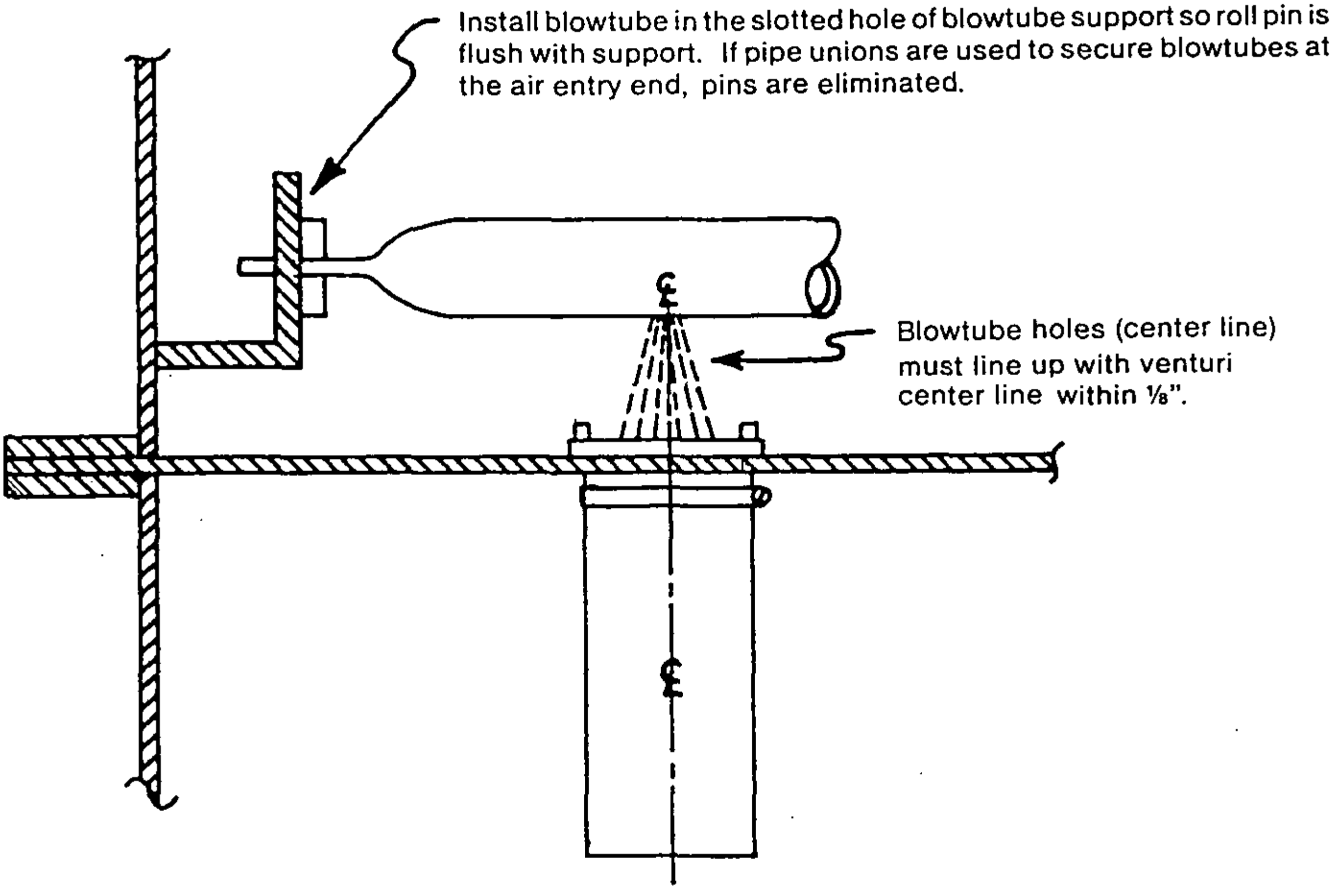
TORQUE VENTURI: 120/130 FT. LBS.
Filter element assembly - Venturi, retainer, bag, and clamp assembled, as per instructions (see page 7)

Gasket is to be installed on venturi before installing assembled filter elements in the tubesheet.

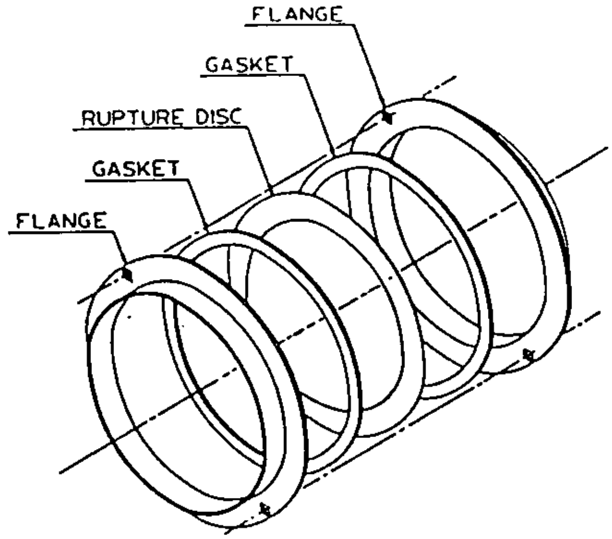
For the protection of some filter media, optional element installation tool (P/N 391008) may be required. Tool is removed from the tubesheet opening just prior to locking the venturi in place.

Tubesheet of fabric filter.

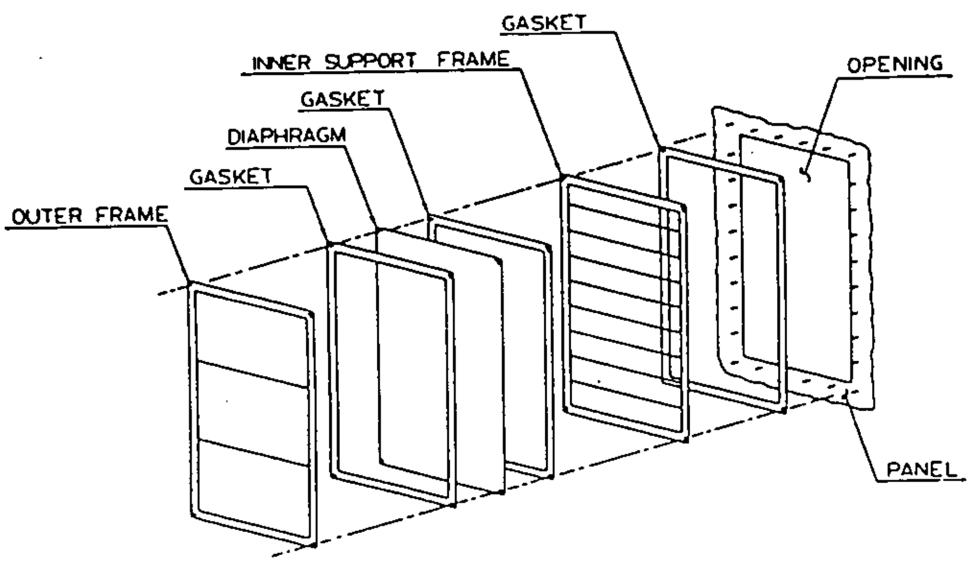
Figure 7 INSTALLATION OF TOP REMOVAL BLOWTUBES



Supplement information to owner's manual STD. 0-06.
Page 7 and Page 15



DISC TYPE
EXPL. VENT ASSY



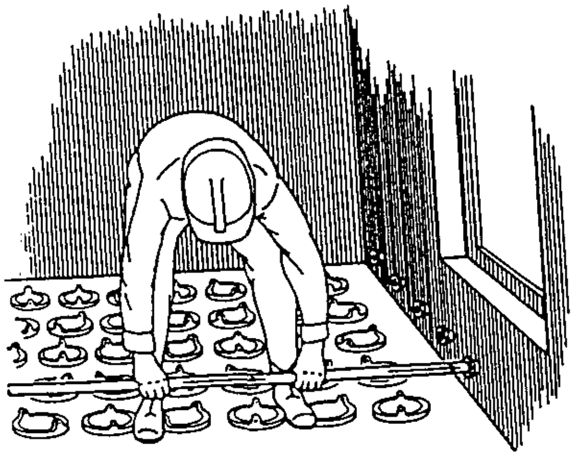
DIAPHRAGM TYPE
EXPLOSION VENT

Figure 8. Typical Field Assembly of Diaphragm And Disc Type Explosion Vents

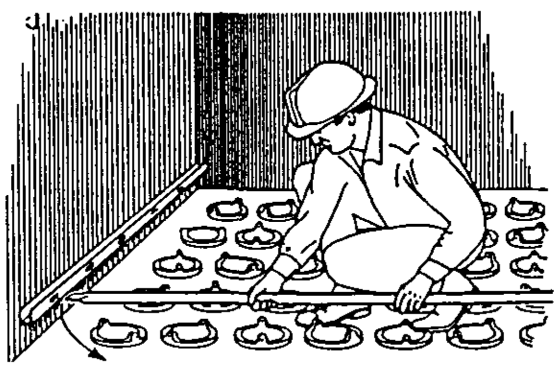
5. **Blowtubes**

The blowtubes are lengths of schedule 40 pipe with orifice holes spaced along their lengths. One end of each blowtube is open.

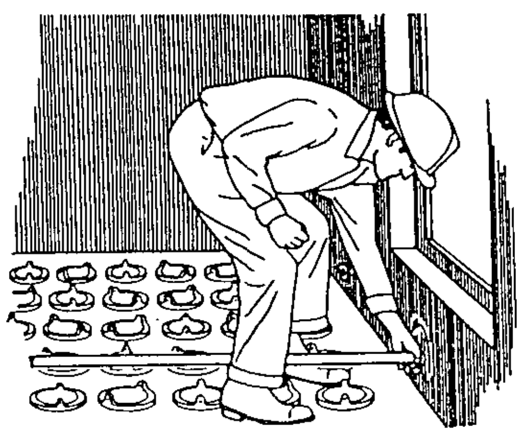
a. Insert the open end of the blowtube (holes aiming toward the tubesheet) into the open coupling located on the inside wall of plenum. Push the blowtube far enough into the coupling to permit the other end of the blowtube to clear the slotted bracket.



b. With the crimp of the blowtube aligned with the slot in the bracket, slide the blowtube back fully into the slot. allowing the locating pin to push against the bracket. (see figure 7)



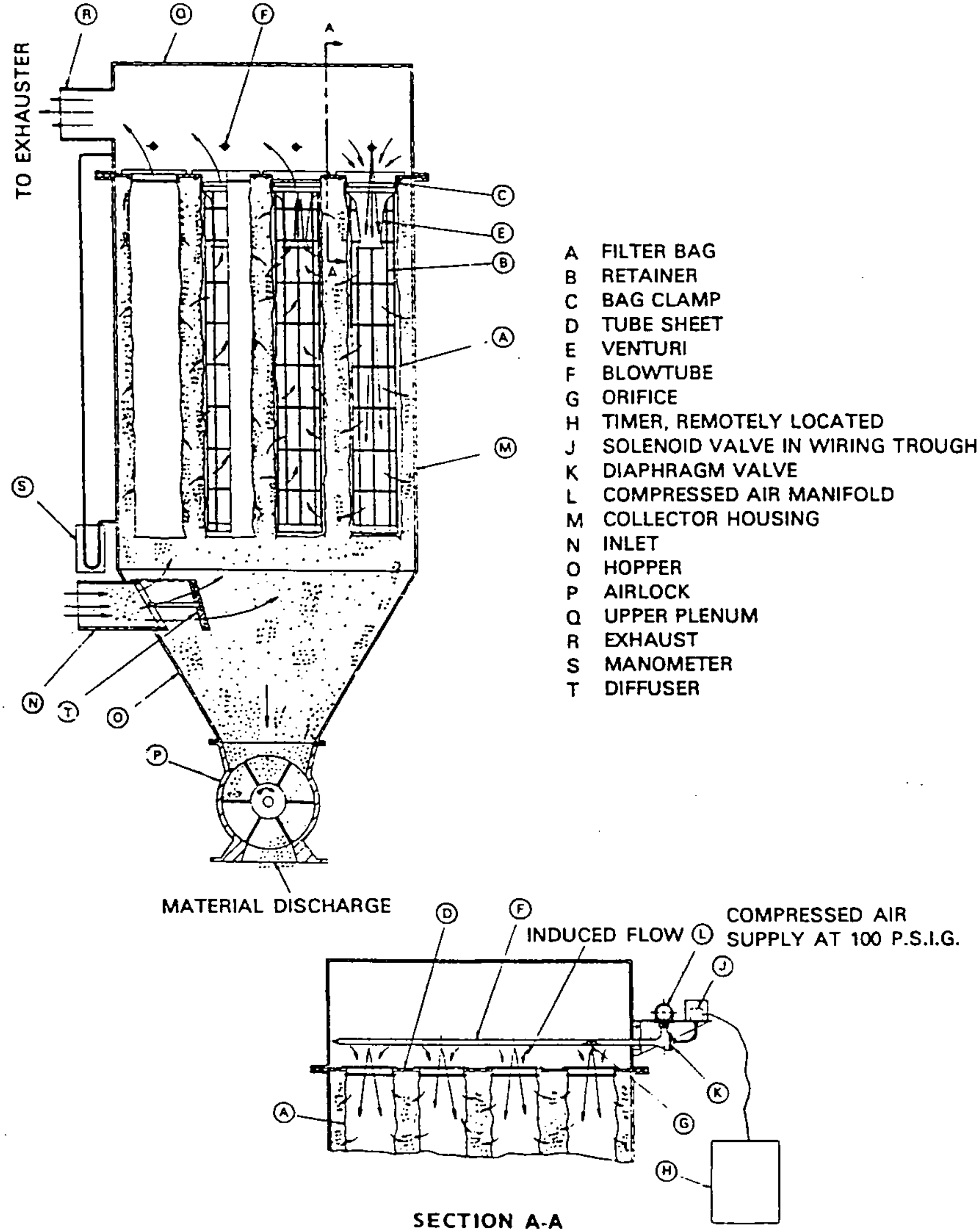
c. Tighten the nut on the coupling secure with a pipe wrench. The blowtubes may also be removed by reversing this sequence.



6. **Diaphragm or Disc Type Explosion Vents**

Install diaphragm or disc type explosion vents in accordance with figure 8.

Figure 9. Operational Components



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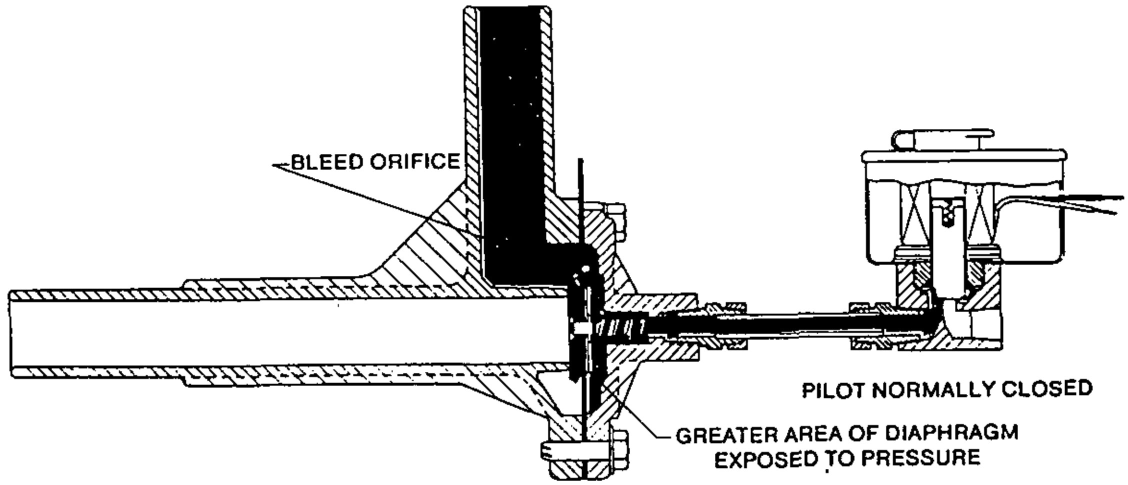
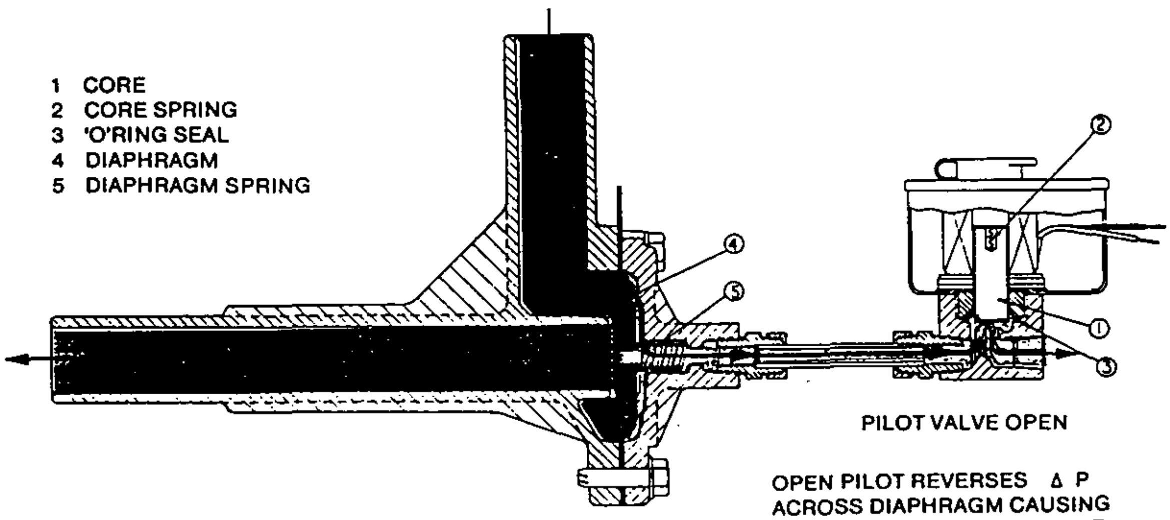


-SOLENOID DE-ENERGIZED-



-SOLENOID ENERGIZED-

Figure 10. Diaphragm/Solenoid Valve Operation

IV. THEORY OF OPERATION

Dust laden air under suction or pressure enters the lower section of the collector (Figure 9). The air travels through the filter bags, which retain the dust particles, on up through the venturis, into the clean air plenum and out the collector exhaust.

Dust collects on the outside of the filter bags and causes a reduction in the porosity of the bags. The result is a pressure differential across the collector, a cyclic timer actuates a series of normally closed solenoid valves at present intervals causing them to open. The diaphragm valve opens as a result of the decrease in pressure from the opening of the solenoid (for detailed operation of the solenoid and diaphragm valves, see Figure 10). A momentary inrush of high pressure air (90-110PSIG) flows from the compressed air manifold to the blowtube and is expelled from the blowtube through orifices at a high velocity. Air from each orifice induces a secondary airflow several times the volume of surge air as it passes through the venturi throat. The combined effect of the primary and induced secondary air causes an instantaneous pressure rise on the clean side of the filter bags, causing a reverse flow of air through the filter bags sufficent for cleaning. Through this mechanism, the collected dust is released from the bags and falls into the hopper. As dust falls into the hopper, it is discharged into a collection system which may be a bin under the hopper or a conveying system which carries the dust to a remote disposal area.

Since only a fraction of the total filter area of the collector is cleaned at any one instant, continuous flow through the collector at rated capacities is assured.

V. START-UP

A. Checklist

Perform a pre-start check to ascertain that the collector will function properly. Refer to Section VII, Maintenance Procedures, for specific instructions on performing adjustments which may be required.

1. *Compressed Air System*

Check the compressed air system for leaks. Insure that 90-110 psig pressure is available at the collector. Open main air valve momentarily and verify that there are no leaks in the solenoid and diaphragm valves.

WARNING: Turn off the compressed air and bleed the valve system before attempting to adjust or service valves.

NOTE: Air lines must be clean and free of moisture.

2. *Timer Circuit*

Check line voltage to the timing circuit. It must be 110 volts plus or minus 10%. Check electrical connections. Refer to the timer Owner's Manual and adjust as instructed. Apply power to the timer. Check that timer is operating by listening for clicking in each of the solenoid valves connected to the timer. Remove power from the timer.

3. *Auxiliary Equipment*

Insure that all auxiliary equipment (fans, airlocks, conveyors, etc.) are performing correctly and rotating in the correct directions.

B. Start-Up Procedures

1. *Spray Dryer or Process Equipment*

Initial adjustments must be made on the system before installing bags in the collector. An incorrectly functioning dryer or other process equipment may result in destruction of the bags if temperature or moisture is not in control. When used with drying equipment, preheat the collector for 30 minutes to 1 hour before start-up with material to eliminate the danger of condensation in the collector.

2. *Start-Up with New Filter Bags*

Close inlet or exhaust dampers approximately 50% before attempting to start up with new filter bags. High speed impingement, due to low resistance to air flow, can cause dust penetration of the filter bags. This will be particularly true when the air stream carries materials which tend to "blind" the bags. Open the inlet damper to design flow only after the filter bags have built up resistance (3 to 4 inches w.g. on the manometer). The timer controlling the compressed air pulsing should not be turned on until the differential pressure has reached 4 to 5 in. w.g., unless unattainable or if operating conditions will not permit this pressure drop.

3. *Normal Start-Up (with seasoned bags)*

Apply power to all auxiliary equipment (except fan). Energize timer and turn on compressed air. Introduce gases to the collector by opening dampers and starting fans.

CAUTION: Low collector resistance may overload the fan.

4. *Differential Pressure Control*

The expected differential pressure operating range is 1 to 6 inches w.g. If this tolerance cannot be maintained, adjust the cleaning cycle on the timer.

a. To reduce differential pressure, adjust time delay so that cleaning pulses occur at a more frequent rate (shorter OFF time).

b. To increase differential pressure that is on the low side, adjust time delay so that cleaning pulses occur at a less frequent rate (longer OFF time).

VI. SAFETY

IMPORTANT: Prior to operating this equipment, read this list of safety recommendations through in its entirety, along with the Operating Instructions.

A. During baghouse erection, objects lifted by crane or hoist must be securely fastened and carefully handled to prevent injury to personnel. If lifting lugs are available they should be used according to sound engineering practice. When overhead work is being performed, all areas below the collector must be restricted for unauthorized personnel. Personnel in the area must wear safety gear complying with plant safety standards.

B. Work crews should always consist of two or more persons. **Never allow personnel to work inside the collector alone**. After work has been completed, all tools should be removed from within the baghouse and ALL PERSONNEL MUST BE ACCOUNTED FOR PRIOR TO CLOSING THE UNIT AND STARTING UP.

C. Before entering the plenum of a MikroPulsaire, switch off the power to the exhaust fan (blower), screw conveyor (where applicable), airlock, timer and other related equipment. A means of locking these switches in the "off" position should be made, and the key to the lock(s) should be with one of the personnel entering the unit. The compressed air should also be off and a suitable respirator and eye protection worn. Purge system of all gases and vapors other than air. Be certain gas flow has ceased and temperatures are at a safe level.

D. When installing or removing filter bags within the plenum, do not walk on the blowtubes and exercise care to avoid tripping.

E. The compressed air manifold assembly is designed to safely handle up to 125 psig compressed air. Precautions should be taken to see that this maximum pressure is not exceeded.

F. Use caution when wiring the pilot valves or timer to avoid shock. The power should always be off when this is done.

G. Whenever adjusting either the on-time or off-time of the timer, be very careful not to touch any components on the timer that are electrically "hot". The potentiometers are easily adjusted by hand and a screwdriver should not be used.

H. If frequent access to the unit is required, a sturdy external catwalk assembly should be installed, along with handrailings, ladder and safety cage. If the unit is a top-remova style, then handrailing should be installed around the perimeter of the plenum roof area.

I. Whenever servicing or adjusting the pilot valves or diaphragm valves, be certain that the compressed air has been turned off and the system thoroughly bled to atmospheric pressure.

J. If the material being collected by the MikroPulsaire is explosive (by nature) or can become explosive under conditions that may exist in the unit, explosion-venting protection should be installed. Depending on the severity of the condition, fire and explosion suppression equipment may also have to be installed to afford safe operation of the baghouse system.

K. As an additional safety precaution to avoid dust explosions, filter bags with ground straps or conductive bags can be employed. At the same time, all sections of the baghouse and accessory equipment should be effectively grounded.

L. When explosion-vents are used on MikroPulsaires located inside a building, the vent areas should be ducted to the outside of the building. This will provide safety for passers-by and will not permit any burning dust or bag material to be scattered inside the building.

M. If the cleaned exhaust from the MikroPulsaire is to be recycled back into the building for heat recovery or makeup air, provisions must be made to bypass the return flow outside the building should a filter bag develop a hole or some other problem. A back-up filter should also be used when the exhaust air is recycled to work areas. This will protect personnel in the plant from inhaling the dust in the event of a baghouse problem.

N. The fan discharge from the MikroPulsaire collector should be directed to an area away from pedestrian traffic in the event of a bag failure.

O. When dust or product is present in the baghouse or related equipment connected to the baghouse, no welding or other spark producing operation (e.g., grinding, drilling) should be performed on the equipment until the system is shut down and thoroughly cleaned of the dust or product. If welding is to be performed in the area of the filter bags, the bags should first be removed and stored in a dry, remote location.

VII. MAINTENANCE

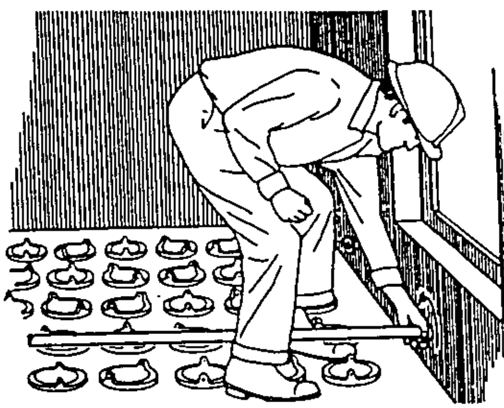
A. General

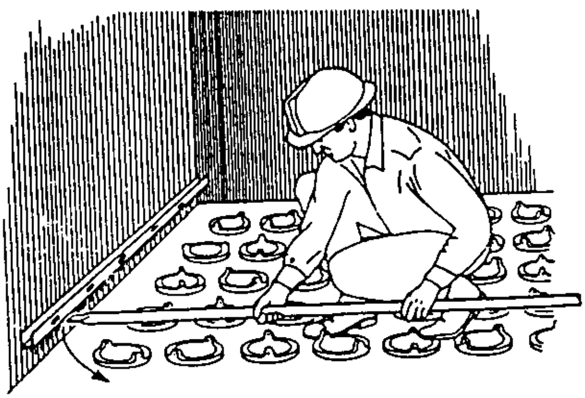
A sound preventive maintenance program will eliminate most breakdown situations and insure long life from the collector. The tables in this section provide recommended maintenance and troubleshooting procedures. Recommended time periods may be changed as a result of experience or unusual operating conditions as determined after a reasonable period of operation.

B. Maintenance Procedures

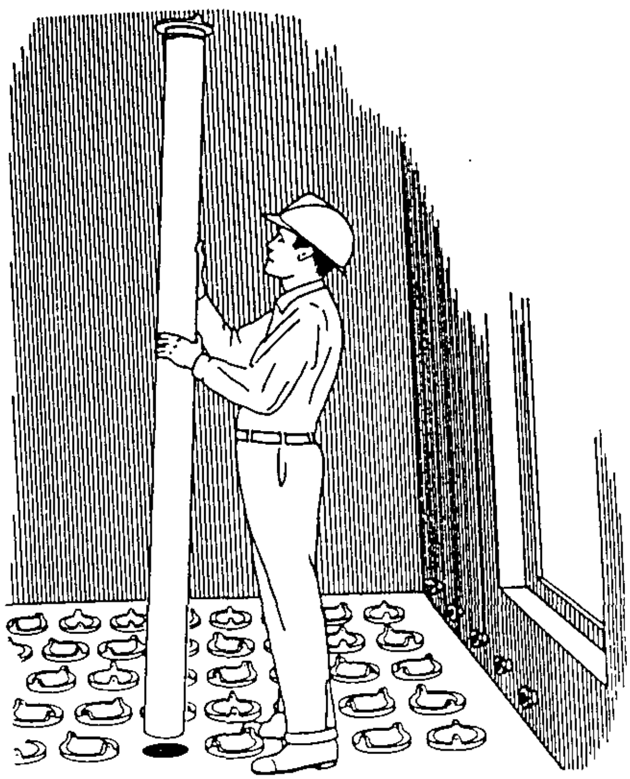
1. Bag Replacement

a. Loosen the coupling nut and remove the corresponding blowtube.





b. Remove all filter bags from the row and strip the old bags from the retainers.



NOTE: If only a few filter bags are damaged, as a result of puncture or other mechanical source, replace only those damaged bags.

c. It is generally desirable to replace the venturi gasket whenever replacing the filter bag.

d. Slip a new bag over the retainer with the seam located 180° from the slot in the retainer collar (figure 3) and pull up tight.

NOTE: The bottom of the bag must be snug against the bottom of the retainer.

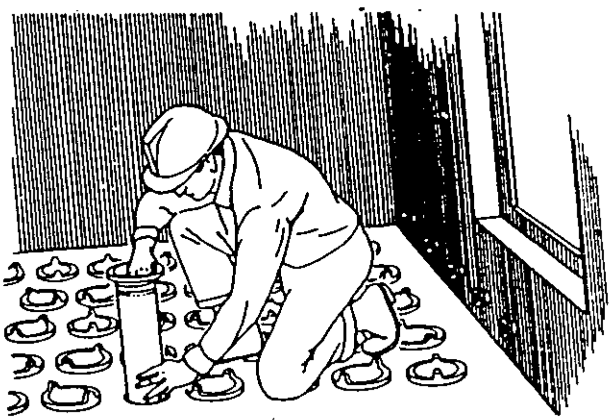
e. Fold the top of the bag into the retainer (figure 4) and install a bag clamp loosely.

f. Install the venturi gasket in place on the venturi.

g. Install the bag/retainer assembly over the venturi collar (figure 5), making sure the retainer groove is aligned with the collar groove.

h. Tighten the clamp firmly using as much hand torque as possible, preferably using a 5/16" socket wrench (50-60 in-lbs. torque).

i. Replace the bag/retainer/venturi assembly into the tubesheet, locking it in place with a strong clockwise twist.



j. Properly installed bag assemblies should hang straight and bags should not touch each other or the walls of the collector.

k. Replace blowtube and tighten the coupling.

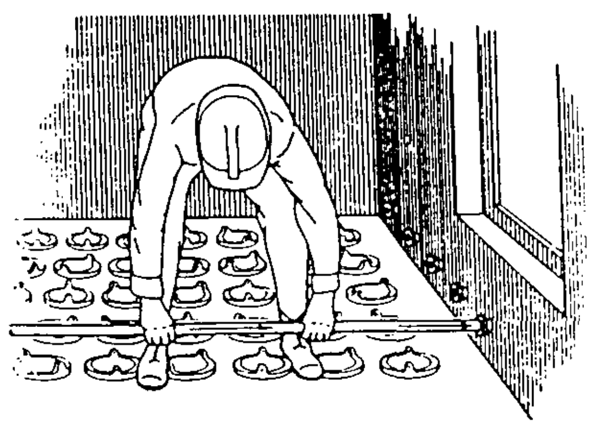


TABLE II. MAINTENANCE SCHEDULE

INSPECTION FREQUENCY	COMPONENT	PROCEDURE
Daily	Collector	•Check exhaust for visible dust; refer to troubleshooting.
	Compressed Air System	•Check for air leakage (low pressure); repair as necessary. Check valves.
	Manometer	•Check and record reading; if out of limits, refer to troubleshooting. Watch for a trend.
Weekly	Filter Bags	•Check for tears, holes, proper fastening; repair or replace as necessary.
	Hopper	•Check for bridging or plugging; clean out.
Annually	Collector	•Inspect thoroughly, clean, touch up paint where necessary.

2. Bag Cleaning

NOTE: The cost involved in removing, cleaning and replacing bags may be greater than for installing new bags, considering labor expenses. If cleaning is performed, it should be done locally.

a. Vacuum clean each bag prior to cleaning.

b. Clean bags in the manner noted in Table III.

CAUTION: Any shrinkage will make bags unfit for use, as will swelling of the felt fabric.

3. Emergency Operation

When new bags are not immediately available and unit operation is necessary, press a venturi stopper, part number 25198, into the venturi to remove the damaged bag from service until it can be replaced. This should only be done on a temporary basis since it alters the air-to-cloth ratio.

4. Solenoid Valve Repair

WARNING: High pressure air supply must be shut off and timer de-energized before attempting to service valves.

a. Disconnect air line between solenoid valve and diaphragm valve.

TABLE III. BAG CLEANING INSTRUCTIONS

MATERIAL	PROCESS	REMARKS
Wool	Dryclean	Use pure cleaning solvent - drycleaning detergents and additives using water will cause shrinkage — hang in drying rooms — do not tumble dry.
Cotton	Dryclean	Same as for wool
Synthetic Fabrics	Launder or Dryclean	Wash in cool or warm water (140° F. max.) using mild soap or clean in Stoddard solvent — hang in drying room.

b. Remove Red Cap from solenoid valve. Remove valve body from coil assembly.

c. Using tool supplied with replacement kits, carefully remove core assembly from valve body.

d. Remove core, spring and "O" ring from core assembly.

e. Carefully clean out core cylinder and valve body with a dry, lint-free cloth.

f. Replace core, spring and "O" ring with components supplied in replacement kit.

g. Reassamble core assembly to valve body.

h. Install the valve body stem through the solenoid coil, retaining it in place with Red Cap.

i. Reconnect air line and test operation of solenoid valve. If still a problem, entire valve should be replaced.

5. Diaphragm Valve Repair

WARNING: High pressure air supply must be shut off and timer de-energized before attempting to service valves.

a. Disconnect air line between diaphragm valve and solenoid valve.

b. Remove cap screws holding valve body and bonnet together.

c. Lift bonnet from body.

d. Replace diaphragm and spring.

e. Reassemble valve and connect air line. Check operation of valve. If still a problem, entire valve will probably have to be replaced.

6- Manometer

During operation, the manometer should usually indicate a value between 1 and 6 inches pressure differential. If the differential is 0 or over 7 inches with the collector in operation, the following conditions should be checked and repaired as necessary:

a. Check manometer tubing for blockage and verify that manometer contains oil of proper specific gravity.

b. Check manometer filter in coupling on housing for blockage. Replace if necessary.

c. Check flow of gas through collector.

d. Shut down collector and check hopper for material accumulation. If hopper is full of material, remove the material through hopper door or through discharge opening.

7- Exhaust

Continuous emissions of smoke or dust is an indication of bag problems.

a. Check filter bags to insure they are securely and properly attached to the tubesheet.

b. Check filter bags for rips, tears, or holes along entire length.

Caution: Damaged bags should be replaced immediately as they will damage other bags and may cause damage to fan bearings due to internal loading.

C. Troubleshooting

Perform troubleshooting of the collector in accordance with Table IV.

TABLE IV. TROUBLESHOOTING

TROUBLE	CAUSE	REMEDY
Visible dust from outlet	a. Bags improperly installed	*Check bag installation; repair as necessary
	b. Bag clamps too loose	*Tighten bag clamps
	c. Torn or damaged bags	*Replace damaged bags
	d. Leakage at tube sheet level	*Check tube sheet joints; repair as necessary
	e. Venturi fasteners loose or missing	*Repair as necessary
Bag filtering action rapidly impaired	a. Inadequate cleaning air supply	*Check air supply; correct to between 90 and 100 psig
	b. Improper solenoid valve operation	*Check solenoid valves; steady rush of air indicates open valve; no air pulse indicates plugged valve; repair as necessary.
	c. Defective timer	*Replace timer mechanism
	d. Excessive moisture entering collector and blinding bags	*Check collector for excessive moisture; minor wetting is corrected by closing dampers and running cleaning mechanism (if not corrected in 24 to 30 hours, replace bags); correct moisture level in air stream
	e. Incorrect gas flow (too high or too low)	*Check fan rotation, fan speed, damper position, outlet CFM; correct as necessary to obtain specified gas flow

TABLE IV. TROUBLESHOOTING [Cont]

TROUBLE	CAUSE	REMEDY
High manometer pressure drop (above 8 in. W.G.) (cont)	h. Dust in clean air plenum	*Clean plenum; check bags for dirt on clean air side; clean or replace bags.
	i. Static electricity in collector	*Increase relative humidity in collector
Gas flow through system below design rating	a. Incorrect fan rotation	*Check fan rotation; correct if wrong
	b. High differential pressure drop	*Refer to high manometer pressure drop trouble immediately above
	c. Fan belts slipping	*Check tension on fan belts; adjust if necessary
	d. Air leakage in gas system	*Check doors, plenum, manifolds, duct work; repair leaks
	e. Leakage in dust collection system	*Check hopper, discharge device, leakage at discharge; repair as necessary
	f. Blocked gas system	*Check bags for blinding, obstruction in duct passages, closed damper; clean or repair as necessary
Pressure of cleaning air keeps falling off	a. Faulty or under-sized compressor	*Check compressor manual
	b. Leakage in main air line	*Locate and repair leak
	c. Solenoid or Diaphragm valve sticking open	*Examine the valve; clean; repair as necessary

TABLE IV. TROUBLESHOOTING [Cont]

TROUBLE	CAUSE	REMEDY
Filter bags deteriorate rapidly	a. High Collector temperature	*Check reason for high temperature; correct if possible.
		*Check temperature rating of bag material (Table I); replace bags if not within range of collector temperature.
	b. Chemical composition of gas stream incompatible with bag material	*Check composition of gases; if incompatible with bag material, replace with bags of compatible material.
	c. Shrinkage in filter bags	*Replace shrunken bags.
	d. Hopper bridging	*Locate cause of bridging and correct; clean out hopper.
	e. Incorrect bag installation	*Check for physical contact with collector wall or other bags; check tightness of clamp; correct as necessary.
	f. Abrasion by impingement of high velocity particles	*Check for impingement; it evident, exp iment with diffuser in gas steam.

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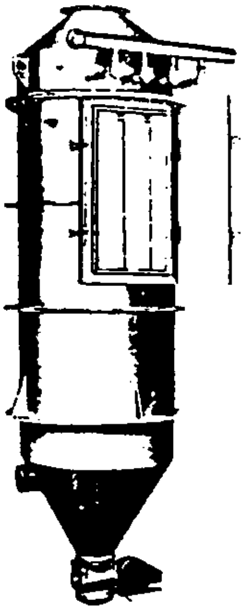

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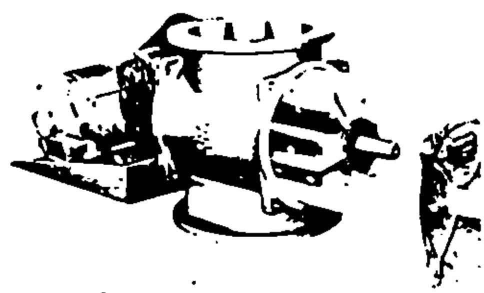

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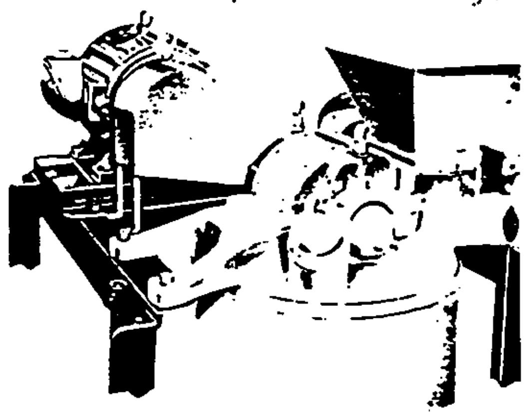

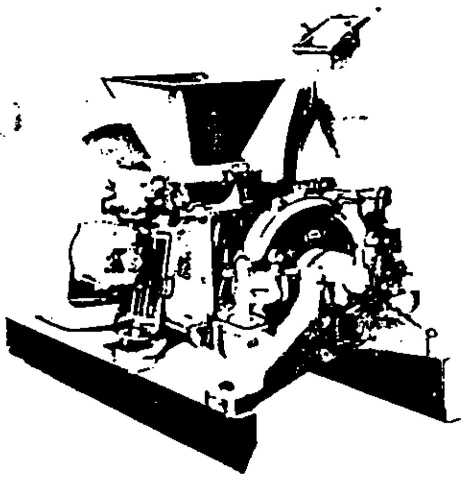

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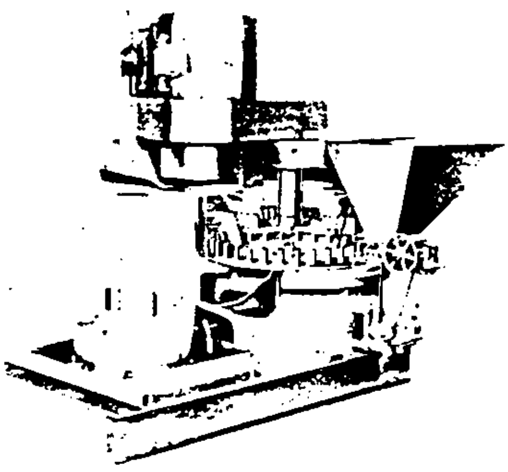

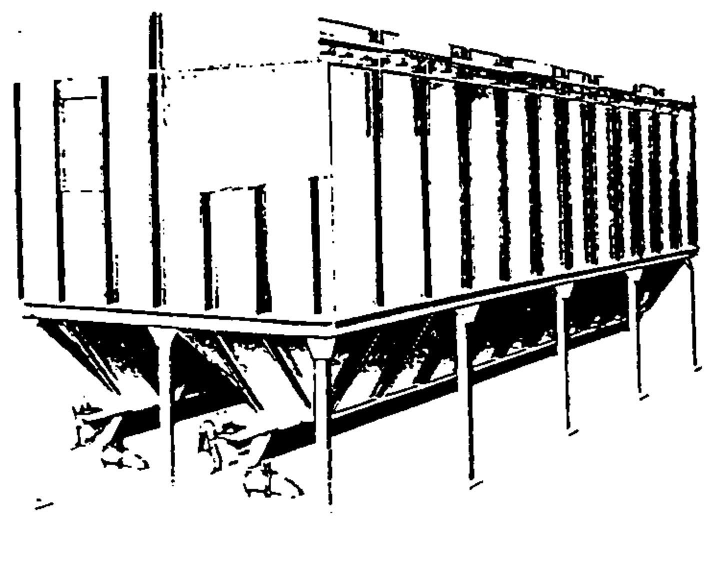

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ATTACHMENT 3

AIR QUALITY IMPACT ASSESSMENT

ATTACHMENT 3

AIR QUALITY IMPACT ANALYSES FOR THE PROPOSED FALLING FILM EVAPORATOR AND SPRAY DRYER FOR THE CENTRAL FLORIDA COGENERATION PLANT

1.0 INTRODUCTION

KBN Engineering and Applied Sciences, Inc. (KBN), has performed air quality impact analyses to determine the maximum concentrations for the operation of the combustion turbine (CT) and duct burner (DB), and a wastewater spray dryer and evaporator unit for the integrated cogeneration facility proposed by Central Florida Power Limited Partnership. Air quality impacts [i.e., emissions from the heat recovery steam generator (HRSG) stack] have been identified for the facility, which is referred to as the Central Florida Cogeneration Plant, as part of the air construction permit application (AC53-214903, PSD-FL-190). The spray drying equipment includes two falling film evaporators, a spray dryer, and a baghouse. The spray dryer will be fired with natural gas with an estimated heat input rate of 1.35 and 3.066 million British thermal units per hour (MMBtu/hr) for average and design operating conditions, respectively. The modeling analyses take into account the exhaust through the HRSG unit (which includes emissions from the CT and DB) and the evaporator and spray dryer (which are vented through a separate stack). The results presented in the present analysis supplement the previous analyses and address total impacts from both stacks (i.e., HRSG and spray dryer). These results are compared to the prevention of significant deterioration (PSD) Class I and Class II significance levels to determine whether additional analyses (i.e., analyses that were not performed for the original permit application) would be required due to the additional emissions from the spray dryer stack. Impacts are also compared to the concentrations predicted for the HRSG stack only.

The following sections present the approaches, methods, and results of the air quality impact analyses.

2.0 EMISSION DATA AND AIR QUALITY IMPACT METHODS

An air quality modeling analysis was performed to determine the maximum pollutant concentrations, including the regulated pollutants of particulate matter (PM), particulate matter with an aerodynamic diameter of 10 micrometers (PM10), nitrogen dioxide (NO_2), and carbon monoxide (CO) from the operation of the CT, DB, and spray dryer/evaporator. Concentrations were calculated with the Industrial Source Complex Short-Term 2 (ISCST2) model using the emissions from the proposed combustion turbine for the maximum emission case [i.e., 27 degrees Fahrenheit (°F)] and minimum exit gas flow rate (i.e., 97°F) for two operating loads (i.e., 70 and 100 percent). For the CT, emission data for fuel oil were used for all short-term emissions rates, while annual emission rates were based on burning distillate oil and natural gas for 300 and 8,460 hours, respectively. For the duct burner and spray dryer/evaporator, emission rates were based on natural gas use only. The design information, stack parameters, and emissions for the spray dryer/evaporator are presented below. The design information, stack parameters, and emissions for the CT and duct burner were presented in the original permit application. Spray dryer/evaporator emissions were modeled for the design operating conditions based on an operation time of 8,760 hours per year. This is a conservative estimate of concentrations because the spray dryer is expected to operate at design condition for 200 hours or less in a year. The following data were used in the modeling analysis:

- Stack height = 73.0 feet (ft),
- Stack diameter = 1.3 ft,
- Exit velocity = 63.4 feet per second (ft/s),
- Exit temperature = 340°F,
- PM emissions = 0.021 pound per hour (lb/hr) = 0.092 ton per year (ton/yr),
- CO emissions = 0.061 lb/hr = 0.28 ton/yr, and
- NO_2 emissions = 0.322 lb/hr = 1.4 ton/yr.

Because the proposed spray dryer stack will be less than Good Engineering Practice (GEP) height, the potential for downwash effects on the spray dryer stack from other building structures were included in the modeling analysis. A summary of building structures that potentially influence the spray dryer stack is presented in Table 1.

As presented in the original construction permit application, the maximum emissions of two CT types (i.e. General Electric (GE) and Westinghouse) were considered for the modeling analysis for each load and temperature scenario. Because the GE CT has now been selected for this project, only the GE emissions were considered in the present analysis. A summary of emissions used in the previous and present modeling analysis is presented in Table 2.

The impacts were predicted using the ISCST2 model using the same methodology presented in the construction permit application. These include:

1. Five-year meteorological record collected from 1982 through 1986 of surface and mixing height data from the National Weather Service (NWS) stations in Tampa and Ruskin, respectively;
2. Building downwash effects for the HRSG stack; and
3. A general receptor grid consisting of 36 radials spaced at 10-degree increments at the plant property and at distances of 300, 500, 700, 1,000, 1,500, 2,000, 3,000, 4,000, and 5,000 meters (m) from the HRSG stack.

Because the ISCST2 model is unable to calculate a concentration within the cavity region of a building, selected plant property receptor locations were adjusted outward from the spray dryer stack to a distance where a concentration could be predicted by the model. Additional near-field receptors were placed beyond the plant boundary in the vicinity of the spray dryer stack to capture maximum impacts. The plant property and near-field receptors used in the analysis are presented in Table 3.

3.0 MODEL RESULTS

Maximum screening and refined impacts predicted for the proposed facility with the CT/DB and spray dryer/evaporator in operation are presented in Table 4. These results are presented for the CT/DB operating at two load and temperature conditions and are based on the highest impacts from the 5-year meteorological record. For comparison purposes, impacts for the CT/DB only, as presented in the original permit application, are also included. These results indicate that, except for NO_2 and annual PM/PM10 impacts, there is a decrease in predicted impacts with the additional emissions from the spray dryer/evaporator compared to the impacts from stack emissions of the CT/DB alone. This decrease is a result of only considering GE CT emissions rather than the highest of either the GE or Westinghouse as presented in the original permit application.

For NO_2 and PM/PM10, there is a slight increase in predicted annual average impacts due to the operation of the spray dryer/evaporator unit. However, for all pollutants, the maximum concentrations are predicted to be less than PSD Class II significance levels. Therefore, additional modeling analyses with other sources are not warranted.

Maximum predicted PM/PM10 and NO_2 concentrations at the Chassahowitzka National Wildlife Refuge (NWR) due to the CT/DB and spray dryer/evaporator are presented in Table 5. Impacts are expected to be approximately equal to or less than the impacts presented in the original permit application due to the CT/DB alone. All predicted impacts are less than the National Park Service (NPS) suggested Class I significance values. Therefore, additional Class I modeling analyses with other sources are not warranted.

4.0 CONCLUSIONS

With the addition of the spray dryer/evaporator unit, the proposed facility's impacts are expected to be less than the allowable PSD Class II and suggested PSD Class I significance levels. Therefore, no additional modeling analyses with other sources are needed.

Table 1. Building Structures That Potentially Influence the Spray Dryer Stack for Use in the Building Downwash Analysis

DTEVTAB1
04/27/93

Wind Direction Radials (degrees)	Influencing Building Structure(s)	Building Height (m)	Building Width (m)
10	Cooling Tower	15.24	35.89
20	Cooling Tower	15.24	38.08
30	HRSG Building	24.38	18.45
40	HRSG Building	24.38	18.96
50	HRSG Building	24.38	19.01
60	Gas Turbine	19.51	25.73
70	Gas Turbine	19.51	25.93
80	Gas Turbine	19.51	25.88
90	Gas Turbine	19.51	25.29
100	Gas Turbine	19.51	25.63
110	Spray Dryer/Baghouse	12.19	8.38
120	Spray Dryer/Baghouse	12.19	9.61
130	Spray Dryer/Baghouse	12.19	10.56
140	Spray Dryer/Baghouse	12.19	11.18
150	Spray Dryer/Baghouse	12.19	11.47
160	Spray Dryer/Baghouse	12.19	11.48
170	Spray Dryer/Baghouse	12.19	11.38
180	Spray Dryer/Baghouse	12.19	11.04
190	Spray Dryer/Baghouse	12.19	11.56
200	Spray Dryer/Baghouse	12.19	11.72
210	Spray Dryer/Baghouse	12.19	11.72
220	Spray Dryer/Baghouse	12.19	11.49
230	Spray Dryer/Baghouse	12.19	10.92
240	Spray Dryer/Baghouse	12.19	10.01
250	Spray Dryer/Baghouse	12.19	8.79
260	Spray Dryer/Baghouse	12.19	7.31
270	Spray Dryer/Baghouse	12.19	6.27
280	Spray Dryer/Baghouse	12.19	7.09
290	Spray Dryer/Baghouse	12.19	8.38
300	Spray Dryer/Baghouse	12.19	9.61
310	Spray Dryer/Baghouse	12.19	10.56
320	Spray Dryer/Baghouse	12.19	11.18
330	Spray Dryer/Baghouse	12.19	11.47
340	Cooling Tower	15.24	42.31
350	Cooling Tower	15.24	34.78
360	Cooling Tower	15.24	24.36

Note: Downwash parameters developed using the BREEZEWAKE program.

Table 2. Summary of Emission Rates Used in the Air Dispersion Modeling for the HRSG and Spray Dryer/Evaporator Unit DTEVTAB2 05/03/93

Pollutant	Units	CT/DB - Original Submittal[a]				CT/DB - Permit Conditions[b]				Spray Dryer/ Evaporator Unit[c]
		100% Load		70% Load		100% Load		70% Load		
		27°F	97°F	27°F	97°F	27°F	97°F	27°F	97°F	
Particulate Matter (PM)	lb/hr	41.4	37.7	35.2	30.2	18.0	18.0	18.0	18.0	0.021
	TPY	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	0.092
Nitrogen Dioxide (NO2)	TPY	802.5	655.2	629.8	528.4	777.5	655.2	623.3	528.4	1.4
Carbon Monoxide (CO)	lb/hr	174.0	157.0	152.0	131.0	108.4	93.2	84.3	75.6	0.061

[a] As presented in the original PSD permit application. Emissions modeled were based on the highest emission rate from the GE or Westinghouse gas turbines. Stack velocity and temperature based on GE design information. Short-term rates are based on burning distillate oil in the gas turbine and natural gas in the duct burner. Annual emission rates are based on burning distillate oil and natural gas for 300 and 8,460 hours, respectively, in the gas turbine and natural gas for 8,760 hours in the duct burner.

[b] All emissions and stack operating parameters based on the GE gas turbine since this unit has been selected for the project.

[c] Emissions based on design operating conditions and 8,760 hours of operation per year. Emission rates based on vendor's guarantee.

Table 3. Summary of Plant Boundary and Near-Field Receptors Used in the Modeling Analysis

DTEVTAB3
4/27/93

Receptor Location		Receptor Location	
Direction (degrees)	Distance (meters)	Direction (degrees)	Distance (meters)
10	149	190	69/100
20	125	200	71/100
30	124/150/200/250	210	84/100
40	141/150/200/250	220	86/100
50	140/150/200/250	230	86/100
60	132/150/200/250	240	83/100
70	77/100	250	80/100
80	76/100	260	74/100
90	76/100	270	74/100
100	77/100	280	72/100
110	79/100	290	69/100
120	85/100	300	65/100
130	94/100	310	59/100
140	84/100	320	51/100
150	81/100	330	43/100
160	77/100	340	59/100
170	69/100	350	100
180	69/100	360	184

Note: For radial directions 30 to 60 degrees and 200 to 320 degrees, the first distance represents the closest distance that the ISCST2 model can calculate a concentration (i.e., 3 building heights) due to the extent of the building cavity region.

Table 4. Summary of Screening and Refined Air Modeling Impacts for the CT/DB and Spray Dryer/Evaporator Unit

DTEVTAB4
05/03/93

CT Operating Load (percent)	Ambient Temperature (°F)	Pollutant	Averaging Period	Highest Concentration (µg/m³)		Significant Impact Level (µg/m³)
				CT/DB Only^a	CT/DB + SD/Evap^b	
SCREENING IMPACTS						
100	27	PM	24-Hour	0.63	0.28	5
			Annual	0.015	0.015	1
		NO2	Annual	0.26	0.26	1
		CO	1-Hour	25.8	16.9	2000
			8-Hour	6.38	3.97	500
100	97	PM	24-Hour	0.88	0.49	5
			Annual	0.017	0.018	1
		NO2	Annual	0.25	0.26	1
		CO	1-Hour	29.8	18.0	2000
			8-Hour	10.5	5.61	500
70	27	PM	24-Hour	1.59	0.86	5
			Annual	0.020	0.021	1
		NO2	Annual	0.29	0.29	1
		CO	1-Hour	34.3	19.3	2000
			8-Hour	19.5	7.94	500
70	97	PM	24-Hour	1.94	1.31	5
			Annual	0.022	0.023	1
		NO2	Annual	0.26	0.27	1
		CO	1-Hour	33.0	19.3	2000
			8-Hour	19.4	8.22	500
REFINED IMPACTS						
70	97	PM	24-Hour	2.12	1.31	5
			Annual	0.022	0.023	1
70	27	NO2	Annual	0.29	0.29	1
70	27/97^c	CO	1-Hour	45.8	20.4	2000
			8-Hour	20.8	12.2	500

^a As presented in the original PSD permit application. Emissions modeled were based on the highest emission rate from the GE or Westinghouse gas turbines. Stack velocity and temperature based on GE design information. Short-term rates are based on burning distillate oil in the gas turbine and natural gas in the duct burner. Annual emission rates are based on burning distillate oil and natural gas for 300 and 8,460 hours, respectively, in the gas turbine and natural gas for 8,760 hours in the duct burner.

^b Based on GE gas turbine emission rates and the spray dryer/evaporator operating at design conditions for 8,760 hours per year.

^c For CT/DB only impacts, maximum concentrations were predicted for the 27°F case. For CT/DB and spray dryer/evaporator total impacts, maximum concentrations were predicted for the 97°F case.

Table 5. Summary of Maximum Predicted PM and NO2 Concentrations Due to the CT/DB and Spray Dryer/Evaporator Unit at the Chassahowitzka NWA

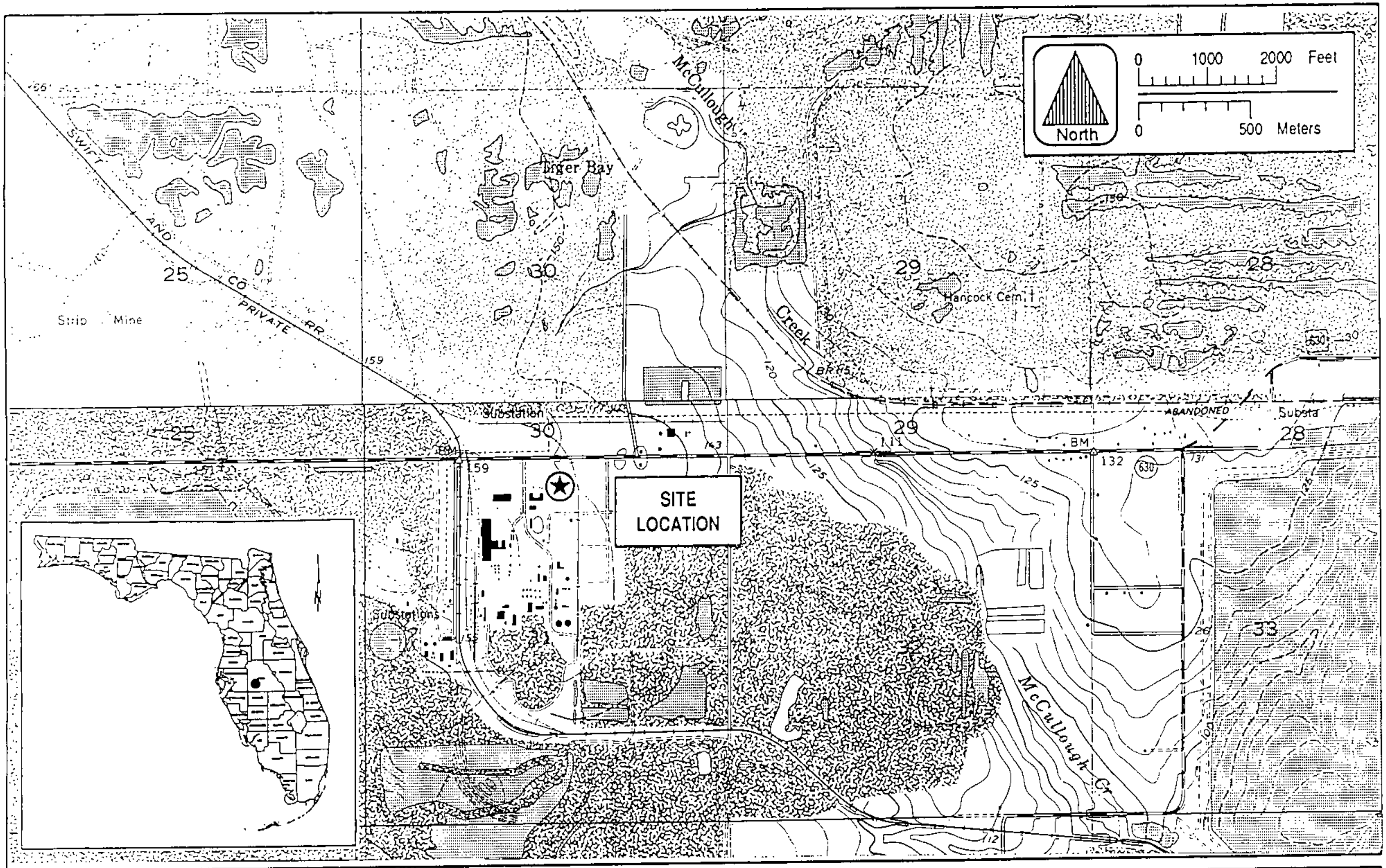
DTEVTAB5
04/27/93

CT Operating Load (percent)	Ambient Temperature (°F)	Pollutant	Averaging Period	Highest Concentration ($\mu g/m^3$) CT/DB Only^a	Highest Concentration ($\mu g/m^3$) CT/DB + SD/Evap^b	NPS Recommended Significance Level ($\mu g/m^3$)
100	27	PM	24-Hour	0.046	0.020	0.33
			Annual	0.0008	0.00077	0.1
		NO2	Annual	0.014	0.013	0.024
100	97	PM	24-Hour	0.043	0.020	0.33
			Annual	0.0008	0.00079	0.1
		NO2	Annual	0.011	0.012	0.024
70	27	PM	24-Hour	0.041	0.021	0.33
			Annual	0.0008	0.00083	0.1
		NO2	Annual	0.011	0.011	0.024
70	97	PM	24-Hour	0.036	0.021	0.33
			Annual	0.0008	0.00084	0.1
		NO2	Annual	0.010	0.0099	0.024

^a As presented in the original PSD permit application. Emissions modeled were based on the highest emission rate from the GE or Westinghouse gas turbines. Stack velocity and temperature based on GE design information. Short-term rates are based on burning distillate oil in the gas turbine and natural gas in the duct burner. Annual emission rates are based on burning distillate oil and natural gas for 300 and 8,460 hours, respectively, in the gas turbine and natural gas for 8,760 hours in the duct burner.

^b Based on GE gas turbine emission rates and the spray dryer/evaporator operating at design conditions for 8,760 hours per year.

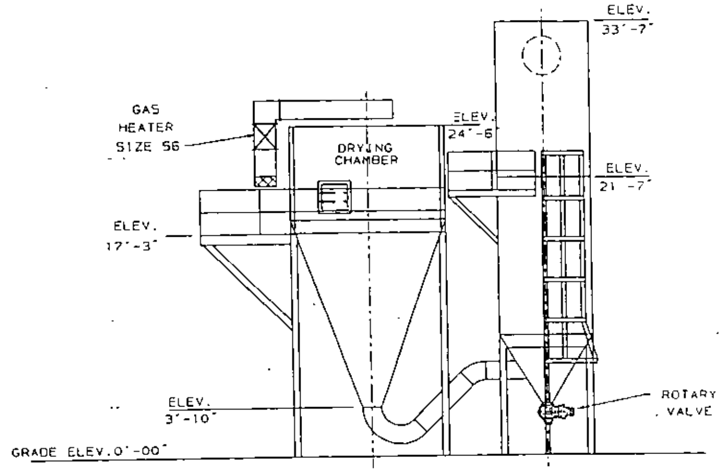
6/2/92

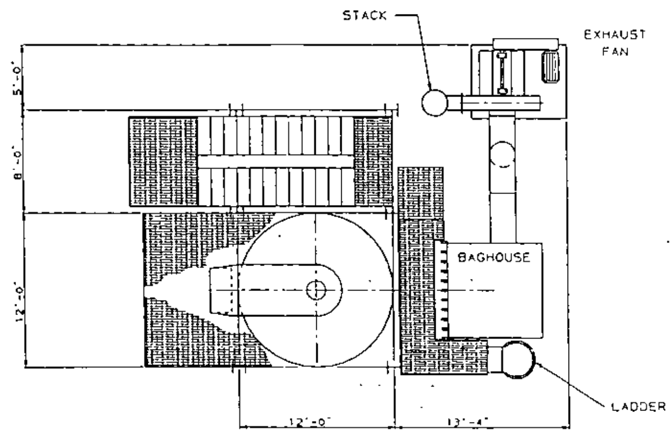


SITE VICINITY MAP
TIGER BAY COGENERATION FACILITY

SOURCES: USGS, 1986; KBN, 1992.

KBN





REV	DATE	BY	CHK'D	APVD	DESCRIPTION

DRAWING TITLE: GENERAL ARRANGEMENT DRYING SYSTEM

CUSTOMER: DESTEC ENGINEERING, INC. HOUSTON, TEXAS

ENGINEER:

UNITECH

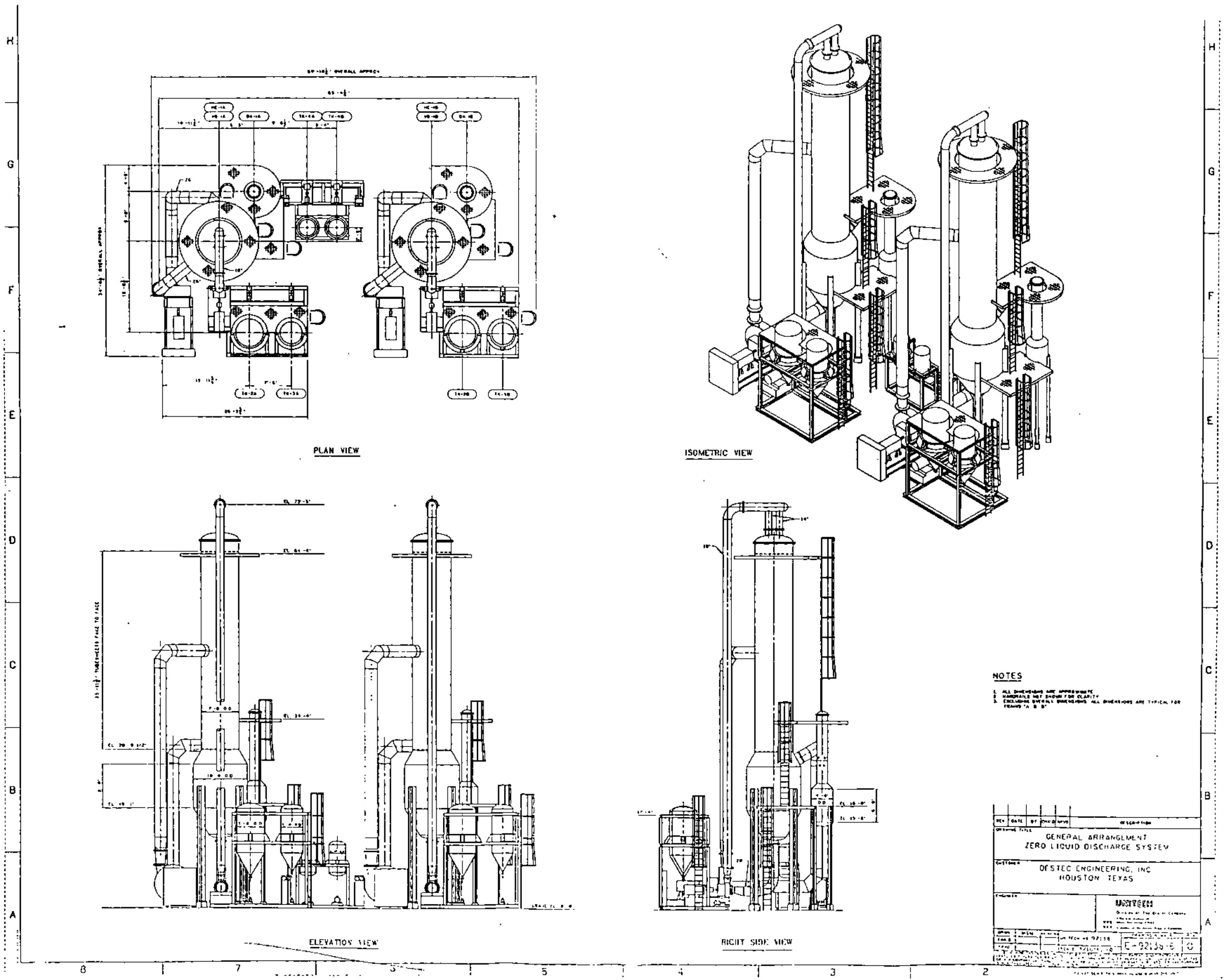
DRAWN: MSM

UNITECH NO 92138

SCALE NONE

DRAWING NUMBER: D-92138-7

REV: 0


PLAN VIEW
ISOMETRIC VIEW
ELEVATION VIEW
RIGHT SIDE VIEW
NOTES
1. ALL DIMENSIONS ARE APPROXIMATE
2. HANDRAILS NOT SHOWN FOR CLARITY
3. EXCLUDING OVERALL DIMENSIONS ALL DIMENSIONS ARE TYPICAL FOR TRAINS "A" & "B"
REV DATE BY CHK'D APVD DESCRIPTION
GENERAL ARRANGEMENT
ZERO LIQUID DISCHARGE SYSTEM
DESTEC ENGINEERING, INC
HOUSTON TEXAS
UNITECH
E-92136-6

ATTACHMENT 4

LETTER OF AUTHORIZATION

DESTEC
ENGINEERING

DESTEC ENGINEERING, INC.
2500 CITYWEST BLVD., SUITE 1700
P.O. BOX 4411
HOUSTON, TEXAS 77210-4411
(713) 974-8200

June 12, 1992

TO WHOM IT MAY CONCERN:

Subject: Letter of Authorization

Please be advised that Robert I. Taylor, Project Manager, is authorized to represent Central Florida Power Limited Partnership in matters relating to necessary permits and approvals required from federal, state, county, and local regulatory authorities in the areas of air, water and land issues.

Sincerely,

Robert O. Rogers

Robert O. Rogers
President, Central Florida DGE Inc.
Managing General Partner of
Central Florida Power Limited Partnership

tk

ATTACHMENT 5

TIGER BAY COGENERATION FACILITY
FULL-SCALE PLOT PLAN