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BUREAU OF AIR REGULATION

APPLICATION FOR AIR PERMIT
INSTALLATION OF EVAPORATIVE COOLING HUMIDIFICATION UNIT
UNIT 5

Prepared For:

City of Vero Beach
Municipal Utilities
P.O. Box 1389
Vero Beach, Florida 32961-1389

Prepared By:

Golder Associates Inc.
6241 NW 23rd Street, Suite 500
Gainesville, Florida 32653-1500

October 2000
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1 Copy - Golder Associates Inc.

PART I

APPLICATION FOR AIR PERMIT
LONG FORM

Department of Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - TITLE V SOURCE

See Instructions for Form No. 62-210.900(1)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: **City of Vero Beach**	
2. Site Name: **City of Vero Beach Municipal Utilities**	
3. Facility Identification Number: **0610029** [ ] Unknown	
4. Facility Location: Street Address or Other Locator: **100 17th Street** City: **Vero Beach** County: **Indian River** Zip Code: **32960**	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Application Contact

1. Name and Title of Application Contact: **Mr. Richard M. Siefert, Manager of Support Services**
2. Application Contact Mailing Address: Organization/Firm: **City of Vero Beach** Street Address: **100 17th Street** City: **Vero Beach** State: **FL** Zip Code: **32960**
3. Application Contact Telephone Numbers: Telephone: (**561**) **978 - 5020** Fax: (**561**) **978 - 5090**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	11-1-2000
2. Permit Number:	0610029-004-AC
3. PSD Number (if applicable):	PSD-FL-152C
4. Siting Number (if applicable):	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[ ] Initial Title V air operation permit for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number:_____

[ ] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number:_____

Operation permit number to be revised:_____

[ ] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected:_____

[ ] Title V air operation permit revision for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit number to be revised:_____

Reason for revision:_____

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   Rex Taylor, City Manager, Utilities Director
2. Owner/Authorized Representative or Responsible Official Mailing Address:
   Organization/Firm: **City of Vero Beach**
   Street Address: **P.O. Box 1389**
   City: **Vero Beach** State: **FL** Zip Code: **32961-1389**
3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
   Telephone: (**561**) **978 - 5151** Fax: (**561**) **778 - 3856**
4. Owner/Authorized Representative or Responsible Official Statement:

   I, the undersigned, am the owner or authorized representative(check here [ ], if so) or the responsible official (check here [ ], if so) of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.*

   Rex Taylor — Signature

   Oct. 24, 2000 — Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1. Professional Engineer Name: **Kennard F. Kosky**
   Registration Number: **14996**
2. Professional Engineer Mailing Address:
   Organization/Firm: **Golder Associates Inc.**
   Street Address: **6241 NW 23rd Street, Suite 500**
   City: **Gainesville** State: **FL** Zip Code: **32653-1500**
3. Professional Engineer Telephone Numbers:
   Telephone: (**352**) **336 - 5600** Fax: (**352**) **336 - 6603**

4. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain a Title V source air operation permit (check here [ ], if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [X], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature

10/23/00
Date

(seal)

*Attach any exception to certification statement.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
005	Combined Cycle Combustion Turbine	AC1B	

Application Processing Fee

Check one: [ ] Attached - Amount: $: _____ [X] Not Applicable

Construction/Modification Information

1. Description of Proposed Project or Alterations:

   Installation of evaporative cooling/humidification unit. Since the facility holds a Title V permit pursuant to Chapter 62-213 F.A.C., a permit fee is not required. Refer to Part II for discussion.

2. Projected or Actual Date of Commencement of Construction:

3. Projected Date of Completion of Construction:

Application Comment

The combustion turbine associated with Unit 5 will be installed with a evaporative cooling/ humidification unit that will reduce the turbine inlet air temperature. The temperature reduction will improve the heat rate and increase power due to the cooler-denser inlet air. The net emissions change from this project will not result in an increase of any regulated pollutant greater than the PSD significant emission rates. PSD review does not apply to proposed project. Discussed in Part II.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: **17** East (km): **561.4** North (km): **3056.5**			
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): **27 / 37 / 52** Longitude (DD/MM/SS): **80 / 22 / 33**			
3. Governmental Facility Code: **0**	4. Facility Status Code: **A**	5. Facility Major Group SIC Code: **49**	6. Facility SIC(s): **4911**
7. Facility Comment (limit to 500 characters): **The existing City of Vero Beach Municipal Utilities power plant consists of 4 Fossil Fuel Fired Steam Generators (Units 1 - 4) and 1 Combined Cycle Unit (Unit 5). The combined cycle unit consists of a combustion turbine and an associated heat recovery steam generator (HRSG). The primary fuel for the combustion turbine is natural gas with the distillate oil as back-up. Refer to Part II for discussion.**			

Facility Contact

1. Name and Title of Facility Contact: **Mr. Richard M. Siefert, Manager of Support Services**
2. Facility Contact Mailing Address: Organization/Firm: **City of Vero Beach, Power Plant** Street Address: **100 17th Street** City: **Vero Beach** State: **FL** Zip Code: **32960**
3. Facility Contact Telephone Numbers: Telephone: (**561**) **978 - 5020** Fax: (**561**) **978 - 5090**

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source?	[ ] Unknown
2. [X] Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?	
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?	
4. [ ] Major Source of Hazardous Air Pollutants (HAPs)?	
5. [ ] Synthetic Minor Source of HAPs?	
6. [X] One or More Emissions Units Subject to NSPS?	
7. [ ] One or More Emission Units Subject to NESHAP?	
8. [ ] Title V Source by EPA Designation?	
9. Facility Regulatory Classifications Comment (limit to 200 characters): **NSPS Subpart GG applies to the combustion turbine for Unit 5.**	

List of Applicable Regulations

Facility emissions covered under existing Title V permit, no additional facility or emission unit applicable requirements as a result of the proposed change.
See Attachment B for specific conditions for Unit 5.

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap lb/hour	tons/year	4. Basis for Emissions Cap	5. Pollutant Comment

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Area Map Showing Facility Location: [ ] Attached, Document ID: _____ [X] Not Applicable [ ] Waiver Requested
2. Facility Plot Plan: [ ] Attached, Document ID: _____ [X] Not Applicable [ ] Waiver Requested
3. Process Flow Diagram(s): [X] Attached, Document ID: Part II [ ] Not Applicable [ ] Waiver Requested
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: [ ] Attached, Document ID: _____ [X] Not Applicable [ ] Waiver Requested
5. Fugitive Emissions Identification: [ ] Attached, Document ID: _____ [X] Not Applicable [ ] Waiver Requested
6. Supplemental Information for Construction Permit Application: [X] Attached, Document ID: Part II [ ] Not Applicable
7. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities:
   [ ] Attached, Document ID:_____ [ ] Not Applicable

9. List of Equipment/Activities Regulated under Title VI:
   [ ] Attached, Document ID:_____
   [ ] Equipment/Activities On site but Not Required to be Individually Listed
   [ ] Not Applicable

10. Alternative Methods of Operation:
    [ ] Attached, Document ID:_____ [ ] Not Applicable

11. Alternative Modes of Operation (Emissions Trading):
    [ ] Attached, Document ID:_____ [ ] Not Applicable

12. Identification of Additional Applicable Requirements:
    [ ] Attached, Document ID:_____ [ ] Not Applicable

13. Risk Management Plan Verification:
    [ ] Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID:_____) or previously submitted to DEP (Date and DEP Office:_____)
    [ ] Plan to be submitted to CEPPO (Date required:_____)
    [ ] Not Applicable

14. Compliance Report and Plan:
    [ ] Attached, Document ID:_____ [ ] Not Applicable

15. Compliance Certification (Hard-copy Required):
    [ ] Attached, Document ID:_____ [ ] Not Applicable

PART II

SUPPORTING INFORMATION

TABLE OF CONTENTS

1.0 INTRODUCTION

The City of Vero Beach is proposing to operate an evaporative cooling system in the inlet duct of the combustion turbine (Unit 5) in combined cycle configuration at the Municipal Utilities Power Plant. The purpose of the evaporative cooling system is to provide adiabatic inlet air cooling, which increases turbine output and decreases heat rate. The project is part of increasing capacity in a cost effective manner. The City of Vero Beach does not propose any increase in the existing emission limitations for Unit 5.

1.1 DESCRIPTION

Evaporative cooling systems achieve adiabatic cooling using water that is evaporated in the turbine inlet air stream. The water is typically distributed over a porous surface where the inlet air and water can come into contact. This surface extracts the latent heat of vaporization from the gas stream when water is converted to gas. Heat is removed at a rate of 1,075 Btu/lb of water. The result of the cooling is a denser more moisture laden, air stream.

The amount of heat removed is highly dependent upon the ambient air conditions. The two most important parameters are the dry bulb temperature and relative humidity. As moisture is added to the inlet air by the evaporative cooling, the vaporization of water cools the air toward the wet-bulb temperature. For typical design condition of 95°F and 50 percent relative humidity for ambient air, the wet bulb temperature, based on psychrometric charts is 79°F. At 100 percent saturation the inlet cooling system would result in a 16°F decrease of the turbine inlet air. This is referred to 100-percent efficiency in evaporative cooling.

The evaporative cooling system to be operated on Unit 5 is a Munters TURBIdek™ Single Stage Evaporative Cooling/Humidification Unit. The evaporative cooling system will have an evaporative cooling efficiency of 89 percent. Attachment A contains manufacturer information on the system.

While adiabatic cooling is most efficient for dry climates, adiabatic cooling in Florida can be an effective means of inlet air cooling during the late morning to evening hours. This period is typically 8 to 10 hours per day from about 10 a.m. to 8 p.m. In the early morning hours

and evening hours, the typical relatively humidity in Florida is 70 to 90 percent depending on the climatic conditions and less suitable for evaporative cooling. Because of the highly variable nature of ambient air conditions, the annual average inlet cooling was assumed to be 10°F. This average was reviewed against a 30 year record of meteorological data for West Palm Beach and found to be representative of the range in conditions that occur over 24-hour periods. (Note: Vero Beach has a limited number of years of climatological data but conditions reported are similar to West Palm Beach.)

The maximum amount of cooling would occur during summer afternoons when temperatures are about 95°F with relative humidity in the 60-percent range. In this case, about 12°F cooling could be obtained. The typical mid-afternoon cooling for West Palm Beach would be 11°F and would occur in June with a mid-afternoon temperature of 90°F and 64-percent relative humidity. During January, the mid-afternoon cooling would be about 9°F. The typical cooling that would occur in the summer during early morning hours with temperatures of about 80°F and a relative humidity of 80 percent would be 5°F. The average minimum temperatures for the months of November through April range from 55.5°F to 65.1°F with relative humidities ranging from 83 to 81 percent. The amount of adiabatic cooling would range from 3 to 4°F.

The ambient air conditions that are modified by the evaporative cooling system occur naturally but are more frequent. The annual average temperature reduction assumed for 24-hour operation is 10°F, which provides a very conservative estimate of the amount of cooling over an annual period.

1.2 TURBINE PERFORMANCE AND EMISSION ESTIMATES

The effect of decreasing the turbine inlet air through the use of evaporative cooling will be to increase the mass flow of air that can go through the turbine, which allows higher heat input and power output. The combustion turbine is also more efficient since the heat rate decreases with decreasing temperature. For the GE Model PG6541 (Frame 6) combustion turbine, a 10°F decrease in temperature for gas firing would result in a 3.9 percent increase in power and an associated 1.0 percent decrease in heat rate. Thus, while power increases, the

production of power is more efficient with concomitant lower emissions per MW-hr generated. The increase in heat rate as a function of temperature decrease is a linear function and for the Unit 5 turbine would be 1.2 mmBtu/hr/°F when firing natural gas and 1.3 mmBtu/hr/°F when firing distillate oil. The data were determined using GE supplied data (see Attachment B).

Because the turbine is operating on its original power curve, the emission characteristics do not change from what would normally occur at that temperature and relative humidity. An evaluation of emissions from the evaporative cooling tests conducted at several facilities in Florida did not result in any statistically significant differences in emission rates. The increase in emissions of criteria pollutants associated with evaporative cooling were determined using emission limits contained in the Title V Permit for the facility. This provides an estimate of the maximum potential emissions and would conservatively estimate annual increases in emission. Tables 1 and 2 presents a listing of the operating conditions and emission increases resulting from evaporative cooling when firing natural gas and distillate fuel oil, respectively. Table 3 presents the maximum potential emissions for both fuels.

The annual emissions were determined by multiplying the heat input increase per degree Fahrenheit (°F) times the emissions rate in lb/mmBtu for the number of °F-hours proposed for the turbine. The °F-hours/year represents the maximum potential amount of annual temperature reduction of evaporative cooling and was calculated by using the average temperature reduction multiplied by the hours of year assumed. For example, the °F-hours for gas firing are calculated by multiplying 8,760 hours times 10°F or 87,600°F-hours. For Unit 5, a maximum of 58,890°F-hours of operation when firing natural gas and 28,710°F-hours of operation when firing distillate fuel oil was used as the basis for annual emission estimates for the turbine (see Tables 1 and 2).

An amount of 87,600°F-hours provides a conservatively high basis for determining potential emissions from firing natural gas at 58,890°F-hours and distillate oil at 28,710°F-hours. Since natural gas is the primary fuel, with distillate oil backup, actual emission increases, assuming

mostly gas firing, would be less than that shown in Table 3. As seen in Table 1, potential emissions at 8,760 hours operation on gas are less than those estimated with both fuels.

In addition, during periods when the evaporative cooling system is not used, the operation of the CTs will not change as currently authorized by the Department's previous approvals (e.g., authorized to operated 8,760 hours/year; see Attachment C).

1.3 REGULATORY APPLICABILITY

A modification is defined in Rule 62-210.200 Florida Administrative Code (F.A.C.) as any physical change in, or a change in the method of operation of, or addition to a facility which would result in an increase in the actual emissions of any air pollutant subject to regulation under the Clean Air Act. A modification to a major source of air pollution, such as the City of Vero Beach, Municipal Utilities Power Plant, may be subject to review under the Department's Prevention of Significant Deterioration (PSD) rules codified in Rule 62-212.400 F.A.C.

In recent permitting actions, the Department has considered installation of inlet fogging systems, similar to the evaporative cooling system proposed by the City of Vero Beach, to be modifications under Rule 62-212.200 (188) F.A.C., since annual emissions may potentially increase as a result of the increased power and heat input.

Based on the available data, it is concluded that the emission rate does not change as a result of installation and operation of the proposed inlet evaporative cooling system on Unit 5 at the Vero Beach Municipal Power Plant. Therefore, any increase in annual potential emissions can be conservatively determined through the use of projected increases in heat input associated with the use of the evaporative cooling system.

These maximum potential emission rates are less than the significant emission rates in Table 62-212.400-2 in Rule 62-212.400 F.A.C. and, therefore, PSD would not apply. The pollutant closest to the PSD significant emission rates when firing natural gas is NO_x and is 7 tons per year (TPY) compared to the significant emission rate of 40 TPY. Emissions of SO_2

are 5 TPY and are primarily associated with distillate fuel oil, which is only used a backup to natural gas. Emission rates for CO and VOC on each fuel are less than about 1 percent of the significant emission rates for those pollutants.

Given the low potential emission increases and the conservative basis for estimating these increases, it is requested that the Department approve the operation of the evaporative cooling system. The City of Vero Beach will record the hours of operation that the evaporative cooling system will be used.

Table 1 Emission Estimates of the City of Vero Beach Municipal Utilities Unit 5 - Combustion Turbine with Inlet Evaporative Cooling/Humidification Unit (Natural Gas Firing - 8,760 hours/year).

Performance Basis			
Temperature Decrease	°F (1)	10	
Power Increase		3.90%	Average of GE Data for Frame 6
Heat Rate Decrease		-1.03%	Average of GE Data for Frame 6
Heat Input Increase		2.91%	Average of Heat Input vs. Temperature
Heat Input Change	mmBtu/ °F	1.2	Average from 59 °F to 90 °F turbine inlet
Hours/year		8,760 (2)	
Hours-°F/year		87,600	hours/year times temperature decrease

Pollutants	Units	Emissions	Comments
PM	lb/MMBtu	0.0060	from Title V Permit(3)
	TPY	0.31	
NO_x	lb/MMBtu	0.1070	from Title V Permit(3)
	TPY	5.56	
SO_2	lb/MMBtu	0.0030	1 grains/100 scf of gas; Title V Application
	TPY	0.16	
CO	lb/MMBtu	0.0224	from Title V Permit(3)
	TPY	1.16	
VOC	lb/MMBtu	0.0112	from Title V Permit(3)
	TPY	0.58	

Legend - TPY: tons per year

(1) Temperature decrease is average temperature differential of ambient temperature to compressor inlet temperature utilizing representative of average daytime conditions.

(2) Hours of evaporative cooler operation based on estimate of 24 hours per day and 365 days per year.

(3) Emission factor references - Title V Permit Application and Permit based on maximum hourly emissions and 59 °F turbine inlet conditions.

Table 2 Emission Estimates of the City of Vero Beach Municipal Utilities Unit 5 - Combustion Turbine with Inlet Evaporative Cooling/Humidification Unit (Distillate Oil Firing - 2,871 hours/year).

Performance Basis			
Temperature Decrease	°F (1)	10	
Power Increase		3.90%	Average of GE Data for Frame 6
Heat Rate Decrease		-1.03%	Average of GE Data for Frame 6
Heat Input Increase		2.91%	Average of Heat Input vs. Temperature
Heat Input Change	mmBtu/ °F	1.3	Average from 59 °F to 90 °F turbine inlet
Hours/year		2,871 (2)	
Hours-°F/year		28,712	hours/year times temperature decrease

Pollutants	Units	Emissions	Comments
PM	lb/MMBtu	0.0250	from Title V Permit(3)
	TPY	0.47	
NO_x	lb/MMBtu	0.1736	from Title V Permit(3)
	TPY	3.25	
SO_2	lb/MMBtu	0.2700	from Title V Permit(3)
	TPY	5.05	
CO	lb/MMBtu	0.0226	from Title V Permit(3)
	TPY	0.42	
VOC	lb/MMBtu	0.0113	from Title V Permit(3)
	TPY	0.21	

Legend - TPY: tons per year

(1) Temperature decrease is average temperature differential of ambient temperature to compressor inlet temperature utilizing representative of average daytime conditions.

(2) Hours of evaporative cooler operation based on 10,000,000 gallons/year at 455 mmBtu/hr heat input.

(3) Emission factor references - Title V Permit Application and Permit based on maximum hourly emissions and 59 °F turbine inlet conditions.

Table 3 Maximum Annual Emissions of the City of Vero Beach Municipal Utilities Unit 5 Combustion Turbine with Inlet Air Cooling System with Evaporative Cooling/Humidification Unit (Natural Gas Firing - 5,889 hours/year and Oil Firing 2,871 hours/year).

	Annual Emissions (tons/year)			PSD SERs[1]
Pollutants	Gas Firing	Oil-Firing	Total	(tons/year)
PM	0.21	0.47	0.68	15 & 25[2]
NO_x	3.74	3.25	6.98	40
SO_2	0.11	5.05	5.16	40
CO	0.78	0.42	1.20	100
VOC	0.39	0.21	0.60	40

(1) PSD = Prevention of Significant Deterioration; SERs - Significant Emission Rates; Rule 62-212.400(2)(e)2.
(2) 15 tons/year is for PM10 and 25 tons/year is for PM.

ATTACHMENT A

MANUFACTURER INFORMATION FOR EVAPORATIVE COOLING SYSTEM

The MUNTERS TURBIdek™ Unit, which has been supplied for this project, is a single stage, media based evaporative cooling/humidification unit, which will increase power output during the hot summer days by cooling and humidifying the incoming air. This TURBIdekTM unit has been designed to give years of trouble free service with a minimum of maintenance. Care has been taken during design and fabrication to make the unit easy to start, operate and maintain.

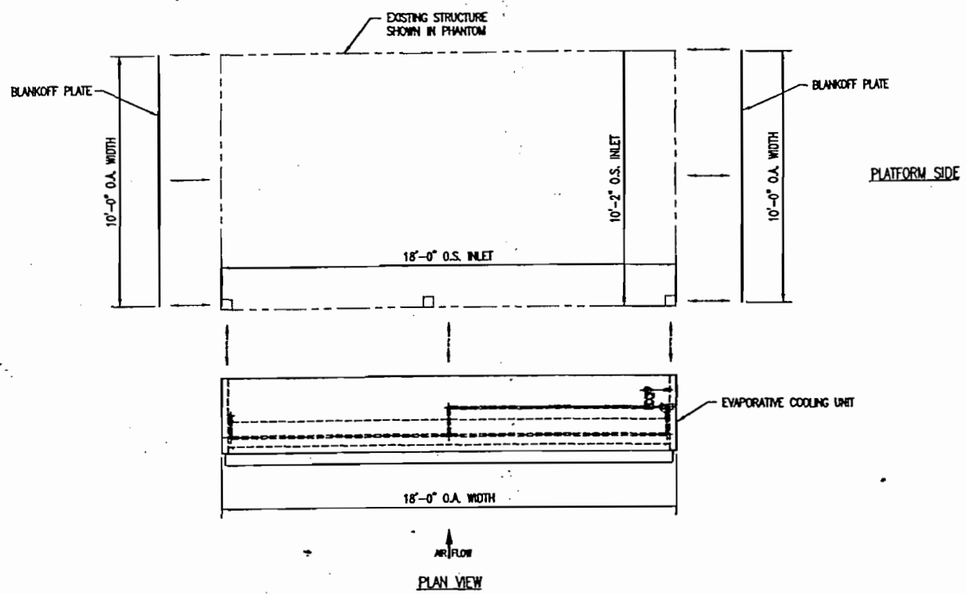
The heart of the unit is a single bank of Munters GLASdek® evaporative cooling media, which provides the porous surface over which the inlet air and water pass and contact each other. The inlet edge of the media has been treated with TUFedg® to protect the media and increase its life. Only Munters' GLASdek® replacement media with TUFedg® should be used to maintain performance and fire resistance.

Water is provided to the media by means of a submersible pump fitted with a safety float switch to prevent operation without sufficient water. Water is recirculated from the sump which also catches excess water exiting the media. A portion of the water is evaporated, cooling and humidifying the inlet air. Another portion of the water is discarded to "bleed" minerals and salts from the system where they are concentrated as water is evaporated. The sump is sloped to the drain connection to facilitate drainage and cleaning, and allow it to be completely emptied.

A float-operated valve and positive overflow maintain water level in the sump. A flow meter, complete with strainer, is provided to monitor water flow. The distribution header is provided with flush valves at each end to assist in keeping the water distribution system clean and free of debris. The unit is designed for simple on or off operation, and attempts at controlling output by throttling water flow may result in scaling, plugging or other damage to the media.

A bank of Munters' DRIFdek is installed after the media to protect the turbine against any carryover of water droplets from the media. Another bank has been installed before the unit to protect the unit from weather and light.

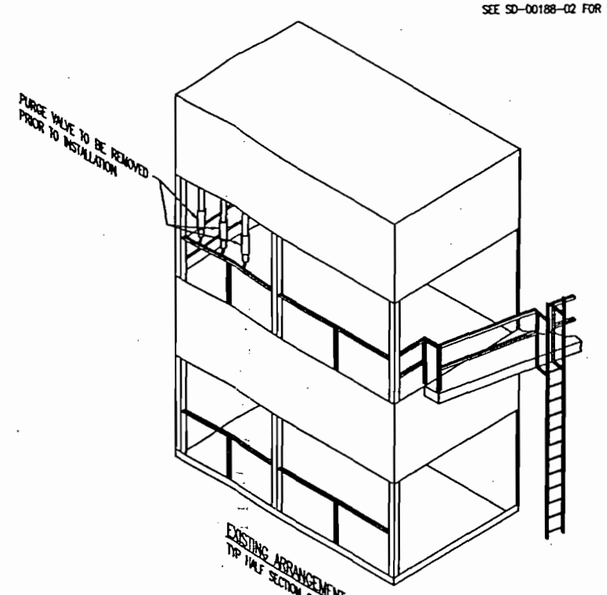
The material contained in this manual is designed to help operating personnel keep the unit operating efficiently. If problems arise, please refer to the TROUBLE SHOOTING section provided, or, for any unusual problem, please contact Munters directly (1-800-446-6868), your source for genuine Munters replacement media and parts.



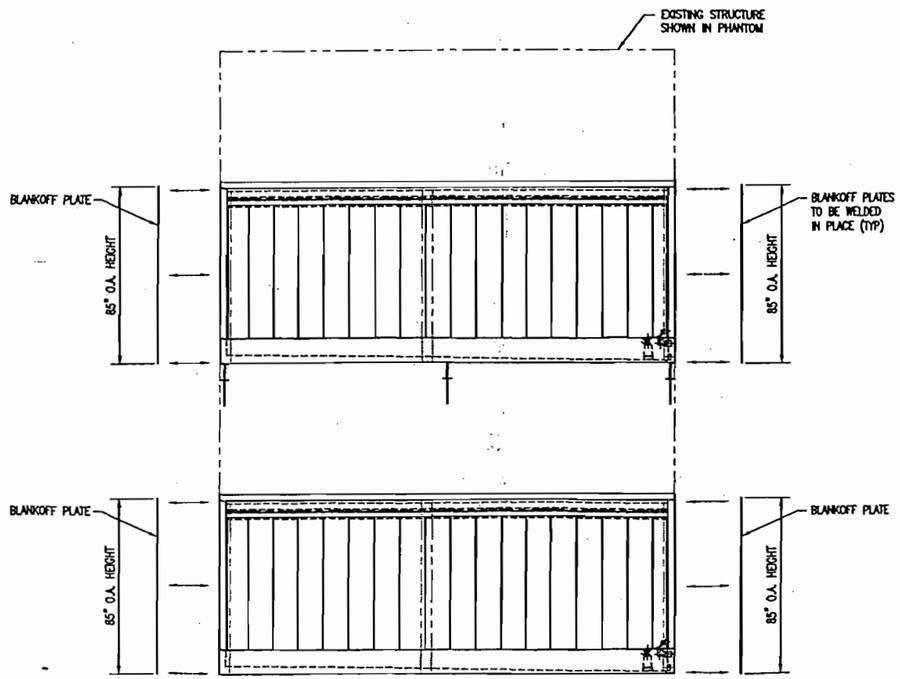
PLATFORM SIDE

PLAN VIEW

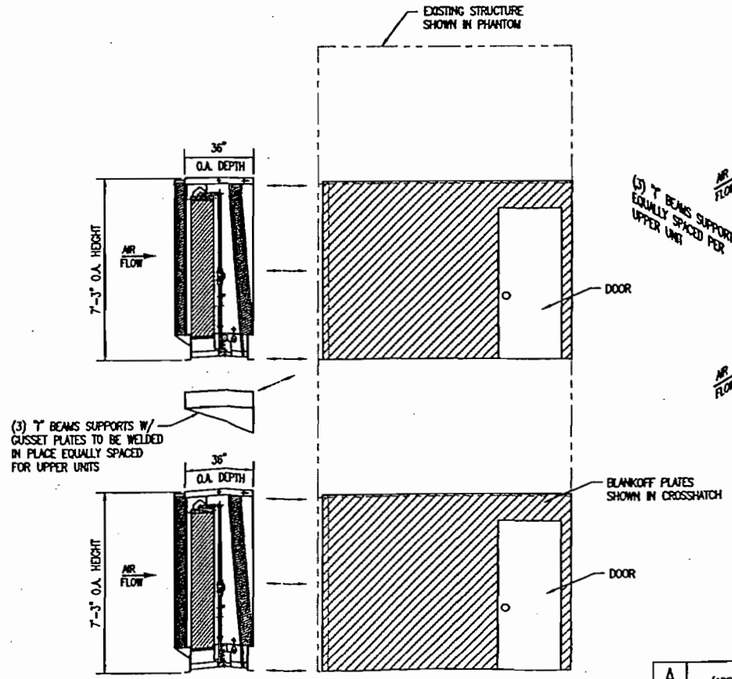
REFERENCE:
SEE SD-00188-02 FOR UNIT & FOR NOTES



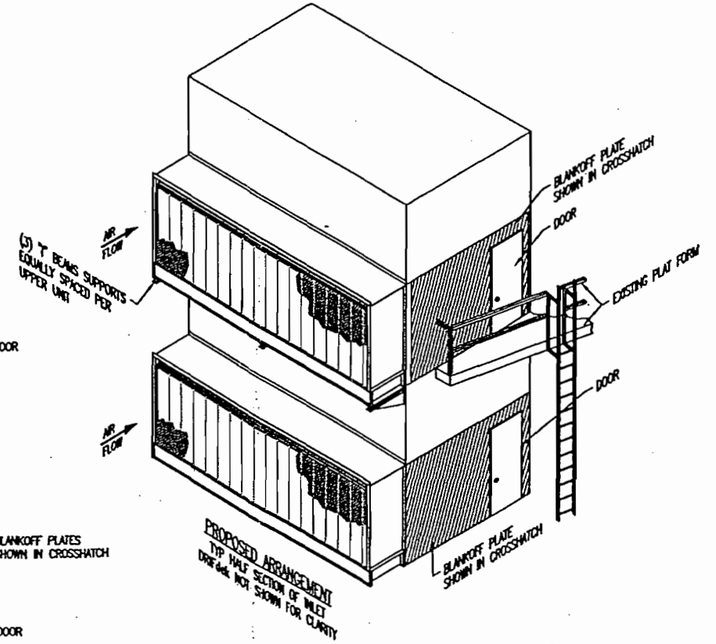
EXISTING ARRANGEMENT
TYP HALF SECTION OF INLET



ELEVATION



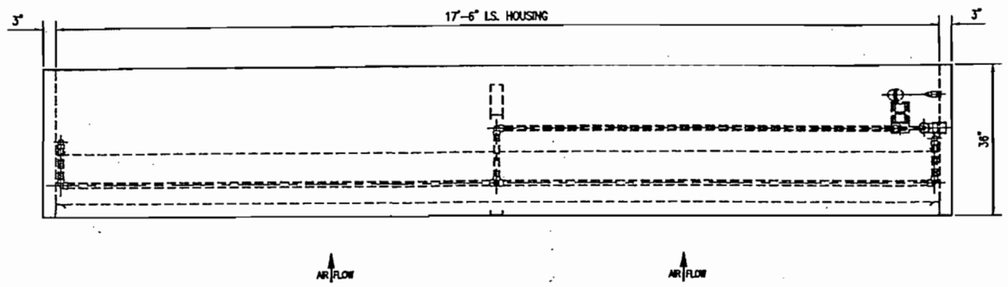
SIDE VIEW



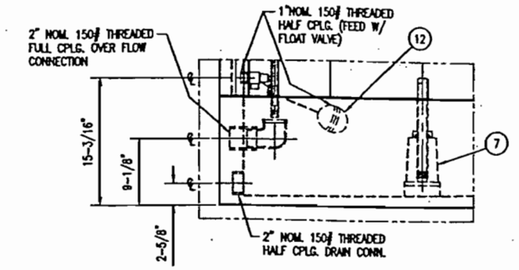
PROPOSED ARRANGEMENT
TYP HALF SECTION OF INLET
DRIFdek NOT SHOWN FOR CLARITY

SYM	REVISION	BY	DATE
A	UPDATED UNIT DESIGN (ADDED DRIFdek TO THE INLET)	SJ	5/30 00

DRAWN BY SJ	SCALE 3/4"=1'-0"	THE MUNTERS CORPORATION 7450 84th STREET S.E. P.O. BOX 6428 FT. MYERS, FLORIDA 33911 PHONE (941) 278-1255 FAX (941) 274-1276	
CHECKED BY MAC	DATE 10/5/99		
APPROVED BY DT	FOR VERO BEACH S806-00188		
TITLE	GENERAL ARRANGEMENT: EVAPORATIVE COOLING UNIT INSTALLATION		
DRAWING NUMBER	SD-00188-01	SHEET OF	REV. A



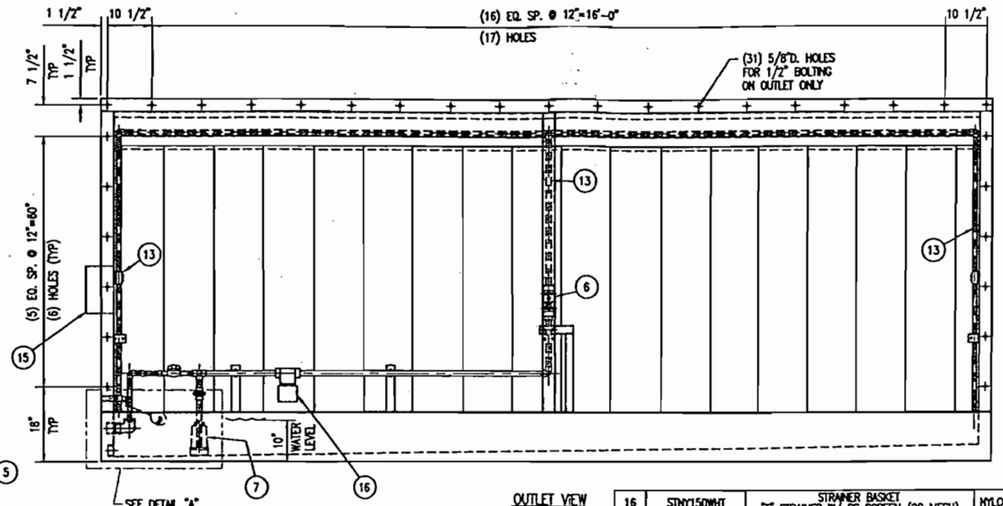
PLAN VIEW



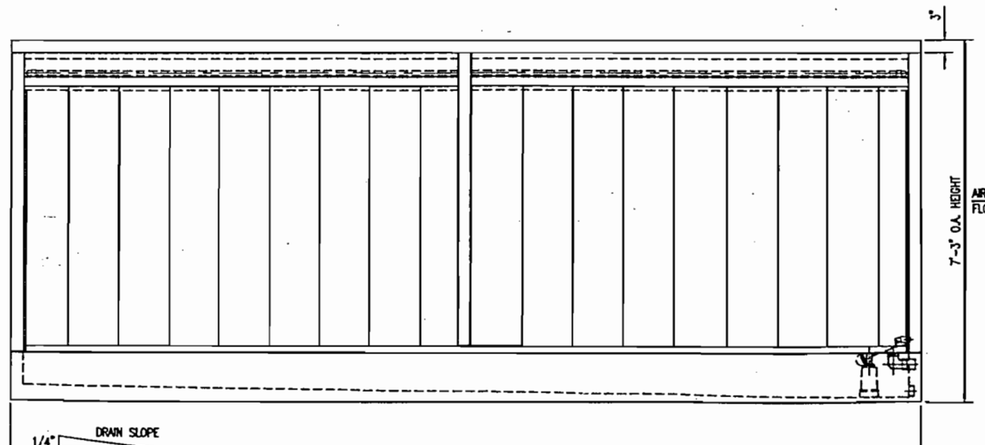
DETAIL "B"

NOTES:

1. MATERIAL: SEE BILL OF MATERIAL
2. APPROX. WEIGHT: TO FOLLOW
3. MEDIA TO BE REMOVABLE FROM AIR INLET SIDE OF UNIT.
4. QUANTITIES SHOWN IS FOR (1) UNIT
5. ALL PIPING INSIDE THE EVAPORATIVE COOLER IS BY MUNTERS. ANY EXTERIOR PLUMBING IS BY OTHERS.
6. ALL CONNECTIONS TO BE @ PLATFORM SIDE.
7. (2) UNITS AS SHOWN REQUIRED. (2) UNITS SYMM. OPPOSITE REQUIRED.
8. UNITS TO BE SEALED ALL AROUND.



OUTLET VIEW



INLET VIEW

SECTIONAL SIDE VIEW

ITEM NO.	PART NO.	PART NAME / DESCRIPTION	MATL.	REQ.
16	STNY150WHT	STRAINER BASKET "Y" STRAINER W/ SS SCREEN (20 MESH)	NYLON	1
15	REAS480V	480V ELECTRICAL BOX (GRAYBAR CAT. No. 8536SBW12V81C6FF4T)		1
14				
13	DS-0288	PIPING ASSEMBLY	PVC	1
12	VALF1 - FLCU6	FLOAT VALVE W/ 6" BALL - 1" NOM. (GRAINGER #'s VALVE-3P937 FLOAT-4UV75)		1
11	STANDARD	LOCKWASHER 3/8	304 SS	12
10	STANDARD	FLAT WASHER 3/8	304 SS	12
9	STANDARD	HEX NUTS 3/8"-16	304 SS	12
8	STANDARD	HEX HEAD BOLT 3/8"-16 x 1 LG.	304 SS	12
7	PU480VLF	PUMP (UTILE GIANT) 16SH-CIM - 480V / 1HP / 3PH / 60HZ		1
6	VAFBR15027	FLOW REGULATING VALVE (GRISWOLD CONTROLS) 1-1/2" NOM. (MODEL #3654) 26.67 GPM		1
5	FM3022PS1M.54B	FLOW METER (1" ECONO - FLOW METER .5 - 4 GPM) (McMASTER CARR #4197K11)		1
4A	DIL052572	INLET DRIFdek 72-7/8"H.x14-1/8"x5-1/4"	PVC	1
4	DIL052572	INLET DRIFdek 72-7/8"H.x25-1/8"x5-1/4"	PVC	8
3A	DIL051272	OUTLET DRIFdek 70-5/8"H.x11-1/2"x5-1/4"	PVC	1
3	DIL052572	OUTLET DRIFdek 70-5/8"H.x25-1/8"x5-1/4"	PVC	8
2	GLA45450212	MEDIA (TUFF EDGE) 2"x12"x70"	GLASdek	3
1	GLA1545121272T1	MEDIA (TUFF EDGE) 12"x12"x65"	GLASdek	18

BILL OF MATERIAL

SYM.	REVISION	BY	DATE
A	UPDATED UNIT DESIGN (ADDED DRIFdek PTO INLET)	SJ	5/31 00

DRAWN BY	SJ	SCALE	3/4"=1'-0"
CHECKED BY	MAC	DATE	10/5/99
APPROVED BY	DT	FOR	VERO BEACH S806-00188

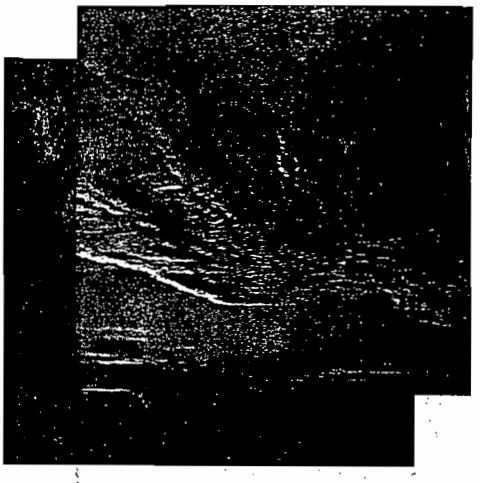
THE MUNTERS CORPORATION
4400 GEM STREET S.E. 33907
P.O. BOX 9428
FT. MYERS FLORIDA 33911
PHONE (941) 936-1555
FAX (941) 278-1318

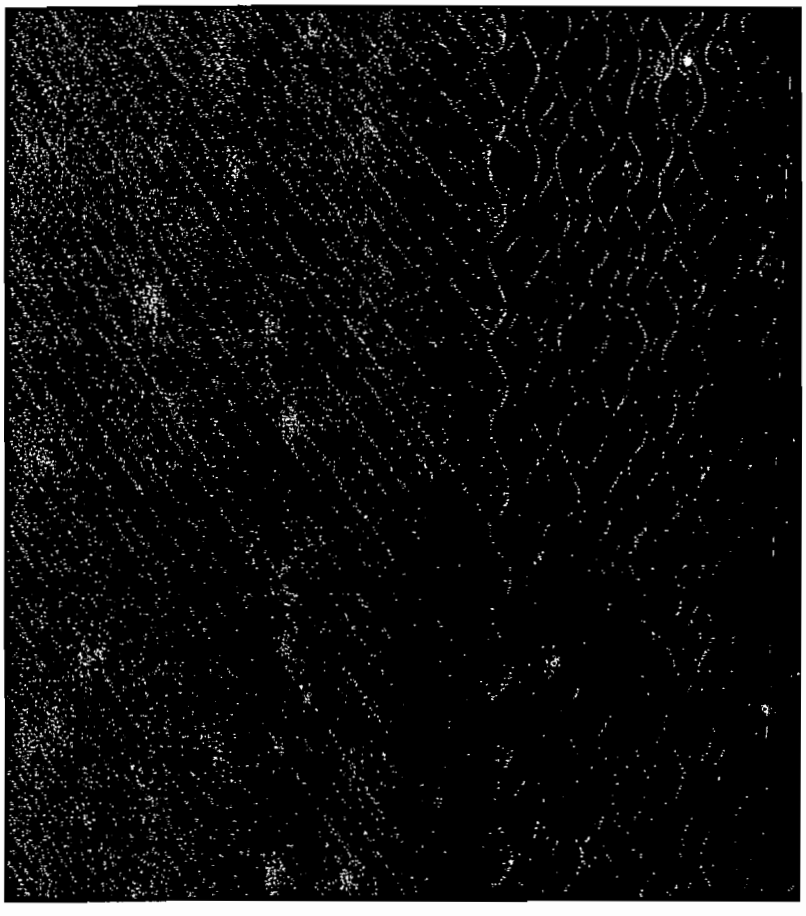
TITLE: GENERAL ARRANGEMENT: EVAPORATIVE COOLING UNIT - 7'-3"H.x18'-0"W.x36"D. O.A. UNIT

DRAWING NUMBER	SHEET	OF	REV.
SD-00188-02			A

GLASdek®

FIRE RATED EVAPORATIVE COOLING AND HUMIDIFICATION MEDIA





PROVIDES SUPERIOR COOLING AND HUMIDIFICATION, AND IS UL® 900, CLASS II FIRE RATED FOR SAFETY

GLASdek® FEATURES:

- **High Cooling Efficiency**
  Exceptional cooling rates are achieved due to the design, manufacturing and materials used in GLASdek®.
- **High Face Velocity**
  The shallow angle of Munters' unequal flute design allows high velocity air to travel through the pad without water droplet carry over.
- **Self-Cleaning Design**
  Munters' GLASdek® resists the clogging caused by dust or sand. The water flushes dirt and debris from the surface of the pad. The water is directed toward the air entering face of the pad by design, where it is needed most.
- **Low Pressure Drop**
- **Simple to Maintain**
- **Fire Rated UL®900, Class II for safety.**

Munters®

GLASdek® evaporative media is made from a flame retardant material fortified with special rigidifying agents. The cross fluted, unequal angle pad design induces highly turbulent mixing of air and water for optimum heat and moisture transfer. This unique design also functions to continually direct more water to the air entering face of the pad, where the most intense evaporation occurs, further enhancing the operating efficiency of the pad.

DESIGN CONSIDERATIONS

Water Distribution:
The water flow needed is based on the depth of the media used. GLASdek® requires 1.5 gallons per minute per square foot of horizontal (top) pad surface area. For installations that have intense evaporation or pad walls taller than 72", an additional 10%-20% of water may be required.

Supply:
The gutter and sump should be sized to supply the system with enough water to operate at its maximum flow rate and not overflow when the system is shut down.

OPTIONS

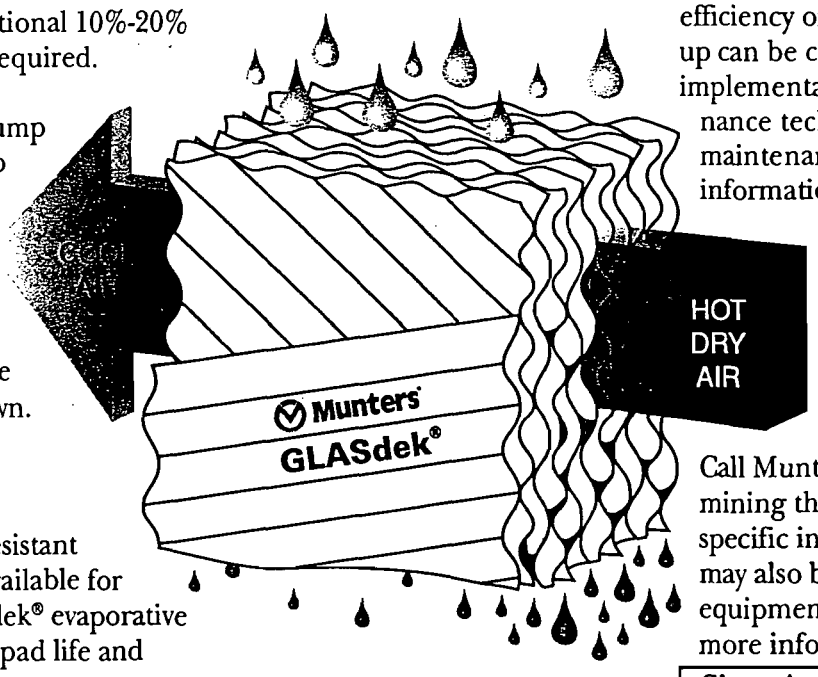
Edge Coating:
TUFedg® algae resistant edge coating is available for all sizes of GLASdek® evaporative media for longer pad life and easier cleaning.

Distribution Pads:
2" or 3" distribution pads disperse water laterally and evenly across the top of the pad. These specially designed pads are also protected with Munters' patented edge treatment.

MAINTENANCE

Scale:
Mineral deposits can be minimized by maintaining a continuous water bleed-off, or by periodically dumping the sump. The exact amount will depend on the pH and hardness of the water supply, and Munters' can assist by recommending individual bleed-off rates.
Note: Fractional timers should not be used. These timers do not enhance the performance of the pad and actually contribute to the development of scale.

Algae:
If algae is allowed to grow freely on GLASdek® it may eventually clog the passages and inhibit the flow of air. This increases the static pressure and reduces the efficiency of the pad. Algae build up can be controlled by early implementation of simple maintenance techniques. Munters' maintenance bulletins provide information to help maximize the efficiency and life of GLASdek®.



The steeper angle directs more water to the air entering side of the pad, where it is needed most.

SELECTION

The depth and height of the media varies by application. Call Munters for help in determining the requirements of specific installations. GLASdek® may also be cut to fit smaller equipment. Call Munters for more information.

Sizes Available:
Depth: 4", 6", 8", 12"
Height: 48", 60", 72"
Width: 12"

Specifications for GLASdek®	
Angles	45° and 15°
Base Sheet	Glass Matt
Max. Intermittent Water Temp.	130° F
Max. Continuous Water Temp.	100° F
Max. Intermittant Air Temp.	300° F
Max. Continuous Air Temp.	150° F
pH Range	6-9
Dry Weight	1.4 lb/ft³
Wet Weight	7.0 lb/ft³
Operating Weight	9.0 lb/ft³
Water Load (gpm/sq. ft)	1.5
Fire Rating (UL)	900 Class II
Flame Spread Index (ASTME84)	5

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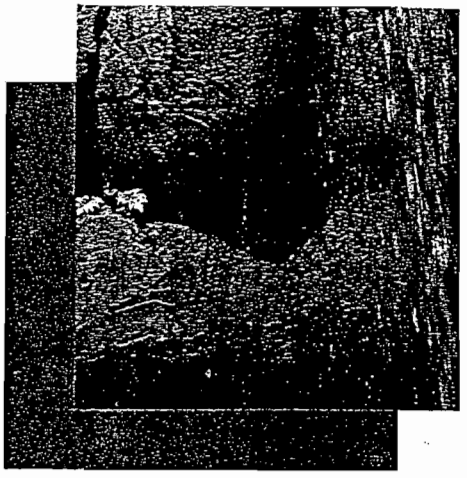
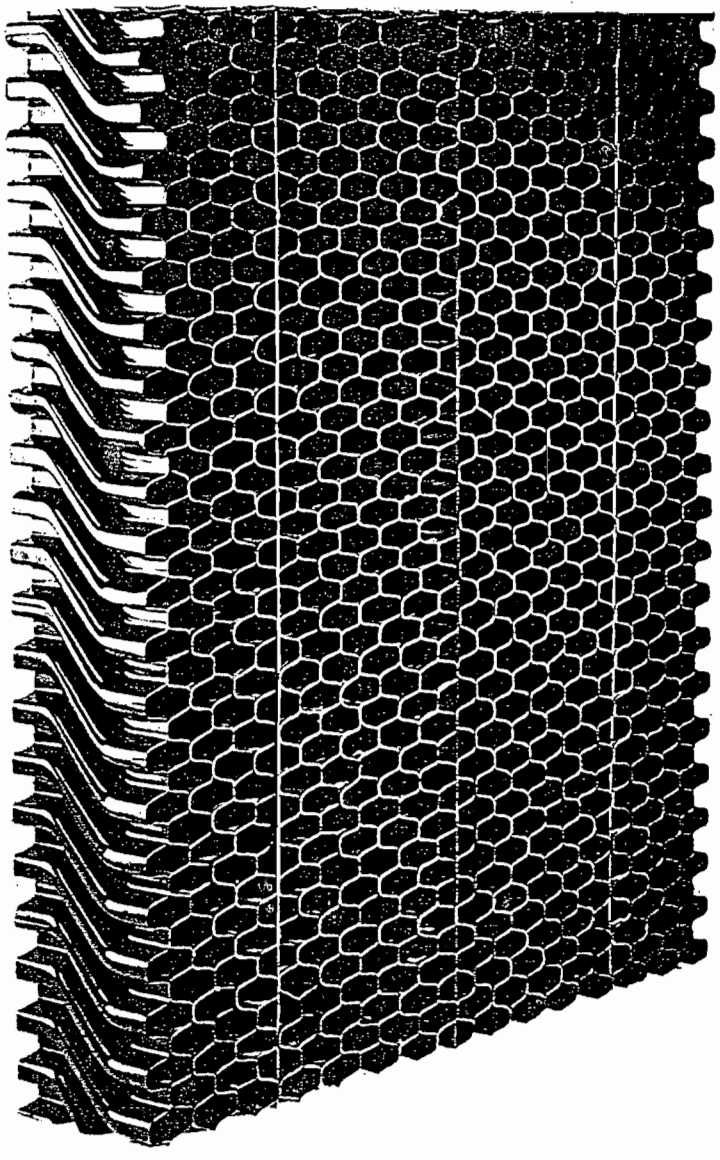
Munters®

MB-GDB 9812 Printed in USA

DRIFdek®-IL
DRIFT ELIMINATORS





DRIFdek® Modular Interlocking Drift Eliminators

DRIFdek®-IL modular interlocking drift eliminators offer easy installation, self sealing design and excellent droplet separation. The overlapping design makes installation fast and watertight. No cauking or weather stripping is needed between the modules.

DRIFdek®-IL modular drift eliminators should be installed downstream of CELdek® and GLASdek® evaporative cooling pads in applications where added assurance of drift free operation is a must.

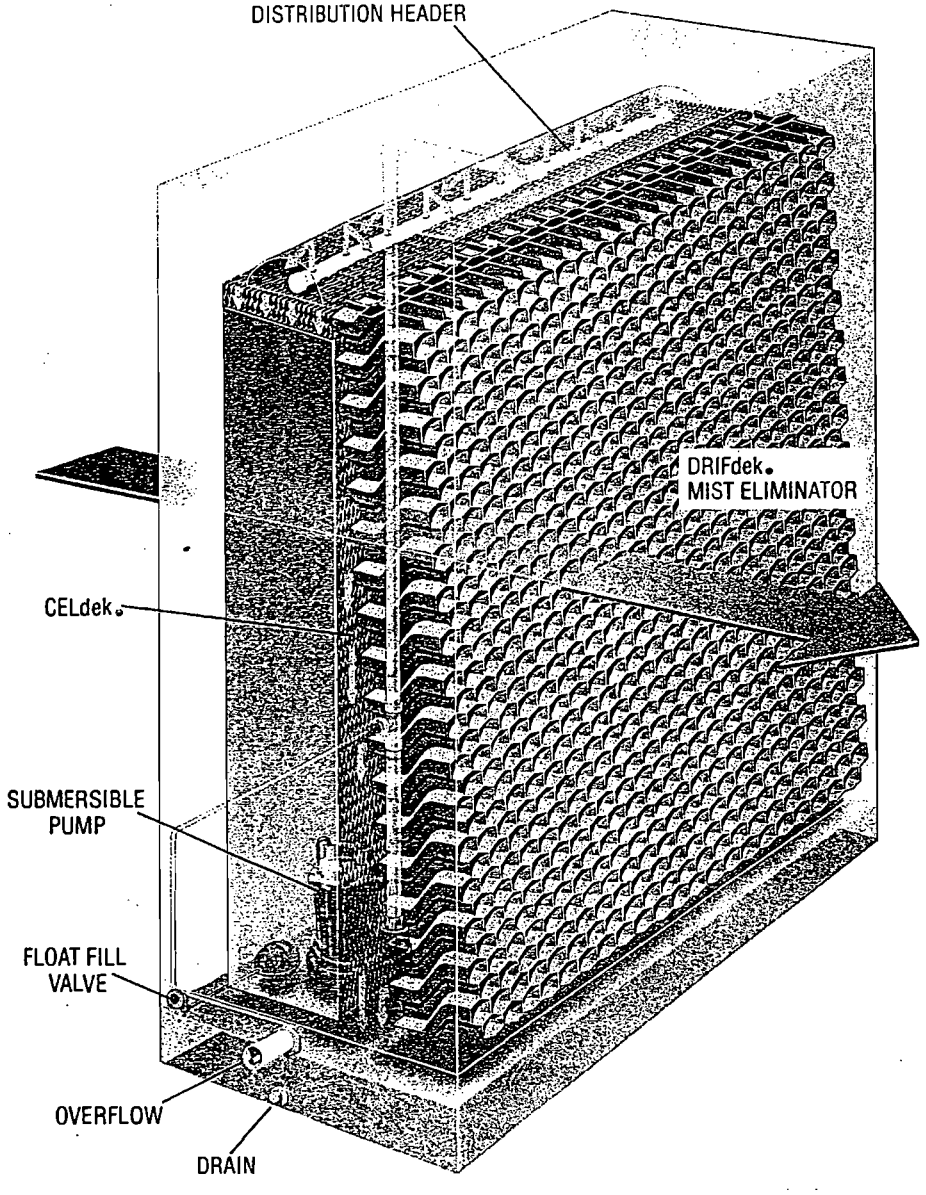
Munters

DRIFdek®-IL

DRIFdek®-IL may be installed horizontally or vertically. For vertical installation, DRIFdek®-IL should be installed at a 5-10 degree angle to allow drainage of the water droplets.

DRIFdek®-IL is designed to interlock at the joints between modules. This interlocking joint is formed by nesting the corrugations of adjacent modules. To size DRIFdek®-IL, remember to allow a loss of 1/2" for each interlocking joint. If a water tight seal is not necessary, DRIFdek®-IL may be installed side by side.

DRIFdek®-IL Installation



HOW DOES DRIFdek® WORK?

Separation of water droplets from air stream depends on inertial forces and, therefore, droplet size and velocity. When the air passes through the 'S' turns of DRIFdek®-IL modular drift eliminators, the heavy water droplets impinge on the outside of each turn. They are drawn out of the air stream into the drainage channels and form droplets large enough to fall out the entering side of DRIFdek®-IL modular drift eliminators without becoming re-entrained. Since the collected water exists on the inlet side, there are no requirements for a separate collection trough under the DRIFdek®-IL.

ECONOMICAL

The engineered honeycomb panel makes the structure very rigid. The simple, lightweight construction not only keeps the initial costs low, it also keeps installation costs down. DRIFdek® modular drift eliminators need no complicated water-collection basin and only simple supports and retainers are required.

LIGHTWEIGHT

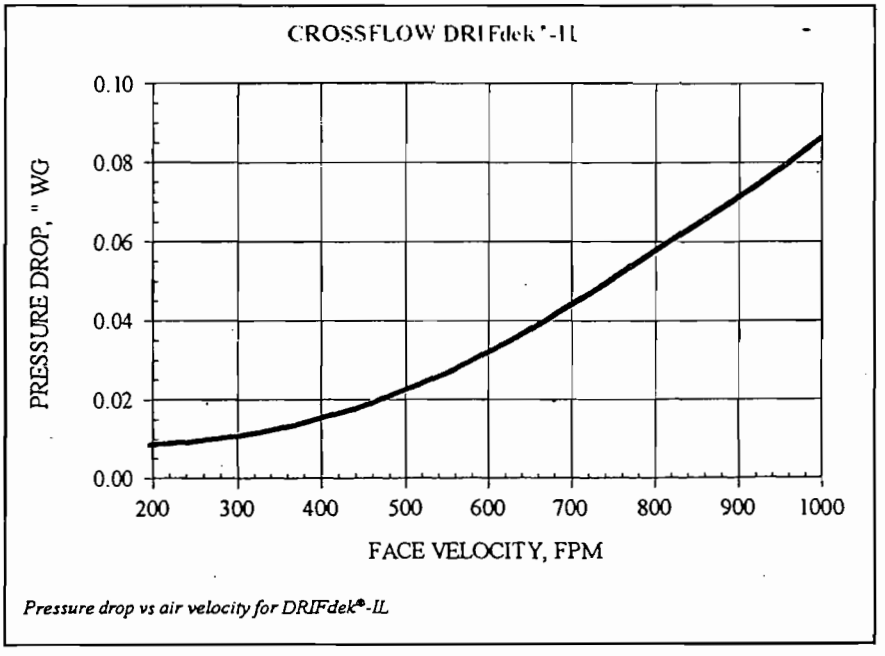
A standard 2' x 6' (60.96 cm x182.88cm) panel is easily handled by one man. It weighs less than 25 lbs (11.34kg).

EFFICIENT

When installed at a 10° slant, and operated between 500 and 700 FPM (2.5 - 3.5 m/sec), DRIFdek® modular drift eliminators will remove more than 99% of the droplets larger than 65 microns.

LOW PRESSURE DROP

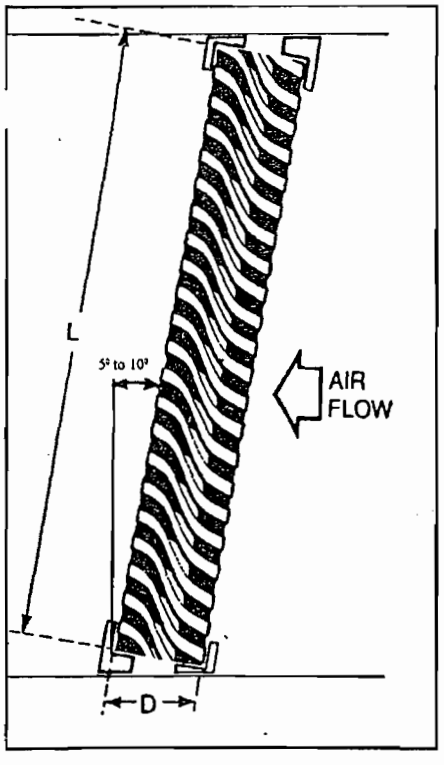
DRIFdek® modular drift eliminators will add less than 0.05 inches W.G.(1.27 mm) static pressure to a system operating at less than 700 FPM (3.5 m/sec) through the drift eliminator. Its unique geometry does not need sharp turns - or splash plates - to achieve high efficiency. Please refer to the curve for the full range of pressure drops.



Pressure drop vs air velocity for DRIFdek®-IL

NON-CORROSIVE PVC

The PVC compound from which DRIFdek® modular drift eliminators are made has proven itself during more than 15 years of service in rigorous cooling tower-operation.



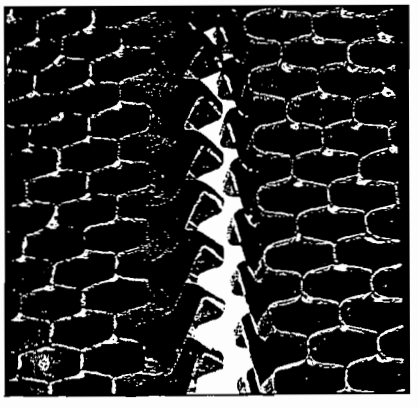
SIZES

Length (L): 48", 60", 72" ± 3/16"
Width (W): 12 1/8" and 25 1/8" ± 3/16"
(Standard, all others are side trimmed)
Depth (D): 5.25" +3/16" - 0"

EASY TO INSTALL

The rigid panel slides easily in and out of supports. DRIFdek®-IL modular drift eliminators are delivered ready to install, and they are easily removed for routine maintenance of the equipment.

Munters DRIFdek®-IL (interlocking) drift eliminator is designed to interlock at the joints between modules. This interlocking joint is formed by nesting the corrugations of adjacent panels. To size DRIFdek®-IL drift eliminators to fit the opening, remember to allow a loss of 1/2" for each interlocking joint. If a watertight seal is not necessary, DRIFdek®-IL interlocking drift eliminators may be installed side by side.



The corrugations of DRIFdek®-IL are designed to fit together like a tongue and groove.

SPECIFICATIONS

DRIFdek®-IL modular drift eliminators are constructed from UV resistive rigid polyvinyl chloride. This compound was developed by Munters especially for harsh conditions. It meets ultra-violet resistive PVC standard ASTM 1784, D3679.

This UV resistive PVC is the same rugged material used for structural piping, conduit, air-conditioning ducts, house siding, greenhouse construction and outdoor irrigation systems. The materials resist common water contaminates and temperatures of up to 130°F (58.8°C) continuous operating temperature.

Care should be taken when storing DRIFdek®-IL modular drift eliminators in the sunlight as radiant heat may be higher than 130°F.

Supports 1" (25 mm) wide should be installed by OEM fabricator.

TEST RESULTS

The summary of test results below shows the influence of water load, velocity and incline angle on the separation efficiency and average droplet-size. The tests were performed by Environmental Systems Corporation, Knoxville, TN an independent laboratory, utilizing the "Sensitive Paper" method.

The Sensitive Paper (SP) system relies on droplet collection by inertial impaction on water sensitive paper. The paper is chemically treated so that a droplet impinging on it will generate a well-defined blue stain on a pale yellow background. The relationship between the size and shape of the stain to the droplet-size is obtained by calibrating the SP system with a monodisperse water-droplet generator over a range of droplet-sizes and impaction velocities. For a more detailed summary of the test results, please request Engineering Bulletin #EB-806-DET.

EMISSION RATE AND DROPLET-SIZE DATA

Slant Angle Degree	Source Water Flow gal/min (g/sec)	Air Velocity FPM (m/sec)	Mass Flux ($mg/m^2/sec$)	Mass Emission Rate (mg/sec)	Drift Rate (%)	Mass Mean Diameter (µm)
0	5 (315)	528 (2.68)	9.81	10.6	0.0033	61
0	5 (315)	733 (3.73)	6.34	6.85	0.0022	59
5	5 (315)	528 (2.68)	8.57	9.25	0.0029	62
5	5 (315)	740 (3.76)	8.16	8.81	0.0028	60
5	5 (315)	925 (4.80)	9.94	10.7	0.0032	226
10	70 (4400)	427 (2.17)	0.103	0.111	0.0000025	184
10	70 (4400)	635 (3.22)	6.62	7.15	0.00016	820

NOTES:
"Mass Flux" is the mass of droplets which cross a unit area per unit time.
"Mass Emission Rate" is the total mass emission of water droplets through the 2' x 6' (61 cm X 183 cm) drift eliminator.
"Drift Rate" is the percentage of drift passing through the drift eliminator as compared to the source water flow.
"Mass Mean Diameter" is the mean diameter of the droplets which pass through the drift eliminator.

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ENGINEERING BULLETIN
EB-063-P101

LEARNING TO USE THE PSYCHROMETRIC CHART

AN IMPORTANT TOOL FOR UNDERSTANDING EVAPORATIVE COOLING

ATMOSPHERIC AIR (the air around us) is a mixture of DRY AIR and invisible WATER VAPOR.

DRY AIR is a mixture of gases; mostly Nitrogen and Oxygen, with other gases in small quantities. WATER VAPOR (not droplets) present in the atmosphere behaves like a gas. The Psychrometric chart is a simple but accurate method of showing the many properties of air and water vapor under different conditions.

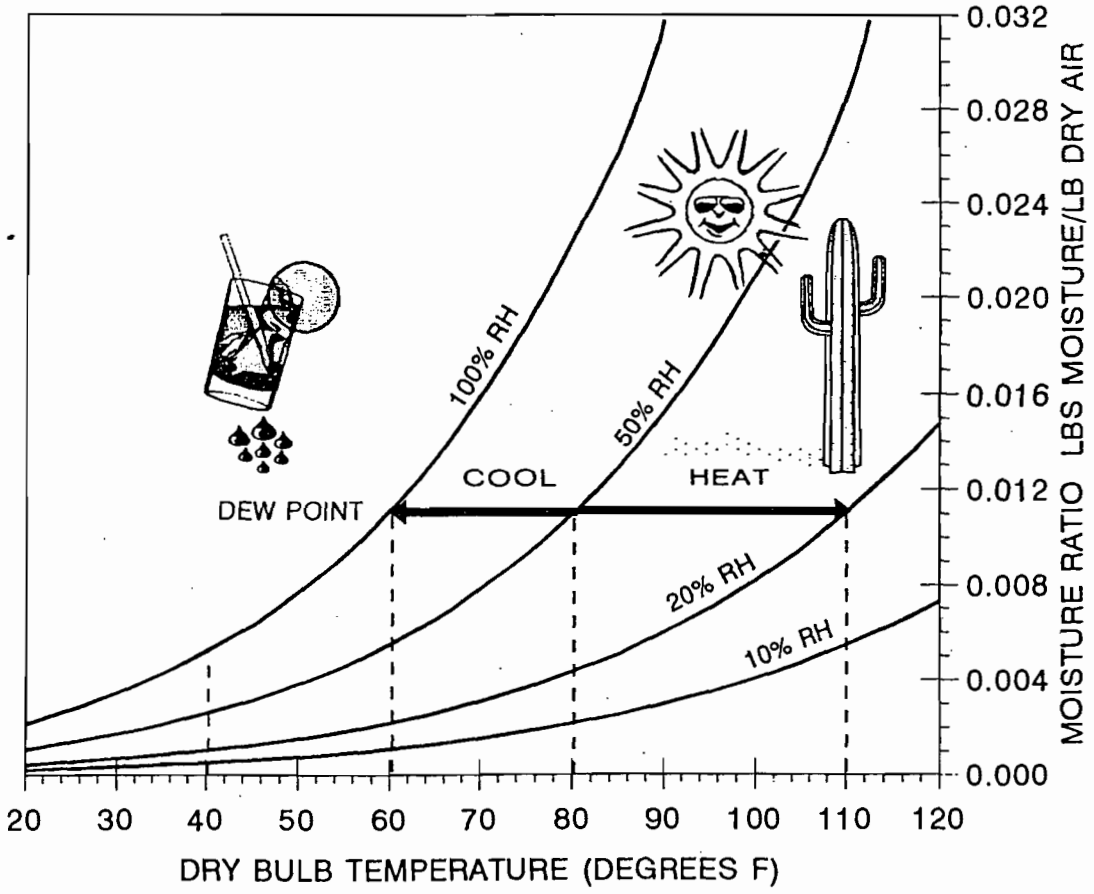


FIGURE 1. HUMIDITY vs TEMPERATURE

On the Psychrometric chart, the horizontal axis represents the **DRY BULB** temperature of the mixture, as measured by an ordinary mercury bulb thermometer, in degrees F.

The vertical axis represents **HUMIDITY RATIO** (w), the moisture content of the mixture, expressed as pounds of moisture per pound of dry air.

Some charts show **HUMIDITY RATIO** as "grains of moisture per pound of dry air"

[7000 grains = 1 pound]

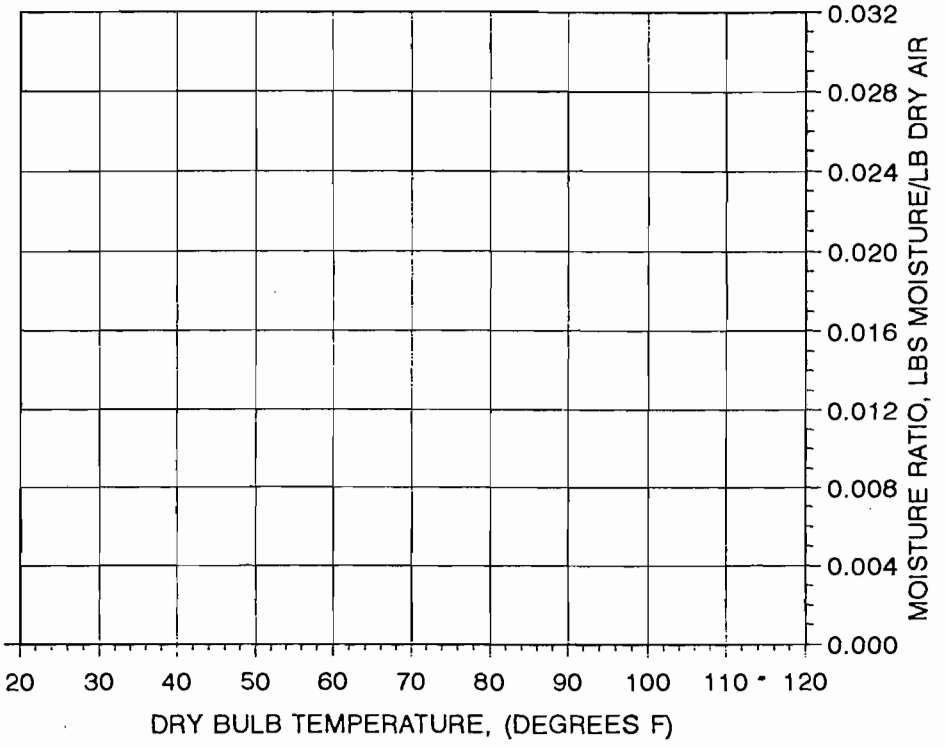
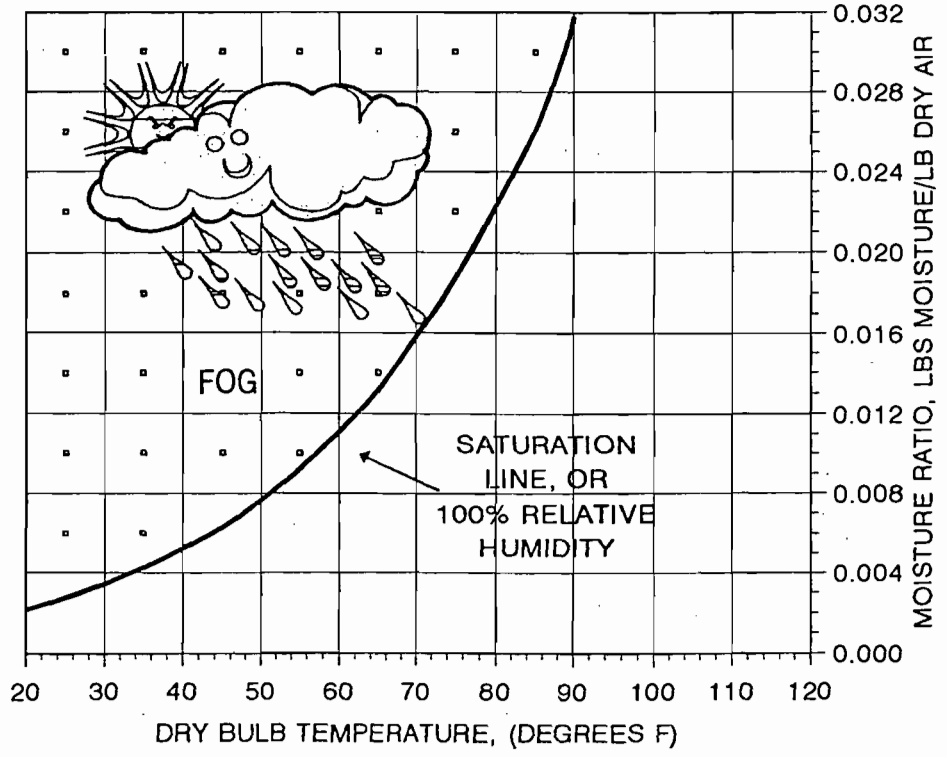


FIGURE 2. SATURATION LINE

At each **DRY BULB** temperature there is a maximum amount of water vapor which can be mixed with dry air at that temperature. The air at this point is "saturated" with water vapor. If the maximum **HUMIDITY RATIO** for each **DRY BULB** temperature is plotted, and a curve is drawn connecting these points, this curve is called the **"SATURATION LINE"** or the 100% **RELATIVE HUMIDITY** line. Any additional moisture in the mixture would be visible droplets (fog).



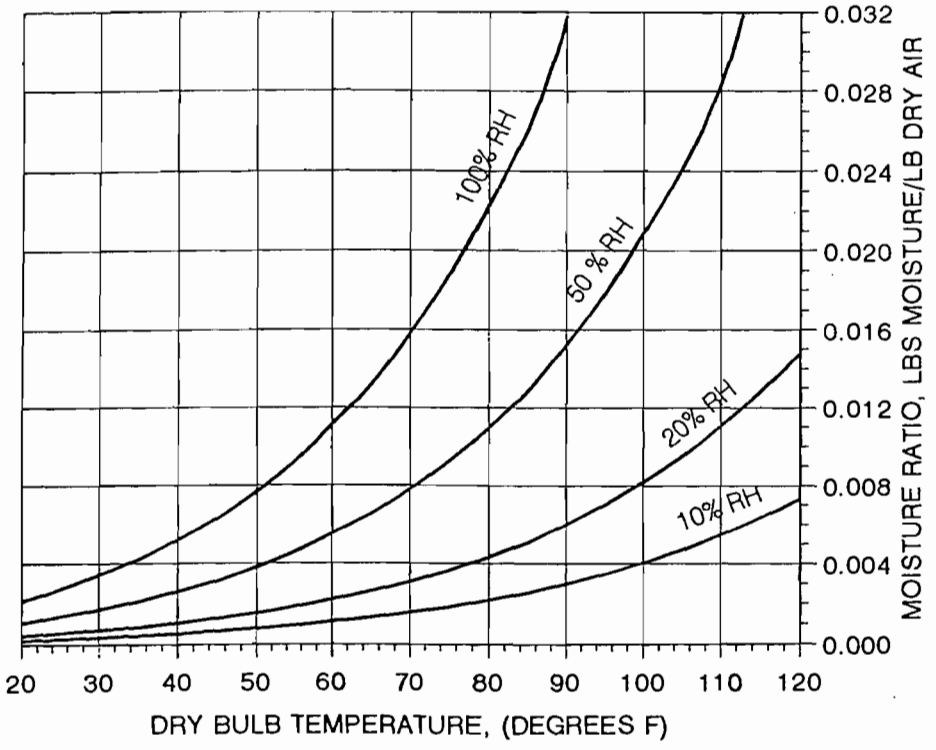


FIGURE 3. RELATIVE HUMIDITY

Now add some **"RELATIVE HUMIDITY"** lines. Notice that air at **50% RELATIVE HUMIDITY** contains half as much moisture as **100% RELATIVE HUMIDITY** air at the same temperature. **20%** and **10% RELATIVE HUMIDITY** air contain proportionate amounts of moisture also.

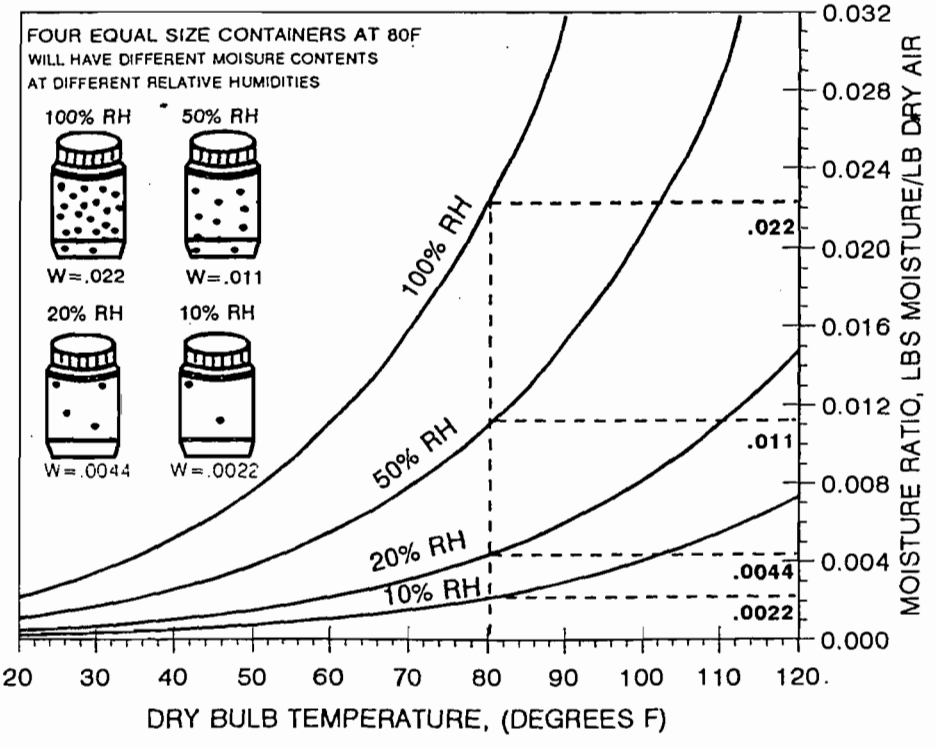


FIGURE 4. HUMIDITY RATIO

As an example, imagine four jars, each containing air at 80°F and sea level.

Plot the intersection of the 80° F **DRY BULB** temperature and the various **RELATIVE HUMIDITY** curves.

Read the moisture content, or **HUMIDITY RATIO, (w)** directly from the right hand side of the chart.

FIGURE 5. DEW POINT TEMPERATURE

When air is heated, but the moisture content of the air is not changed, the **RELATIVE HUMIDITY** will drop. When air is cooled, the **RELATIVE HUMIDITY** will rise. Because **RELATIVE HUMIDITY** is exactly what it is called: **RELATIVE**. And warm air will hold more moisture that cold air.

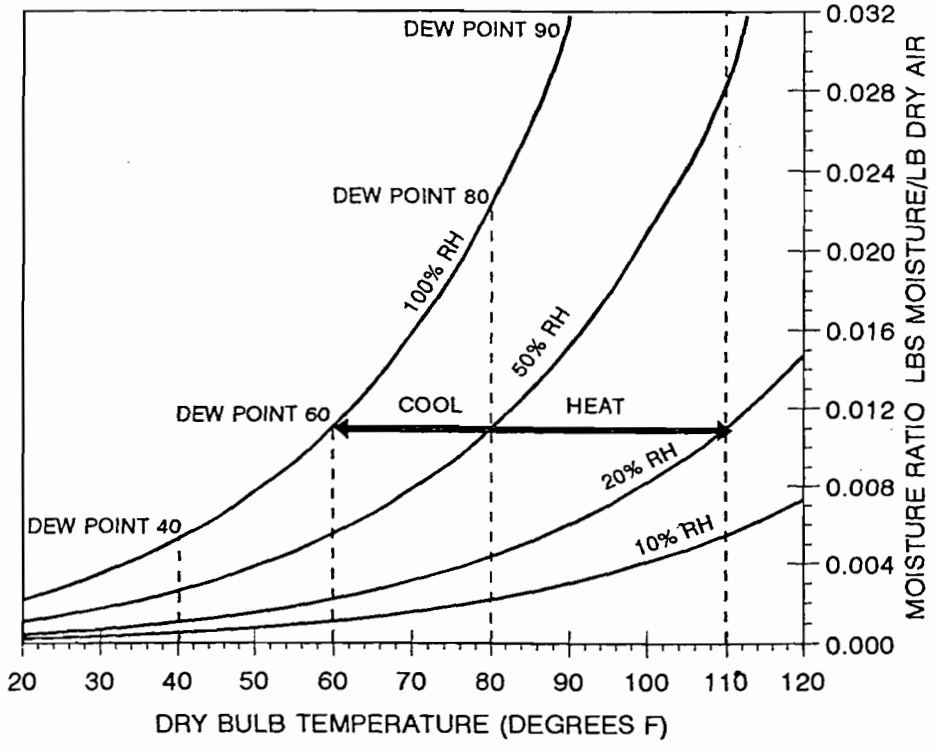


FIGURE 6. "DAMP" AIR AND "DRY" AIR

Water vapor will condence when the **DRY BULB** temperature of the air drops below the **DEW POINT** temperature.

Dew will form on a cold glass if the surface of the glass is lower than the **DEW POINT** temperature of the surrounding air.

Desert air feels "**dry**", (even though it contains moisture) because hot air will hold more moisture than cold air.

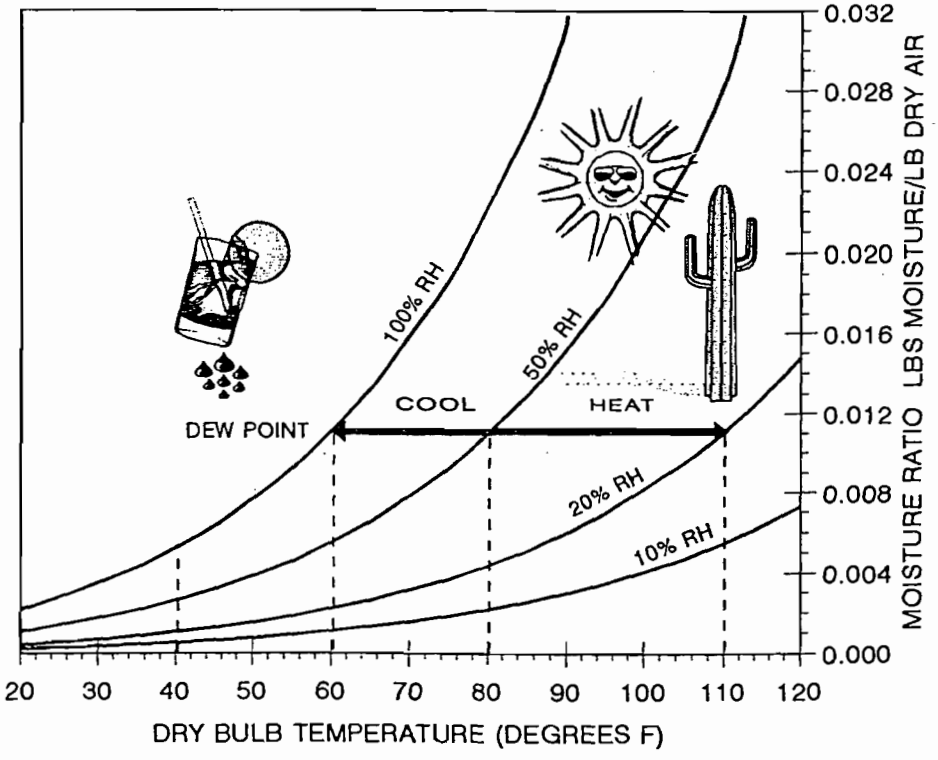
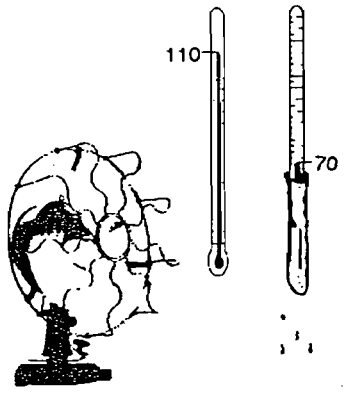


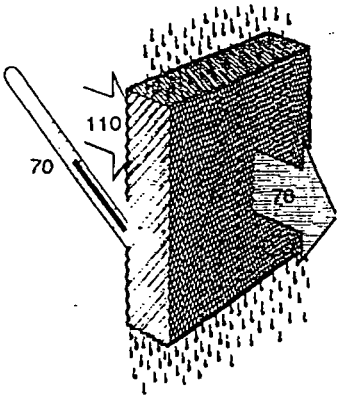
FIGURE 7. WET BULB TEMPERATURE

WET BULB temperature is the temperature at which water evaporates when air is blown over a wet surface. It is the temperature felt by your wet skin on a windy day.



An evaporative cooling pad works in the same way as the wick on a **WET BULB** thermometer, because, when working in equilibrium with its environment, the water passing over the media will approach the **WET BULB** temperature.

The **WET BULB** temperature is normally measured by placing a wetted sock on an ordinary thermometer. When air is blown past the sock at 750 to 2000 feet per minute, the bulb of the thermometer will sense the **WET BULB** temperature. The drier the air the more intense the evaporation and the lower the **WET BULB** temperature.



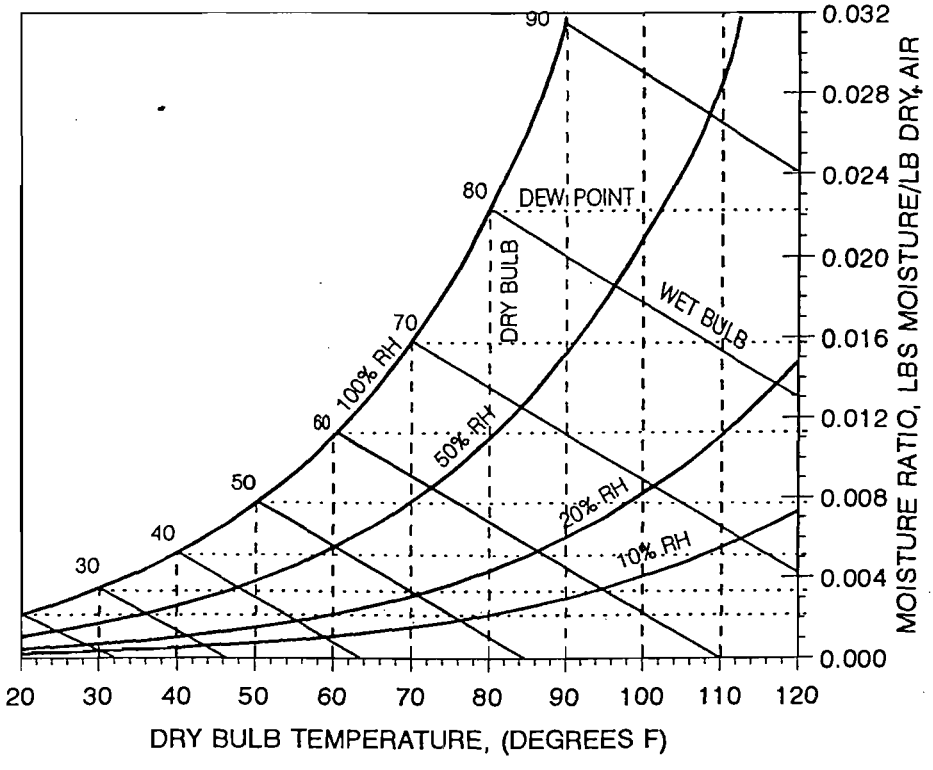


FIGURE 8. THREE DIFFERENT TEMPERATURES

The **DRY BULB** temperature, **DEW POINT** temperature, and **WET BULB** temperature are all the same at **100% RELATIVE HUMIDITY.**

DRY BULB temperatures are represented by the vertical axis of the chart.

DEW POINT temperatures follow the constant moisture lines horizontally across the chart.

WET BULB temperatures approximate the constant enthalpy lines. (Sensible and Latent Heat contained in the air.)

FIGURE 9. WET BULB DEPRESSION

The difference between the ambient **DRY BULB** and **WET-BULB** temperatures is called the **"WET BULB DEPRESSION"** (DBT - WBT).

As air passes through an evaporative cooler, the **DRY BULB** temperature is lowered, but the **WET BULB** temperature remains approximately the same. The **DRY BULB** temperature will "approach" the **WET BULB** temperature as the air is cooled, and the **RELATIVE HUMIDITY** will rise. Moisture is added to the air by evaporation.

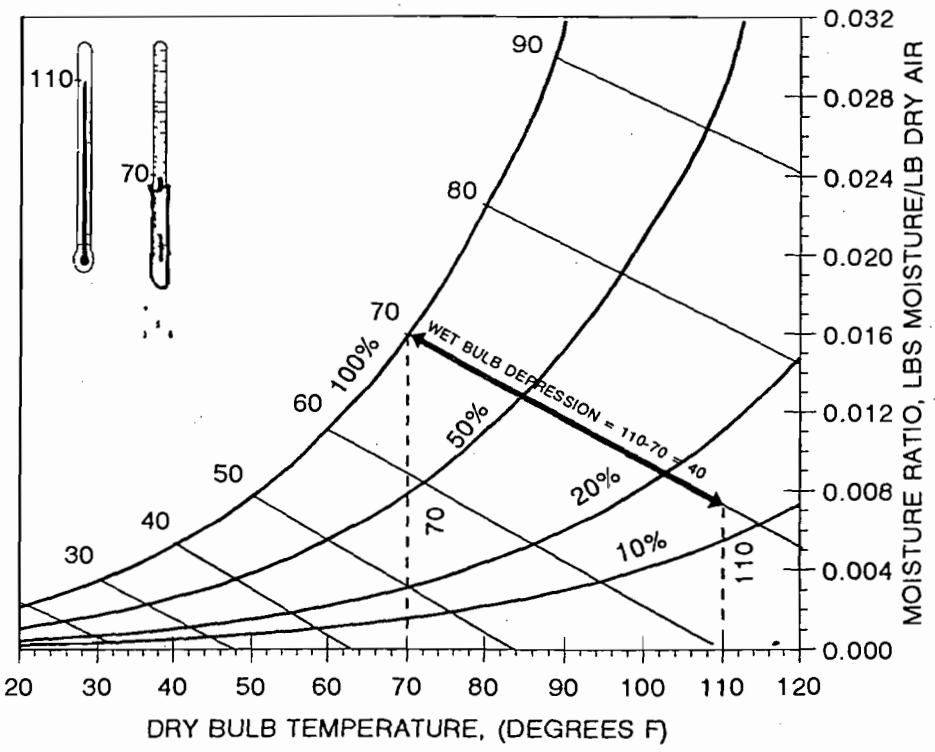
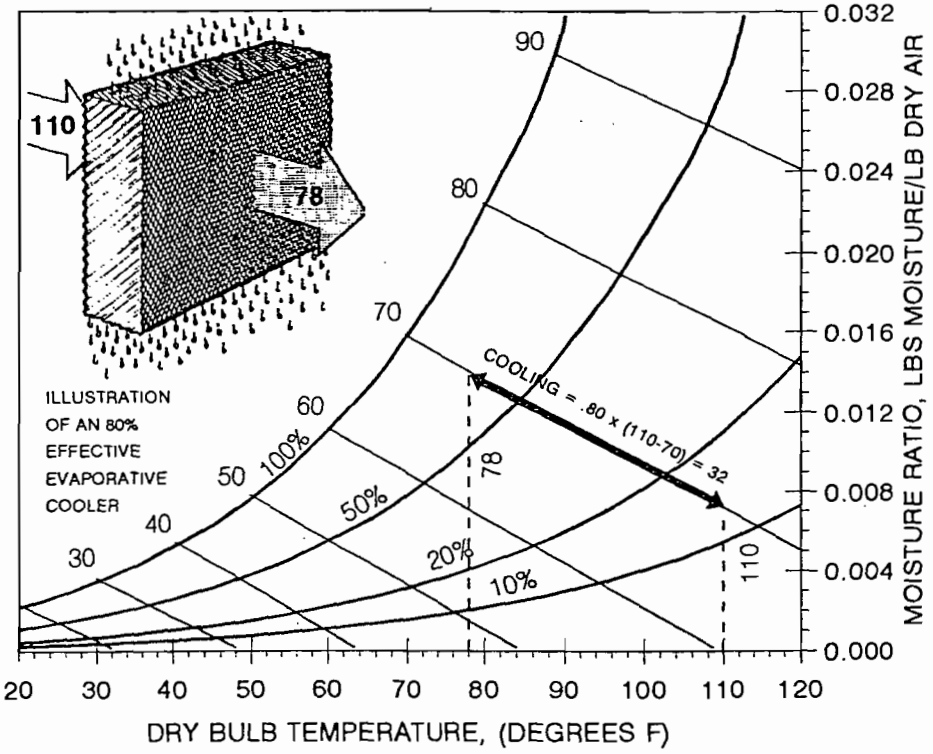


FIGURE 10. EVAPORATIVE EFFECTIVENESS

The performance of an evaporative cooler is based on the ratio of the number of degrees it can cool the air compared to the **WET BULB DEPRESSION.** This rating is the "evaporative **EFFECTIVENESS"** or (evaporative **EFFICIENCY)** of the cooler.

The number of degrees the **DRY BULB TEMPERATURE** (DBT) of the air can be lowered is a percentage of the **WET BULB DEPRESSION** or (DBT - WBT) x **EVAPORATIVE EFFECTIVENESS.**



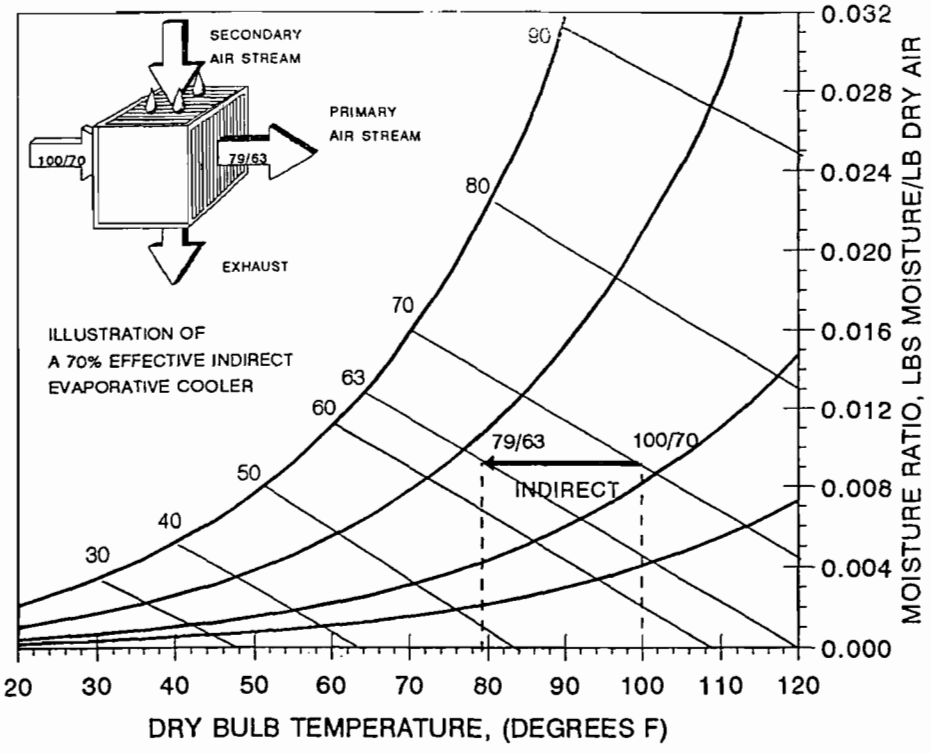


FIGURE 11. INDIRECT EVAPORATIVE COOLING

Indirect Evaporative Coolers evaporatively cool water or secondary air outside of the primary air stream. A coil or air to air heat exchanger is used to remove heat from the primary air.

Thus, the primary air is cooled without adding MOISTURE. The **RELATIVE HUMIDITY** increases but the **WET BULB TEMPERATURE** is lowered.

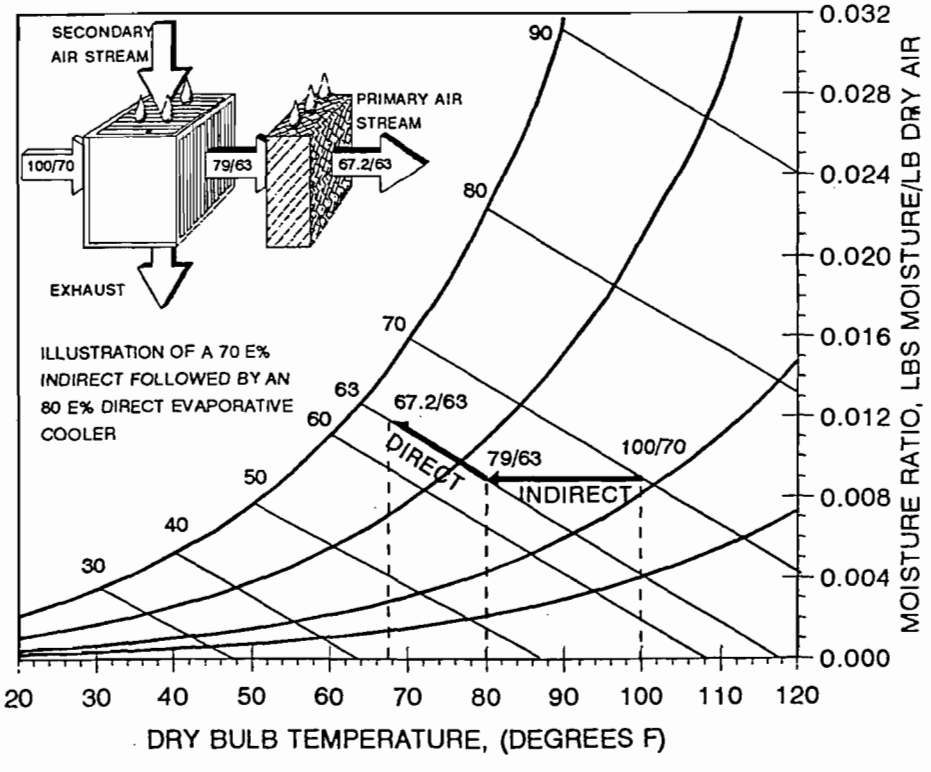


FIGURE 12. TWO STAGE EVAPORATIVE COOLING

Placing a **DIRECT EVAPORATIVE COOLER** after an **INDIRECT EVAPORATIVE COOLER** will further lower the temperature of the air. The leaving temperature will be lower than that possible from a **DIRECT EVAPORATIVE COOLER** alone because of the lower **WET BULB TEMPERATURE** of the air leaving the **INDIRECT** section.

FIGURE 13. DESIGN CONDITIONS FOR CERTAIN CITIES

Some beneficial cooling can be gained from the evaporative effect even in the more humid climates.

Notice that Phoenix and Yuma, AZ as well as Bakersfield and Monterey, CA share almost the same value for **HUMIDITY RATIO** (W) expressed as pounds of moisture per pound of dry air. However the **RELATIVE HUMIDITY** for Monterey is quite different. (51% vs. 14-17% for the desert cities.)

Fort Myers, FL and New Orleans, LA, have a design **RELATIVE HUMIDITY** of 51% like Monterey, but at the higher **DRY BULB** temperature, the **HUMIDITY RATIO** is almost twice that of the western cities.

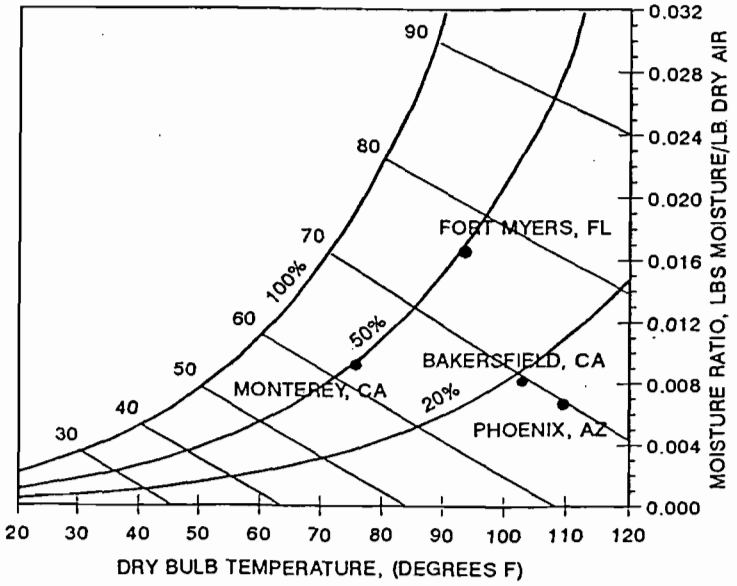
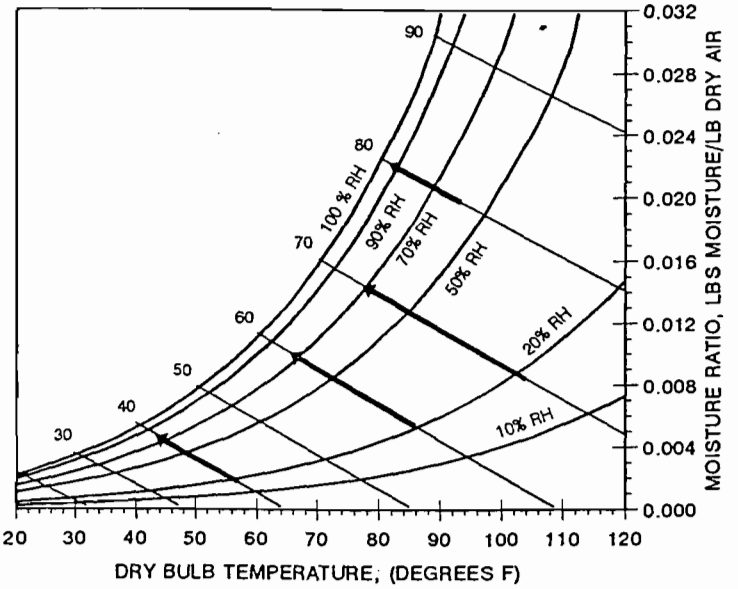


FIGURE 14. DEGREES OF COOLING

An evaporative cooler will always cool a percentage of the difference between the **WET BULB** and **DRY BULB TEMPERATURE** regardless of the starting point. As a rule of thumb, hotter air is lower in **RELATIVE HUMIDITY.** So, an evaporative cooler can cool the most when the air is the hottest.



USEFUL FORMULAS

DIRECT EFFECTIVENESS= (ENTERING DRY BULB - LEAVING DRY BULB) ÷ (ENTERING DRY BULB - WET BULB)

INDIRECT EFFECTIVENESS= (ENTERING DRY BULB - LEAVING DRY BULB) ÷ (ENTERING DRY BULB - ENTERING WET BULB)

WATER EVAPORATED IN GALLONS PER HOUR = (1.2 X CUBIC FEET PER MINUTE OF AIR X TEMPERATURE DROP) ÷ 10,000

The charts in this booklet are for illustration purposes only. Data points were derived from the DesJardins Psychrometrics Computer Program for DOS, DesJardins and Associates, Arcadia, CA.

For more information, see the *ASHRAE Handbook -- 1989 Fundamentals,* American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA.

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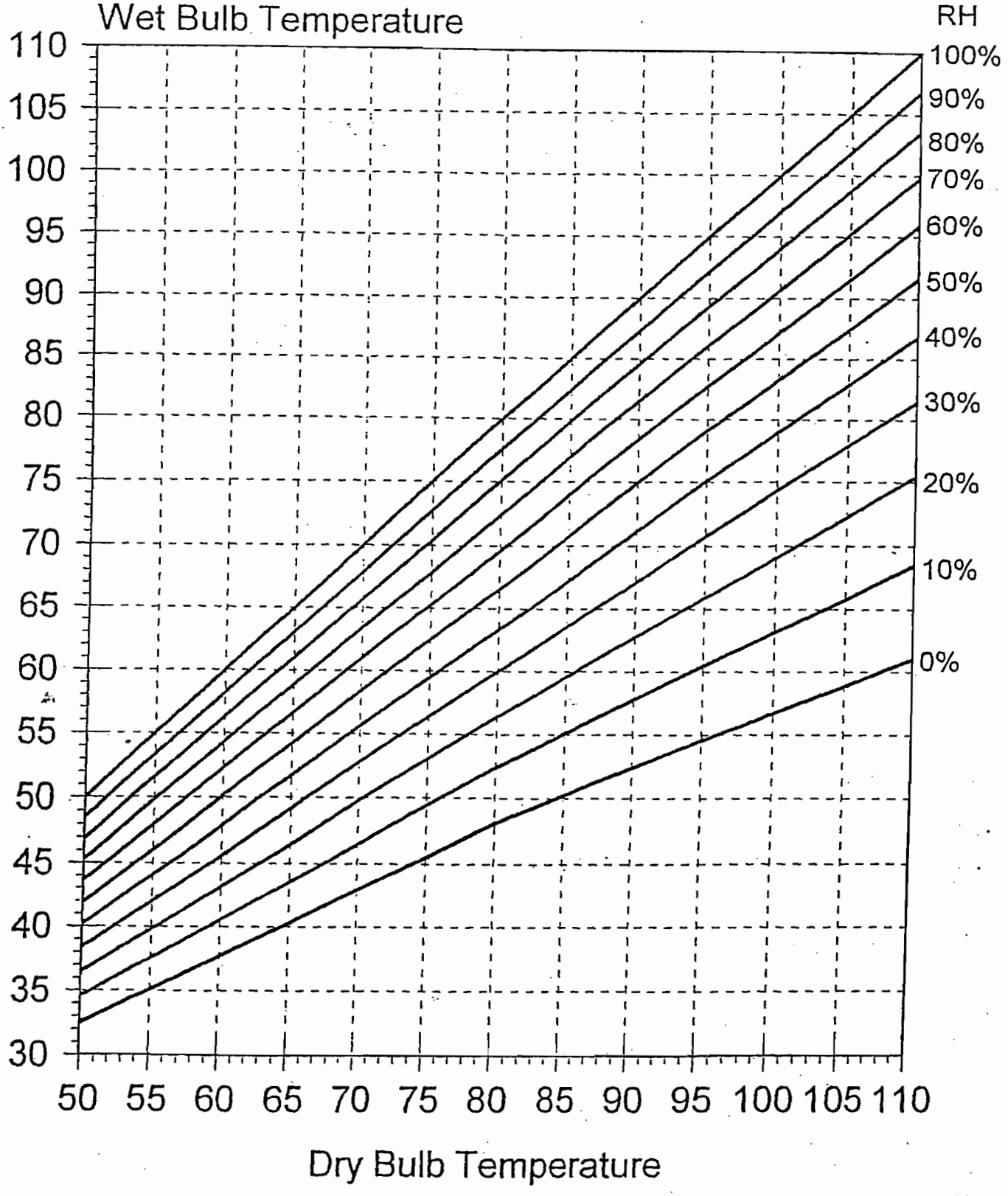
Quick Relative Humidity Chart



EB-QRH-406

ATTACHMENT B

TURBINE PERFORMANCE DATA

Table B-1. Combustion Turbine Performance Data - General Electric Model PG6541(B) Gas Turbine Firing Natural Gas

Temp. (°F)	Heat Input (mmBtu/hr)	Increase (mmBtu/hr)	Increase (%)	Average mmBtu/hr per °F	Capacity (MW)	Increase (MW)	Increase (%)	Average Increase(MW) per °F	Heat Rate (Btu/kWhr)	Decrease (Btu/kWhr)	Decrease (%)	Average Decrease per °F
100	364.32				31.92				11,414			
90	376.74	12.42	3.41%	1.24	33.44	1.52	4.76%	0.15	11,266	-147.39	-1.29%	-14.74
80	389.16	12.42	3.30%	1.24	34.96	1.52	4.55%	0.15	11,132	-134.57	-1.19%	-13.46
70	401.58	12.42	3.19%	1.24	36.48	1.52	4.35%	0.15	11,008	-123.36	-1.11%	-12.34
59	414	12.42	3.09%	1.13	38	1.52	4.17%	0.14	10,895	-113.49	-1.03%	-10.32
Average:	407.79	12.42	3.14%	1.19	37.24	1.52	4.26%	0.15	10,951	-118.42	-1.07%	-11.33

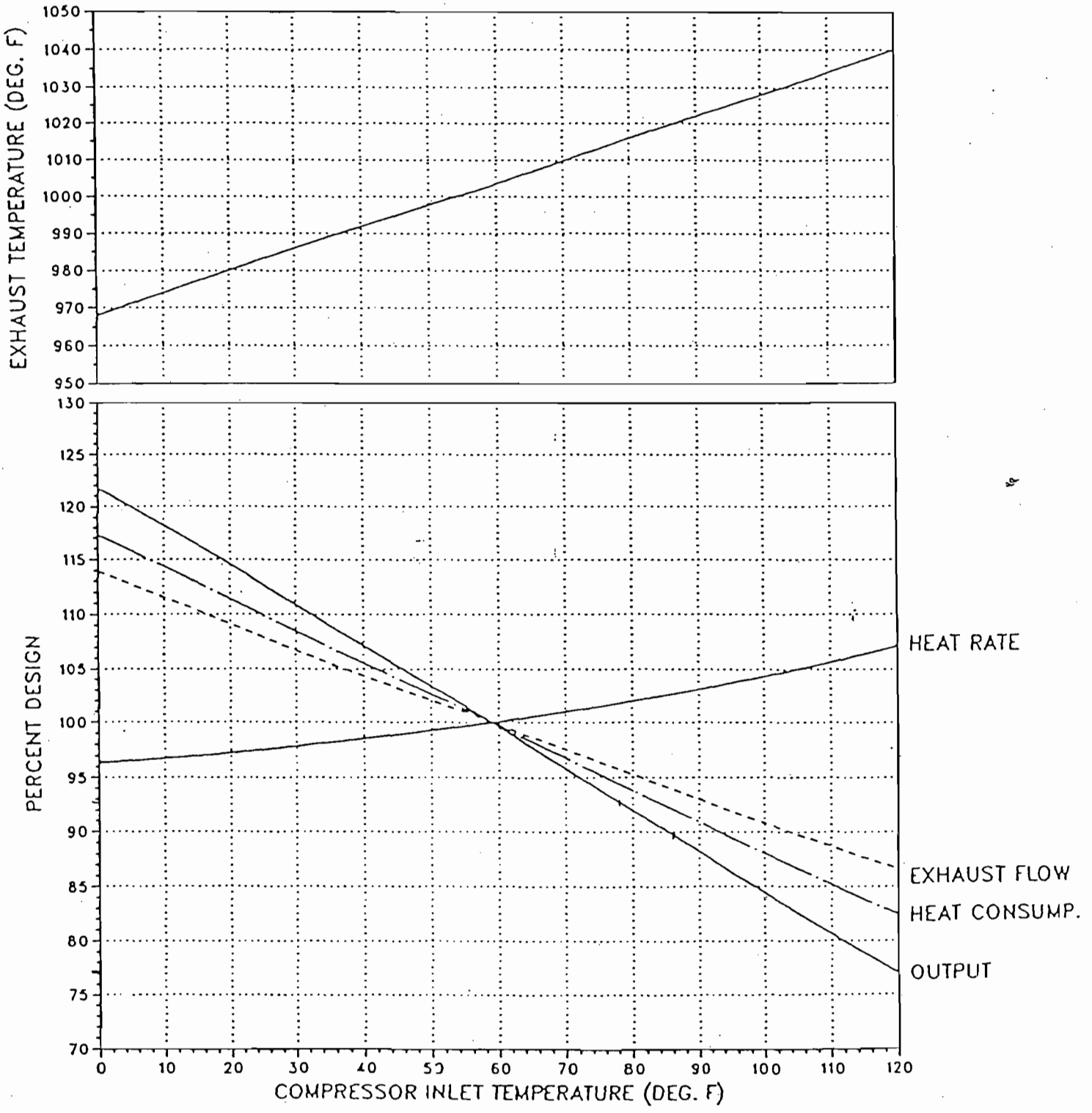
Table B-2. Combustion Turbine Performance Data - General Electric Model PG6541(B) Gas Turbine Firing Distillate Oil

Temp. (°F)	Heat Input (mmBtu/hr)	Increase (mmBtu/hr)	Increase (%)	Average mmBtu/hr per °F	Capacity (MW)	Increase (MW)	Increase (%)	Average Increase(MW) per °F	Heat Rate (Btu/kWhr)	Decrease (Btu/kWhr)	Decrease (%)	Average Decrease per °F
100	400.4				31.92				12,544			
90	414.05	13.65	3.41%	1.37	33.44	1.52	4.76%	0.15	12,382	-161.98	-1.29%	-16.20
80	427.7	13.65	3.30%	1.37	34.96	1.52	4.55%	0.15	12,234	-147.90	-1.19%	-14.79
70	441.35	13.65	3.19%	1.37	36.48	1.52	4.35%	0.15	12,098	-135.57	-1.11%	-13.56
59	455	13.65	3.09%	1.24	38	1.52	4.17%	0.14	11,974	-124.73	-1.03%	-11.34
Average:	448.18	13.65	3.14%	1.30	37.24	1.52	4.26%	0.15	12,036	-130.15	-1.07%	-12.45

GENERAL ELECTRIC MODEL PG6541(B) GAS TURBINE
ESTIMATED PERFORMANCE

OUTPUT, HEAT RATE, HEAT CONSUMPTION
EXHAUST FLOW AND EXHAUST TEMPERATURE AT 100% SPEED

FUELS: NATURAL GAS AND DISTILLATE
MODE: BASE LOAD



DATE 9/11/87

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ATTACHMENT C

TITLE V SPECIFIC CONDITIONS

FOR CITY OF VERO BEACH UNIT 5

FINAL Permit No.: 0610029-002-AV

Subsection E. This section addresses the following emissions unit.

005	Combined Cycle Gas Turbine, Unit 5, rated at 38 MW, 455 mmBtu/hr for number 2 fuel oil and 414 mmBtu/hr for natural gas, capable of burning any combination of, number 2 fuel oil, and natural gas, with emissions exhausted through a 125 ft. stack.

{Permitting Notes: This emissions unit is regulated under Acid Rain, Phase II and Rule 62-210.300, F.A.C., Permits Required and is subject to 40 CFR 60, Subpart GG, Standards of Performance for New Stationary Gas Turbines. The affected facility to which this subpart applies is the combined cycle gas turbine, Unit 5. This unit underwent a BACT Determination dated June 28, 1991. BACT Limits were incorporated into the subsequent PSD permits including AC 31-253502 (PSD-FL-152B). Exhaust is vented through the heat recovery steam generator that is not equipped with duct burners and then through a 125 ft. stack. Emissions are controlled by dry low-NOx burners when firing natural gas, and by water injection when firing fuel oil. The turbine exhaust may also be vented through a bypass stack for simple cycle operation. The turbine began commercial operation in 1992.}

The following specific conditions apply to the emissions unit listed above:

Essential Potential to Emit (PTE) Parameters

E.1. Permitted Capacity. The maximum operation heat input rates are as follows:

Unit No.	mmBtu/hr Heat Input	Fuel Type
005	414*	Natural Gas
	455*	No. 2 Fuel Oil

* Based on 101.3 kilopascals pressure, 288 Kelvin and 60% relative humidity (ISO standard day conditions), and lower heating value of the fuel fired.
[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C., and AC 31-253502 (PSD-FL-152B)]

E.2. Emissions Unit Operating Rate Limitation After Testing. See specific condition **E.10.**
[Rule 62-297.310(2), F.A.C.]

E.3. Methods of Operation - Fuels. Any combination of only natural gas and number 2 fuel oil shall be fired in the combustion turbine. See specific conditions **E.4** and **E.6** of this permit. {Note: The limitations of specific conditions **E.4** and **E.6** are more stringent than the NSPS sulfur dioxide limitation and thus assure compliance with 40 CFR 60.333 and 60.334.}
[Rule 62-213.410, F.A.C.]

E.4. Fuel Oil Consumption Limits. The permitted fuel oil utilization rates for this emissions unit are:

a. Maximum annual consumption of number 2 fuel oil shall not exceed 10,000,000 gal./yr.
b. Maximum annual firing using number 2 fuel oil shall not exceed 33% of the annual capacity factor.

[Rules 62-4.070(3) and 62-213.440, F.A.C., and AC 31-253502 (PSD-FL-152B)]

Emission Limitations and Standards

E.5. Visible Emissions Visible emissions shall not exceed 10% opacity.
[AC 31-253502 (PSD-FL-152B)]

E.6. Sulfur Dioxide - Sulfur Content. The No. 2 fuel oil sulfur content shall not exceed 0.25 percent, by weight. See specific conditions **E.11 and E.12** of this permit. The natural gas sulfur content shall not exceed 10 grains per hundred cubic feet (standard conditions). See specific condition **E.15** of this permit.
{Note: The limitations of specific conditions **E.4** and **E.6** are more stringent than the NSPS sulfur dioxide limitation and thus assure compliance with 40 CFR 60.333 and 60.334. The sulfur limitation on natural gas has been added to assure compliance with 40 CFR 60.333.}
[Rules 62-4.070(3) and 62-213.440, F.A.C., and AC 31-253502 (PSD-FL-152B)]

E.7. The maximum allowable emissions from Unit 5 shall not exceed the emission limitations listed below.

Pollutant	Emission Limits			Basis
	Gas	Number 2 Fuel Oil	Tons/Year [a, b]	
NOx [c]	25 ppmvd at 15% oxygen on a dry basis	42 ppmvd at 15% oxygen on a dry basis	243.7	BACT
SO_2	Natural gas as fuel	0.25% S by weight	178.2	BACT
PM_{10}	0.006 lb/mmBtu	0.025 lb/mmBtu	23.7	BACT
VOC	0.0112 lb/mmBtu	0.0113 lb/mmBtu	21.0	PSD-FL-152B
CO	0.0224 lb/mmBtu	0.0226 lb/mmBtu	42.1	PSD-FL-152B

a Tons per year based on 67% capacity factor for natural gas firing, 33% capacity factor number 2 fuel oil firing.
b Based on 455 mmBtu/hr for number 2 fuel oil and 414 mmBtu/hr for natural gas.
c NOx emission limit during co-firing of natural gas and number 2 fuel oil shall be determined by the following:

$$\text{NOx Limit} = \frac{(Lg \times Qg) + (Lo \times Qo)}{Qg + Qo}$$

where:
Lg = Emission limit for natural gas
Qg = Heat input of natural gas
Lo = Emission limit for fuel oil
Qo = Heat input of fuel oil

{Note: The limitations of specific condition **E.7** are more stringent than the NSPS nitrogen oxides limitation and thus ensure compliance with 40 CFR 60.332 and 60.334.}
[AC 31-253502 (PSD-FL-152B) and requested by applicant in the initial Title V permit application received June 14, 1996]

Test Methods and Procedures

E.8. Annual Compliance Tests. Except as provided in specific conditions F.6 and F.8 of this permit, emission testing for visible emissions and nitrogen oxides shall be performed annually, no later than August 1st of each year, in accordance with specific condition **E.10**, with the fuel(s) used for more than 400 hours in the preceding 12-month period. Tests shall be conducted using the following EPA reference methods in accordance with 40 CFR 60, Appendix A:

a. Method 9 for VE;
b. Method 20 for NOx.

If the unit is not operating because of scheduled maintenance outages and emergency repairs, it will be tested within thirty days of returning to service.
[Rules 62-4.070(3) and 62-213.440, F.A.C., and AC 31-253502 (PSD-FL-152B)]

E.9. Testing for PM, CO, VOC. Except as provided in specific condition **F.6** of this permit, emission testing for emissions of particulate matter and carbon monoxide shall be performed in the year prior to renewal of this permit, in accordance with specific condition **E.10**, while burning fuel oil. Emission testing for emissions of VOC shall be performed only if the CO test does not demonstrate compliance with the emissions limitation of specific condition **E.7** of this permit. Particulate matter tests shall be conducted using EPA test methods 5 or 17. Carbon monoxide tests shall be conducted using EPA test method 10. VOC tests, if required, shall be conducted using EPA test method 25A.
[Rules 62-4.070(3) and 62-213.440, F.A.C., and AC 31-253502 (PSD-FL-152B)]

E.10. Additional Test Requirements. Test results shall be the average of three valid runs. Testing of emissions shall be conducted with the emissions unit operating at permitted capacity, which is defined as 95-100 percent of the maximum heat input rate allowed by this permit, achievable for the average ambient air temperature during the test. If it is impracticable to test at permitted capacity, the emissions unit may be tested at less than permitted capacity. In such cases, subsequent operation is limited by adjusting downward the entire heat input vs. inlet temperature curve by the increment equal to the difference between the maximum permitted heat input value and 105 percent of the value reached during the test. Once the emissions unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purpose of additional compliance testing to regain the authority to operate at the permitted capacity. Data, curves, and calculations necessary to demonstrate the heat input rate correction at both design and test conditions shall be submitted to the Department with the compliance test report.
[AC 31-253502 (PSD-FL-152B)]

E.11. Sulfur Dioxide - Sulfur Content. The permittee shall demonstrate compliance with the liquid fuel sulfur limit by fuel sampling and analysis. See specific conditions **E.6 and E.12**. The permittee shall demonstrate compliance with the gaseous fuel sulfur limit via record keeping. See specific condition **E.15**.
[Rules 62-4.070(3) and 62-213.440, F.A.C.]

E.12. Fuel Sampling & Analysis - Sulfur. Compliance with the liquid fuel sulfur limit shall be determined using fuel sampling and analysis in accordance with the fuel sampling and analysis requirements of 40 CFR 75, Appendix D.
[Rule 62-213.440, F.A.C., and , and AC 31-253502 (PSD-FL-152B)]

Monitoring of Operations

E.13. Continuous Monitoring Required. A continuous monitoring system shall be maintained to record fuel consumption. A continuous monitoring system shall be maintained to record emissions of nitrogen oxides in accordance with the requirements of 40 CFR 75.
[AC 31-253502 (PSD-FL-152B) and requested by applicant in the initial Title V permit application received June 14, 1996]

E.14. Excess Emissions by CEMS. The CEMS for NOx shall be used to determine periods of excess emissions. Excess emissions are defined for this emissions unit as any 60-minute period during which the average emissions exceed the emission limits of specific condition **E.7** of this permit. Periods of startup, shutdown, malfunction shall be monitored, recorded and reported with excess emissions following the format and requirements of 40 CFR 60.7.
{Note: The requirements of specific condition **E.14** are more stringent than the NSPS monitoring provisions and thus assure compliance with 40 CFR 60.334 and 60.335.}
[Rules 62-4.070(3) and 62-213.440, F.A.C.]

Record Keeping and Reporting Requirements

E.15. Natural Gas Sulfur Content Records Required. The owner or operator shall monitor the sulfur content of natural gas received in accordance with the custom fuel monitoring schedule in Appendix M of this permit.
[Rules 62-4.070(3) and 62-213.440, F.A.C.]

E.16. Additional Reports Required. The owner or operator shall report the following with the Air Operating Report (AOR): sulfur content, by weight, and lower heating value of the fuel oil fired in the previous year, sulfur content of natural gas recorded in the previous year, annual fuel consumption of number 2 fuel oil and natural gas, and hours of operation per fuel usage (single fired and co-fired).
[Rule 62-210.370(3), F.A.C., and, AC 31-253502 (PSD-FL-152B)]

Other Conditions

E.17. This emissions unit is also subject to conditions **F.1** through **F.18, except for F.2, F.3, F.7 and F.8,** contained in **Subsection F. Common Conditions.**

E.18. This emissions unit is also subject to condition **G.1** through **G.6** contained in **Subsection G. NSPS Common Conditions.**

Subsection F. Common Conditions.

E.U. ID No.	Brief Description
001	Fossil Fuel Steam Generator, Unit 1
002	Fossil Fuel Steam Generator, Unit 2
003	Fossil Fuel Steam Generator, Unit 3
004	Fossil Fuel Steam Generator, Unit 4
005	Combined Cycle Gas Turbine, Unit 5

The following conditions apply to the emissions units listed above:

Essential Potential to Emit (PTE) Parameters

F.1. Hours of Operation. These emissions units may operate continuously, i.e., 8,760 hours/year.
[Rule 62-210.200(PTE), F.A.C.]

Emission Limitations and Standards

{Permitting Notes: Table 1-1, Summary of Air Pollutant Standards and Terms, summarizes information for convenience purposes only. This table does not supersede any of the terms or conditions of this permit.}

Excess Emissions

F.2. (This condition is not applicable to emissions units 004 and 005.) Excess emissions resulting from malfunction shall be permitted provided that best operational practices to minimize emissions are adhered to and the duration of excess emissions shall be minimized but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for longer duration.
[Rule 62-210.700(1), F.A.C.]

F.3. (This condition is not applicable to emissions units 004 and 005.) Excess emissions resulting from startup or shutdown shall be permitted provided that best operational practices to minimize emissions are adhered to and the duration of excess emissions shall be minimized.
[Rule 62-210.700(2), F.A.C.]

F.4. Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during startup, shutdown or malfunction shall be prohibited.
[Rule 62-210.700(4), F.A.C.]

Monitoring of Operations

F.5. Determination of Process Variables.
(a) Required Equipment. The owner or operator of an emissions unit for which compliance tests are required shall install, operate, and maintain equipment or instruments necessary to determine

process variables, such as process weight input or heat input, when such data are needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.
(b) Accuracy of Equipment. Equipment or instruments used to directly or indirectly determine process variables, including devices such as belt scales, weight hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable process variable to be determined within 10% of its true value.
[Rule 62-297.310(5), F.A.C.]

F.6. Frequency of Compliance Tests. The following provisions apply only to those emissions units that are subject to an emissions limiting standard for which compliance testing is required.
(a) General Compliance Testing.

2. For excess emission limitations for particulate matter specified in Rule 62-210.700, F.A.C., a compliance test shall be conducted annually while the emissions unit is operating under soot blowing conditions in each federal fiscal year during which soot blowing is part of normal emissions unit operation, except that such test shall not be required in any federal fiscal year in which a fossil fuel steam generator does not burn liquid and/or solid fuel for more than 400 hours other than during startup.
3. The owner or operator of an emissions unit that is subject to any emission limiting standard shall conduct a compliance test that demonstrates compliance with the applicable emission limiting standard prior to obtaining a renewed operation permit. Emissions units that are required to conduct an annual compliance test may submit the most recent annual compliance test to satisfy the requirements of this provision. In renewing an air operation permit pursuant to Rule 62-210.300(2)(a)3.b., c., or d., F.A.C., the Department shall not require submission of emission compliance test results for any emissions unit that, during the year prior to renewal:
    a. Did not operate; or
    b. In the case of a fuel burning emissions unit, burned liquid fuel for a total of no more than 400 hours.
4. During each federal fiscal year (October 1 -- September 30), unless otherwise specified by rule, order, or permit, the owner or operator of each emissions unit shall have a formal compliance test conducted for:
    a. Visible emissions, if there is an applicable standard;
    b. Each of the following pollutants, if there is an applicable standard, and if the emissions unit emits or has the potential to emit: 5 tons per year or more of lead or lead compounds measured as elemental lead; 30 tons per year or more of acrylonitrile; or 100 tons per year or more of any other regulated air pollutant; and
5. An annual compliance test for particulate matter emissions shall not be required for any fuel burning emissions unit that, in a federal fiscal year, does not burn liquid and/or solid fuel, other than during startup, for a total of more than 400 hours.
8. Any combustion turbine that does not operate for more than 400 hours per year shall conduct a visible emissions compliance test once per each five-year period, coinciding with the term of its air operation permit.
9. The owner or operator shall notify the Department, at least 15 days prior to the date on which each formal compliance test is to begin, of the date, time, and place of each such test, and the test contact person who will be responsible for coordinating and having such test conducted for the owner or operator.

(b) Special Compliance Tests. When the Department, after investigation, has good reason (such as complaints, increased visible emissions or questionable maintenance of control equipment) to believe that any applicable emission standard contained in a Department rule or in a permit issued pursuant to those rules is being violated, it may require the owner or operator of the emissions unit to conduct compliance tests which identify the nature and quantity of pollutant emissions from the emissions unit and to provide a report on the results of said tests to the Department.
(c) Waiver of Compliance Test Requirements. If the owner or operator of an emissions unit that is subject to a compliance test requirement demonstrates to the Department, pursuant to the procedure established in Rule 62-297.620, F.A.C., that the compliance of the emissions unit with an applicable weight emission limiting standard can be adequately determined by means other than the designated test procedure, such as specifying a surrogate standard of no visible emissions for particulate matter sources equipped with a bag house or specifying a fuel analysis for sulfur dioxide emissions, the Department shall waive the compliance test requirements for such emissions units and order that the alternate means of determining compliance be used, provided, however, the provisions of Rule 62-297.310(7)(b), F.A.C., shall apply.
[Rule 62-297.310(7), F.A.C.; SIP approved]

F.7. (This condition is not applicable to emissions unit 005.) When PM Tests Not Required. Annual and permit renewal compliance testing for particulate matter emissions is not required for these emissions units while burning:

a. only gaseous fuel(s); or
b. gaseous fuel(s) in combination with any amount of liquid fuel(s) for less than 400 hours per year; or
c. only liquid fuel(s) for less than 400 hours per year.

[Rules 62-297.310(7)(a)3. & 5., F.A.C.; and, ASP Number 97-B-01.]

F.8. (This condition is not applicable to emissions unit 005.) When VE Tests Not Required. By this permit, annual emissions compliance testing for visible emissions is not required for these emissions units while burning:

a. only gaseous fuel(s); or
b. gaseous fuel(s) in combination with any amount of liquid fuel(s) for less than 400 hours per year; or
c. only liquid fuel(s) for less than 400 hours per year.

[Rule 62-4.070(3), F.A.C.]

Test Methods and Procedures

{Permitting Notes: The attached Table 2-1, Summary of Compliance Requirements, summarizes information for convenience purposes only. This table does not supersede any of the terms or conditions of this permit.}

F.9. Visible Emissions - Boiler 4, Turbine. The test method for visible emissions for emissions units 004 (Unit 4) and 005 (Turbine, Unit 5) shall be EPA Method 9, adopted and incorporated by reference in Rule 62-204.800, F.A.C., and referenced in Chapter 62-297, F.A.C.
[Rules 62-204.800 and 62-297.401, F.A.C.]

F.10. Visible Emissions - Boilers, Units 1, 2 and 3. The test method for visible emissions for emissions units 001 (Unit 1), 002 (Unit 2) and 003 (Unit 3) shall be DEP Method 9, incorporated in Chapter 62-297, F.A.C. A transmissometer may be used and calibrated according to Rule 62-297.520, F.A.C. See specific condition **F.11**.
[Rules 62-296.405(1)(e)1. and 62-297.401, F.A.C.]

F.11. DEP Method 9. The provisions of EPA Method 9 (40 CFR 60, Appendix A) are adopted by reference with the following exceptions:

1. EPA Method 9, Section 2.4, Recording Observations. Opacity observations shall be made and recorded by a certified observer at sequential fifteen second intervals during the required period of observation.
2. EPA Method 9, Section 2.5, Data Reduction. For a set of observations to be acceptable, the observer shall have made and recorded, or verified the recording of, at least 90 percent of the possible individual observations during the required observation period. For single-valued opacity standards (e.g., 20 percent opacity), the test result shall be the highest valid six-minute average for the set of observations taken. For multiple-valued opacity standards (e.g., 20 percent opacity, except that an opacity of 40 percent is permissible for not more than two minutes per hour) opacity shall be computed as follows:
    a. For the basic part of the standard (i.e., 20 percent opacity) the opacity shall be determined as specified above for a single-valued opacity standard.
    b. For the short-term average part of the standard, opacity shall be the highest valid short-term average (i.e., two-minute, three-minute average) for the set of observations taken.

In order to be valid, any required average (i.e., a six-minute or two-minute average) shall be based on all of the valid observations in the sequential subset of observations selected, and the selected subset shall contain at least 90 percent of the observations possible for the required averaging time. Each required average shall be calculated by summing the opacity value of each of the valid observations in the appropriate subset, dividing this sum by the number of valid observations in the subset, and rounding the result to the nearest whole number. The number of missing observations in the subset shall be indicated in parenthesis after the subset average value.
[Rule 62-297.401, F.A.C.]

F.12. Required Number of Test Runs. For mass emission limitations, a compliance test shall consist of three complete and separate determinations of the total air pollutant emission rate through the test section of the stack or duct and three complete and separate determinations of any applicable process variables corresponding to the three distinct time periods during which the stack emission rate was measured provided, however, that three complete and separate determinations shall not be required if the process variables are not subject to variation during a compliance test, or if three determinations are not necessary in order to calculate the unit's emission rate. The three required test runs shall be completed within one consecutive five day period. In the event that a sample is lost or one of the three runs must be discontinued because of circumstances beyond the control of the owner or operator, and a valid third run cannot be obtained within the five day period allowed for the test, the Secretary or his or her designee may accept the results of the two complete runs as proof of compliance, provided that the arithmetic mean of the results of the two complete runs is at least 20 percent below the allowable emission limiting standards.
[Rule 62-297.310(1), F.A.C.]

F.13. Calculation of Emission Rate. The indicated emission rate or concentration shall be the arithmetic average of the emission rate or concentration determined by each of the separate test runs unless otherwise specified in a particular test method or applicable rule.
[Rule 62-297.310(3), F.A.C.]

F.14. Operating Rate During Testing. Testing of emissions shall be conducted with each emissions unit operation at permitted capacity, which is defined as 90 to 100 percent of the maximum operation rate allowed by the permit. If it is impracticable to test at permitted capacity, an emissions unit may be tested at less than the minimum permitted capacity; in this case, subsequent emissions unit operation is limited to 110 percent of the test load until a new test is conducted. Once the emissions unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purpose of additional compliance testing to regain the authority to operate at the permitted capacity.
[Rules 62-297.310(2) & (2)(b), F.A.C.]

F.15. Applicable Test Procedures.
(a) Required Sampling Time.
1. Unless otherwise specified in the applicable rule, the required sampling time for each test run shall be no less than one hour and no greater than four hours, and the sampling time at each sampling point shall be of equal intervals of at least two minutes.
2. Opacity Compliance Tests. When either EPA Method 9 or DEP Method 9 is specified as the applicable opacity test method, the required minimum period of observation for a compliance test shall be sixty (60) minutes for emissions units which emit or have the potential to emit 100 tons per year or more of particulate matter, and thirty (30) minutes for emissions units which have potential emissions less than 100 tons per year of particulate matter and are not subject to a multiple-valued opacity standard. The opacity test observation period shall include the period during which the highest opacity emissions can reasonably be expected to occur. Exceptions to these requirements are as follows:
c. The minimum observation period for opacity tests conducted by employees or agents of the Department to verify the day-to-day continuing compliance of a unit or activity with an applicable opacity standard shall be twelve minutes.
(b) Minimum Sample Volume. Unless otherwise specified in the applicable rule, the minimum sample volume per run shall be 25 dry standard cubic feet.
(c) Required Flow Rate Range. For EPA Method 5 particulate sampling, acid mist/sulfur dioxide, and fluoride sampling which uses Greenburg Smith type impingers, the sampling nozzle and sampling time shall be selected such that the average sampling rate will be between 0.5 and 1.0 actual cubic feet per minute, and the required minimum sampling volume will be obtained.
(d) Calibration of Sampling Equipment. Calibration of the sampling train equipment shall be conducted in accordance with the schedule shown in Table 297.310-1.
(e) Allowed Modification to EPA Method 5. When EPA Method 5 is required, the following modification is allowed: the heated filter may be separated from the impingers by a flexible tube.
[Rule 62-297.310(4), F.A.C.]

F.16. Required Stack Sampling Facilities. When a mass emissions stack test is required, the owner or operator shall comply with the requirements contained in Appendix SS-1, Stack Sampling Facilities, attached to this permit.
[Rule 62-297.310(6), F.A.C.]

Record Keeping and Reporting Requirements

F.17. Malfunctions - Notification. In the case of excess emissions resulting from malfunctions, each owner or operator shall notify the Central District Air Section in accordance with Rule 62-4.130, F.A.C. A full written report on the malfunctions shall be submitted in a quarterly report, if requested by the Central District Air Section.
[Rule 62-210.700(6), F.A.C.]

F.18. Test Reports.
(a) The owner or operator of an emissions unit for which a compliance test is required shall file a report with the Central District Air Section on the results of each such test.
(b) The required test report shall be filed with the Central District Air Section as soon as practical but no later than 45 days after the last sampling run of each test is completed.
(c) The test report shall provide sufficient detail on the emissions unit tested and the test procedures used to allow the Central District Air Section to determine if the test was properly conducted and the test results properly computed. As a minimum, the test report, other than for an EPA or DEP Method 9 test, shall provide the following information:

1. The type, location, and designation of the emissions unit tested.
2. The facility at which the emissions unit is located.
3. The owner or operator of the emissions unit.
4. The normal type and amount of fuels used and materials processed, and the types and amounts of fuels used and material processed during each test run.
5. The means, raw data and computations used to determine the amount of fuels used and materials processed, if necessary to determine compliance with an applicable emission limiting standard.
6. The type of air pollution control devices installed on the emissions unit, their general condition, their normal operating parameters (pressure drops, total operating current and GPM scrubber water), and their operating parameters during each test run.
7. A sketch of the duct within 8 stack diameters upstream and 2 stack diameters downstream of the sampling ports, including the distance to any upstream and downstream bends or other flow disturbances.
8. The date, starting time and duration of each sampling run.
9. The test procedures used, including any alternative procedures authorized pursuant to Rule 62-297.620, F.A.C. Where optional procedures are authorized in this chapter, indicate which option was used.
10. The number of points sampled and configuration and location of the sampling plane.
11. For each sampling point for each run, the dry gas meter reading, velocity head, pressure drop across the stack, temperatures, average meter temperatures and sample time per point.
12. The type, manufacturer and configuration of the sampling equipment used.
13. Data related to the required calibration of the test equipment.
14. Data on the identification, processing and weights of all filters used.
15. Data on the types and amounts of any chemical solutions used.
16. Data on the amount of pollutant collected from each sampling probe, the filters, and the impingers, are reported separately for the compliance test.
17. The names of individuals who furnished the process variable data, conducted the test, analyzed the samples and prepared the report.

18. All measured and calculated data required to be determined by each applicable test procedure for each run.
19. The detailed calculations for one run that relate the collected data to the calculated emission rate.
20. The applicable emission standard, and the resulting maximum allowable emission rate for the emissions unit, plus the test result in the same form and unit of measure.
21. A certification that, to the knowledge of the owner or his authorized agent, all data submitted are true and correct. When a compliance test is conducted for the Department or its agent, the person who conducts the test shall provide the certification with respect to the test procedures used. The owner or his authorized agent shall certify that all data required and provided to the person conducting the test are true and correct to his knowledge.

[Rules 62-213.440 and 62-297.310(8), F.A.C.]

Subsection G. NSPS Common Conditions.

E.U. ID No.	Brief Description
004	Fossil Fuel Steam Generator, Unit 4
005	Combined Cycle Gas Turbine, Unit 5

{Permitting Notes: The emissions units above are subject to the following conditions from 40 CFR 60 Subpart A, General Provisions. The affected facilities to which this subpart applies are fossil fuel steam generator, Unit 4 and the combined cycle gas turbine, Unit 5. To the extent allowed by law, the Administrator shall mean the Department.}

The following conditions apply to the NSPS emissions units listed above:

G.1. Pursuant to 40 CFR 60.7 Notification And Record Keeping.

(a) Any owner or operator subject to the provisions of 40 CFR 60 shall furnish the Administrator written notification as follows:
(4) A notification of any physical or operational change to an existing facility which may increase the emission rate of any air pollutant to which a standard applies, unless that change is specifically exempted under an applicable subpart or in 40 CFR 60.14(e). This notice shall be postmarked 60 days or as soon as practicable before the change is commenced and shall include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the facility before and after the change, and the expected completion date of the change. The Administrator may request additional relevant information subsequent to this notice.
(b) The owner or operator subject to the provisions of 40 CFR 60 shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.
(c) The owner or operator required to install a continuous monitoring system (CMS) or monitoring device shall submit an excess emissions and monitoring systems performance report (excess emissions are defined in applicable subparts) and/or a summary report form (see 40 CFR 60.7(d)) to the Administrator semiannually, except when: more frequent reporting is specifically required by an applicable subpart; or the CMS data are to be used directly for compliance determination, in which case quarterly reports shall be submitted; or the Administrator, on a case-by-case basis, determines that more frequent reporting is necessary to accurately assess the compliance status of the source. All reports shall be postmarked by the 30th day following the end of each calendar half (or quarter, as appropriate). Written reports of excess emissions shall include the following information:
(1) The magnitude of excess emissions computed in accordance with 40 CFR 60.13(h), any conversion factor(s) used, and the date and time of commencement and completion of each time period of excess emissions. The process operating time during the reporting period.
(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventative measures adopted.

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.

(4) When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.

(d) The summary report form shall contain the information and be in the format shown in Figure 1 unless otherwise specified by the Administrator. One summary report form shall be submitted for each pollutant monitored at each affected facility.

(1) If the total duration of excess emissions for the reporting period is less than 1 percent of the total operating time for the reporting period and CMS downtime for the reporting period is less than 5 percent of the total operating time for the reporting period, only the summary report form shall be submitted and the excess emission report described in 40 CFR 60.7(c) need not be submitted unless requested by the Administrator.

(2) If the total duration of excess emissions for the reporting period is 1 percent or greater of the total operating time for the reporting period or the total CMS downtime for the reporting period is 5 percent or greater of the total operating time for the reporting period, the summary report form and the excess emission report described in 40 CFR 60.7(c) shall both be submitted.

[See Attached Figure 1-Summary Report-Gaseous and Opacity Excess Emission and Monitoring System Performance]

(e)(1) Notwithstanding the frequency of reporting requirements specified in paragraph (c) of this section, an owner or operator who is required by an applicable subpart to submit excess emissions and monitoring systems performance reports (and summary reports) on a quarterly (or more frequent) basis may reduce the frequency of reporting for that standard to semiannual if the following conditions are met:

(i) For one full year (e.g., four quarterly or twelve monthly reporting periods) the affected facility's excess emissions and monitoring systems reports submitted to comply with a standard under 40 CFR 60 continually demonstrate that the facility is in compliance with the applicable standard;

(ii) The owner or operator continues to comply with all record keeping and monitoring requirements specified in this subpart and the applicable standard; and

(iii) The Administrator does not object to reduced frequency of reporting for the affected facility, as provided in paragraph (e)(2) of this section.

(2) The frequency of reporting of excess emissions and monitoring systems performance (and summary) reports may be reduced only after the owner or operator notifies the Administrator in writing of his or her intention to make such a change and the Administrator does not object to the intended change. In deciding whether to approve a reduced frequency of reporting, the Administrator may review information concerning the source's entire previous performance history during the required record keeping period prior to the intended change, including performance test results, monitoring data, and evaluations of an owner or operator's conformance with operation and maintenance requirements. Such information may be used by the Administrator to make a judgment about the source's potential for noncompliance in the future. If the Administrator disapproves the owner or operator's request to reduce the frequency of reporting, the Administrator will notify the owner or operator in writing within 45 days after receiving notice of the owner or operator's intention. The notification from the Administrator to the owner or operator will specify the grounds on which the disapproval is based. In the absence of a notice of disapproval within 45 days, approval is automatically granted.

(3) As soon as monitoring data indicate that the affected facility is not in compliance with any emission limitation or operating parameter specified in the applicable standard, the frequency of reporting shall revert to the frequency specified in the applicable standard, and the owner or operator shall submit an excess emissions and monitoring systems performance report (and summary report, if required) at the next appropriate reporting period following the noncomplying event. After demonstrating compliance with the applicable standard for another full year, the owner or operator may again request approval from the Administrator to reduce the frequency of reporting for that standard as provided for in paragraphs (e)(1) and (e)(2) of this section.
(f) The owner or operator subject to the provisions of 40 CFR 60 shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by 40 CFR 60 recorded in a permanent form suitable for inspection. The file shall be retained for at least five years following the date of such measurements, maintenance, reports, and records.
[40 CFR 60.7 and Rule 62-213.440(1)(b)2.b., F.A.C.]

G.2. Pursuant to 40 CFR 60.8 Performance Tests.

(b) Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart, except as otherwise authorized by an approved alternative method.
(c) Performance tests shall be conducted under such conditions as the Administrator shall specify to the plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of the performance tests. Operations during periods of startup, shutdown, and malfunction shall not constitute representative conditions for the purpose of a performance test nor shall emissions in excess of the level of the applicable emission limit during periods of startup, shutdown, and malfunction be considered a violation of the applicable emission limit unless otherwise specified in the applicable standard.
(f) Unless otherwise specified in the applicable subpart, each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic means of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances, beyond the owner or operator's control, compliance may, upon the Administrator's approval, be determined using the arithmetic mean of the results of the two other runs.
[40 CFR 60.8]

G.3. Pursuant to 40 CFR 60.11 Compliance With Standards And Maintenance Requirements.

(a) Compliance with standards in 40 CFR 60, other than opacity standards, shall be determined only by performance tests established by 40 CFR 60.8, unless otherwise specified in the applicable standard.
(b) **(This paragraph is only applicable to emissions unit 004.)** Compliance with opacity standards in 40 CFR 60 shall be determined by conducting observations in accordance with

Reference Method 9 in appendix A of 40 CFR 60, any alternative method that is approved by the Administrator, or as provided in 40 CFR 60.11(e)(5).
(c) **(This paragraph is only applicable to emissions unit 004.)** The opacity standards set forth in 40 CFR 60 shall apply at all times except during periods of startup, shutdown, malfunction, and as otherwise provided in the applicable standard.
(d) At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.
(e)(5) **(This paragraph is only applicable to emissions unit 004.)** The owner or operator of an affected facility subject to an opacity standard may submit, for compliance purposes, continuous opacity monitoring system (COMS) data results produced during any performance test required under 40 CFR 60.8 in lieu of Method 9 observation data. If an owner or operator elects to submit COMS data for compliance with the opacity standard, he shall notify the Administrator of that decision, in writing, at least 30 days before any performance test required under 40 CFR 60.8 is conducted. Once the owner or operator of an affected facility has notified the Administrator to that effect, the COMS data results will be used to determine opacity compliance during subsequent tests required under 40 CFR 60.8 until the owner or operator notifies the Administrator, in writing, to the contrary. For the purpose of determining compliance with the opacity standard during a performance test required under 40 CFR 60.8 using COMS data, the minimum total time of COMS data collection shall be averages of all 6-minute continuous periods within the duration of the mass emission performance test. Results of the COMS opacity determinations shall be submitted along with the results of the performance test required under 60.8. The owner or operator of an affected facility using a COMS for compliance purposes is responsible for demonstrating that the COMS meets the requirements specified in 40 CFR 60.13(c), that the COMS has been properly maintained and operated, and that the resulting data have not been altered in any way. If COMS data results are submitted for compliance with the opacity standard for a period of time during which Method 9 data indicates noncompliance, the Method 9 data will be used to determine opacity compliance.
[40 CFR 60.11]

G.4. Pursuant to 40 CFR 60.12 Circumvention.

No owner or operator subject to the provisions of 40 CFR 60 shall build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere.
[40 CFR 60.12]

G.5. Pursuant to 40 CFR 60.13 Monitoring Requirements.

(a) For the purposes of this section, all continuous monitoring systems required under applicable subparts shall be subject to the provisions of this section upon promulgation of performance

specifications for continuous monitoring systems under appendix B of 40 CFR 60 and, if the continuous monitoring system is used to demonstrate compliance with emission limits on a continuous basis, appendix F to 40 CFR 60, unless otherwise specified in an applicable subpart or by the Administrator. Appendix F is applicable December 4, 1987.

(c) If the owner or operator of an affected facility elects to submit continuous opacity monitoring system (COMS) data for compliance with the opacity standard as provided under 40 CFR 60.11(e)(5), he/she shall conduct a performance evaluation of the COMS as specified in Performance Specification 1, appendix B, of 40 CFR 60 before the performance test required under 40 CFR 60.8 is conducted. Otherwise, the owner or operator of an affected facility shall conduct a performance evaluation of the COMS or continuous emission monitoring system (CEMS) during any performance test required under 40 CFR 60.8 or within 30 days thereafter in accordance with the applicable performance specification in appendix B of 40 CFR 60. The owner or operator of an affected facility shall conduct COMS or CEMS performance evaluations at such other times as may be required by the Administrator under section 114 of the Act.

(1) The owner or operator of an affected facility using a COMS to determine opacity compliance during any performance test required under 40 CFR 60.8 and as described in 40 CFR 60.11(e)(5), shall furnish the Administrator two or, upon request, more copies of a written report of the results of the COMS performance evaluation described in 40 CFR 60.13(c) at least 10 days before the performance test required under 40 CFR 60.8 is conducted.

(2) Except as provided in 40 CFR 60.13(c)(1), the owner or operator of an affected facility shall furnish the Administrator within 60 days of completion two or, upon request, more copies of a written report of the results of the performance evaluation.

(d)(1) Owners and operators of all continuous emission monitoring systems installed in accordance with the provisions of 40 CFR 60 shall check the zero (or low-level value between 0 and 20 percent of span value) and span (50 to 100 percent of span value) calibration drifts at least once daily in accordance with a written procedure. The zero and span shall, as a minimum, be adjusted whenever the 24-hour zero drift or 24-hour span drift exceeds two times the limits of the applicable performance specifications in appendix B. The system must allow the amount of excess zero and span drift measured at the 24-hour interval checks to be recorded and quantified, whenever specified. For continuous monitoring systems measuring opacity of emissions, the optical surfaces exposed to the effluent gases shall be cleaned prior to performing the zero and span drift adjustments except that for systems using automatic zero adjustments. The optical surfaces shall be cleaned when the cumulative automatic zero compensation exceeds 4 percent opacity.

(2) Unless otherwise approved by the Administrator, the following procedures shall be followed for continuous monitoring systems measuring opacity of emissions. Minimum procedures shall include a method for producing a simulated zero opacity condition and an upscale (span) opacity condition using a certified neutral density filter or other related technique to produce a known obscuration of the light beam. Such procedures shall provide a system check of the analyzer internal optical surfaces and all electronic circuitry including the lamp and photo detector assembly.

(e) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under 40 CFR 60.13(d), all continuous monitoring systems shall be in continuous operation and shall meet minimum frequency of operation requirements as follows:

(1) All continuous monitoring systems referenced by 40 CFR 60.13(c) for measuring opacity of emissions shall complete a minimum of one cycle of sampling and analyzing for each successive 10-second period and one cycle of data recording for each successive 6-minute period.