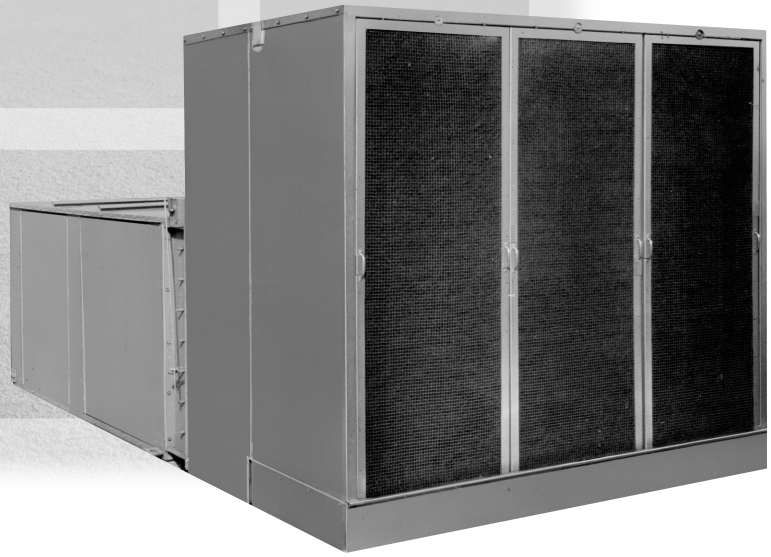
# ECS Direct Fired Evaporative Cooling System

**Technical Guide for:**

**Outdoor Mounted Units To 100,000 CFM**



Applied Air

Keeps You

# Comfortable

Applied Air

# ECS Direct Fired Evaporative Cooling System Technical Guide

Applied Air

In the business of commercial and industrial operations, efficient and low-cost heating is essential. Applied Air keeps you warm for less.

Since 1975, Applied Air has been providing cost-effective, reliable gas heating solutions. Our proven Direct Fired Evaporative Cooling System adds cool, fresh and clean air to your work environment for greater comfort and productivity. With evaporative cooling modules you now have year-round performance.

This Technical Guide will help you choose an Applied Air Direct Fired Evaporative Cooling System to provide efficient, cost-effective make-up air for your kitchen, warehouse, factory or process operation. The Guide covers:

- Technical Specifications — Configure the right system components (e.g., motors, drive, filter, options, etc.) to meet your needs.
- Installation Information — Plan details of on-site installation with dimensional information, unit weights and cabinet arrangement diagrams.

If you have questions, please contact Applied Air's Customer Service Department at 214-638-6010. We'll be glad to help.

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# Evaporative Cooling

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## The Latest In Cooling Technology

In many types of industries where efficient, low cost make-up air is essential, Applied Air has been the word for experience, reliability and innovation. Now Applied Air adds the benefits of evaporative cooling to the already popular and versatile Model DFC make-up air unit.

Applied Air has the facilities, resources and people to assure Leadership and Quality in research and development, design and engineering, manufacturing and service. The Turbocell/ Turbospray series evaporative coolers reflect our high quality standards and our commitment to leadership.

Add to this the professional planning assistance provided by Applied Air. We work with architects, engineers, building owners and plant managers to help select the right equipment, analyze the best way to install it and back it up with service.

## How The Evaporative Cooler Works

Whenever water is evaporated, heat is absorbed. Wet the back of your hand, then blow on it. The skin surface is immediately cooler. This demonstrates the basic principle of evaporative cooling.

The Turbocell works by drawing outside air through a uniquely designed cross-fluted media. Due to its internal geometry, a turbulent mist of air and water is created which optimizes heat transfer. An air washing effect is also created which removes most dust and dirt from the air stream before the air flows into the work area providing a clean, cool environment.

## Benefits Of Evaporative Cooling

Cooling without the cost of refrigeration and ozone destroying CFC refrigerants . . . Cooling nature's way, with water, eliminates the cost of expensive refrigeration systems and reduces operating and maintenance costs. Installation is simple and inexpensive.

### *Big Space or Small*

You can cool a small area or a big plant. With capacities from 5,000 to 100,000 CFM you have the flexibility to put cool air right where you want it. Air changes can be planned for one every 30 seconds to one every five minutes (12 to 120 times per hour) - depending on climate conditions and operational requirements.

### *Comfort Anywhere*

On a humid day in New Orleans the Turbocell can reduce the 93°F air to a relatively cool 70°-80°F. In drier Tucson, 104°F outside air can be brought down 30°F. The hotter and drier the air, the greater the reduction in temperature. That means maximum comfort when you need it most.

### *Ventilation*

Fresh air ventilation is available anytime by just turning off the water spray system. The Direct Fired air handler continues to operate, pumping in plenty of fresh outside air.

## Why Evaporative Cooling is Comfortable

### *Lowers Temperature*

The Direct Fired air handler pumps in cool air, lowering room temperature.

### *Lowers The Temperature You Feel*

The rapid moving air produced by the Direct Fired air handler increases skin surface evaporation. This results in effective cooling, meaning people feel 3 to 5 degrees cooler than the temperature read from a thermometer.

### *Carries Away Radiated Heat*

A constant flow of cool air removes heat from the work place, leaving the area more comfortable.

### *Fresh Air*

The Direct Fired air handler provides fresh, revitalizing air, forcing stale air out.

### *Cleans Air*

The Turbocell system cleans air by removing dust, dirt, pollen and foreign matter, creating a more refreshing environment.

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## Turbocell Features

***A) Cooling Media***
The media, with its unique cross-fluted design, not only offers a higher cooling efficiency (up to 90% in the 400 fpm range) with Turbodek, or slightly higher with Fiberdek, but is also more durable. Its self-cleaning action extends the life span years beyond that of most conventional media. Optional Fiberdek is U.L. approved with a U.L. 900, Class 2 rating.

***B) Optional Maxaire Prefilter***
Keeps bugs out, reduces odor-producing algae by keeping out sunlight, and helps minimize the accumulation of dust, dirt and other airborne particles in the water tank.

***C) Washer Cabinet and Water Pan***
Construction of 304 Stainless Steel

***D) Float Operated Valve***
3/8"; Maintains water level in tank; Parts are corrosion-resistant and replaceable.

***E) Bleed-off Valve***
1/4"; Manually adjustable; Brass construction; Reduces mineral buildup; Helps prevent media clogging, thus extending media life.

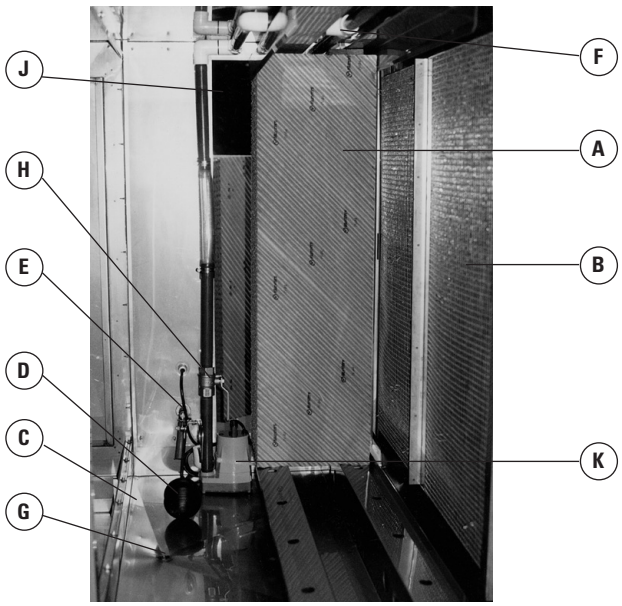
***F) Water Distribution Manifold***
Heavy-duty PVC with metered orifices and removable end caps for easy cleaning.

***G) Bottom Drain***
Drain pan is cross broke to center with stainless steel nipple welded in place to allow complete drainage of water pan.

***H) Water Regulator Valve***
Brass construction; Water flow can be field set.

***J) Access Panel***
Full size side panel provides easy access to pump, float valve, water regulator valve and cooling media so it can be easily removed.

***K) Pump***
Submersible, centrifugal, U.L. listed, dielectric oil-filled motor, lubricated for life. Lightweight and compact with strainer to prevent clogging. Available for 115V, single-phase operation.



# Selection Table

## Turbocell Selection

| Unit Model | CFM Std. Air @70° | Washer(s) and Face Area | Air Press. Drop "W.C. |
|---|---|---|---|
| DFC 109 | 1,600 | WCD-70 FFA-13.30 | 0.16 |
| | 1,800 | | 0.17 |
| | 2,000 | | 0.17 |
| | 2,250 | | 0.18 |
| | 2,500 | | 0.18 |
| | 2,750 | | 0.19 |
| | 3,000 | | 0.20 |
| DFC 112 | 3,250 | | 0.20 |
| | 3,500 | | 0.21 |
| | 3,750 | | 0.22 |
| | 4,000 | | 0.23 |
| | 4,250 | | 0.24 |
| DFC 115 | 4,500 | | 0.25 |
| | 5,000 | | 0.28 |
| | 5,500 | | 0.30 |
| | 6,000 | | 0.32 |
| DFC 118 | 5,500 | | 0.30 |
| | 7,000 | | 0.38 |
| | 7,500 | | 0.42 |
| | 8,000 | | 0.45 |
| | 8,500 | | 0.49 |
| DFC 120 | 9,000 | WCD-100 FFA-17.20 | 0.38 |
| | 9,500 | | 0.41 |
| | 10,000 | | 0.44 |
| | 10,500 | | 0.46 |
| | 11,000 | | 0.49 |
| DFC 122 | 11,000 | | 0.49 |
| | 12,000 | WCD-130 FFA-20.00 | 0.45 |
| | 13,000 | | 0.50 |
| | 14,000 | WCD-210 FFA-32.90 | 0.31 |
| | 15,000 | | 0.32 |
| DFC 125 | 14,000 | | 0.31 |
| | 15,000 | | 0.32 |
| | 16,000 | | 0.35 |
| | 18,000 | | 0.41 |
| | 20,000 | | 0.45 |
| DFC 130 | 22,000 | WCD-300 FFA-49.50 | 0.32 |
| | 24,000 | | 0.35 |
| | 26,000 | | 0.38 |
| | 28,000 | | 0.43 |
| | 30,000 | | 0.46 |
| DFC 215 | 9,000 | WCD-130 FFA-20.00 | 0.32 |
| | 9,500 | | 0.34 |
| | 10,000 | | 0.36 |
| | 10,500 | | 0.38 |
| | 11,000 | | 0.41 |
| | 12,000 | | 0.45 |
| DFC 218 | 13,000 | | 0.50 |
| | 14,000 | WCD-210 FFA-32.90 | 0.31 |
| | 15,000 | | 0.32 |
| | 16,000 | | 0.35 |
| | 17,000 | | 0.37 |
| DFC 220 | 18,000 | | 0.40 |
| | 19,000 | | 0.44 |
| | 20,000 | | 0.46 |
| | 21,000 | | 0.49 |
| | 22,000 | WCD-300 FFA-49.50 | 0.32 |
| | 23,000 | | 0.33 |
| | 24,000 | | 0.35 |
| | 25,000 | | 0.36 |
| | 26,000 | | 0.38 |
| DFC 222 | 27,000 | | 0.40 |
| | 28,000 | | 0.43 |
| | 29,000 | | 0.45 |
| | 30,000 | | 0.46 |
| | 31,000 | | 0.48 |
| DFC 225 | 32,000 | | 0.50 |
| | 36,000 | (2)WCD-210 FFA-65.80 | 0.41 |
| | 40,000 | | 0.46 |
| | 44,000 | (2)WCD-300 FFA-99.00 | 0.32 |
| DFC 230 | 48,000 | | 0.35 |
| | 52,000 | | 0.38 |
| | 56,000 | | 0.43 |
| | 60,000 | | 0.46 |
| | 64,000 | | 0.50 |
| DFC 233 | 70,000 | (3)WCD-300 FFA-148.50 | 0.34 |
| | 75,000 | | 0.36 |
| DFC 240 | 80,000 | | 0.39 |
| | 85,000 | | 0.43 |
| | 90,000 | | 0.46 |
| | 95,000 | | 0.49 |
| | 100,000 | | 0.53 |

***Selection Guide:***

1) After selecting the DFC model from the current DFC catalog, match the DFC model and CFM to the corresponding Turbocell model and determine static pressure.
2) Add the Turbocell static pressure to the DFC to determine the correct motor horsepower.
3) If the Maxaire Prefilter option is selected, add an additional 0.30" W.C. to the total static pressure for determing motor horsepower.

NOTE: Other models can be packaged with evaporative coolers as well as the DFC. Please contact the factory.

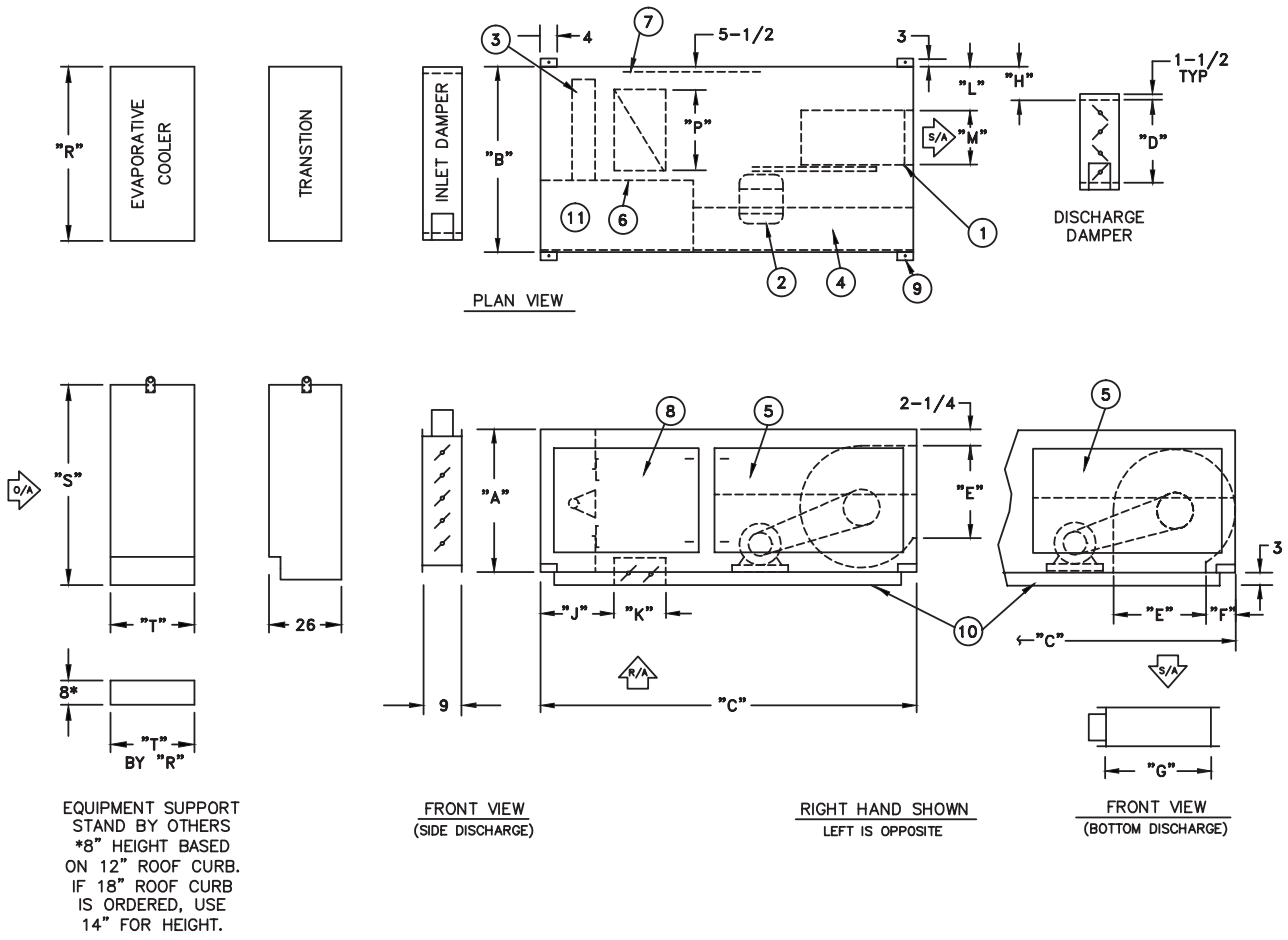
# Dimensions

## DFC-109 Through 118 to WCD-70

C000530A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




EQUIPMENT SUPPORT STAND BY OTHERS *8" HEIGHT BASED ON 12" ROOF CURB. IF 18" ROOF CURB IS ORDERED, USE 14" FOR HEIGHT.

| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| DFC-109 | 36 | 52 | 77 | 17 13/16 | 10 3/8 | 15 1/8 | 14 7/16 | 14 7/16 |
| DFC-112 | 36 | 52 | 77 | 17 13/16 | 13 9/16 | 13 9/16 | 14 7/16 | 14 7/16 |
| DFC-115 | 36 | 52 | 77 | 23 15/16 | 16 | 12 3/8 | 19 7/8 | 8 5/8 |
| DFC-118 | 36 | 52 | 77 | 23 15/16 | 19 | 12 3/8 | 19 7/8 | 6 15/16 |

| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | J | K | L | M | P | R | S | T |
| DFC-109 | 19 | 14 1/4 | 14 1/2 | 11 15/16 | 27 3/4 | 50 | 50 | 30 |
| DFC-112 | 19 | 14 1/4 | 12 1/2 | 15 15/16 | 27 3/4 | 50 | 50 | 30 |
| DFC-115 | 19 | 14 1/4 | 11 1/8 | 18 15/16 | 27 3/4 | 50 | 50 | 30 |
| DFC-118 | 19 | 14 1/4 | 7 7/8 | 22 1/16 | 27 3/4 | 50 | 50 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

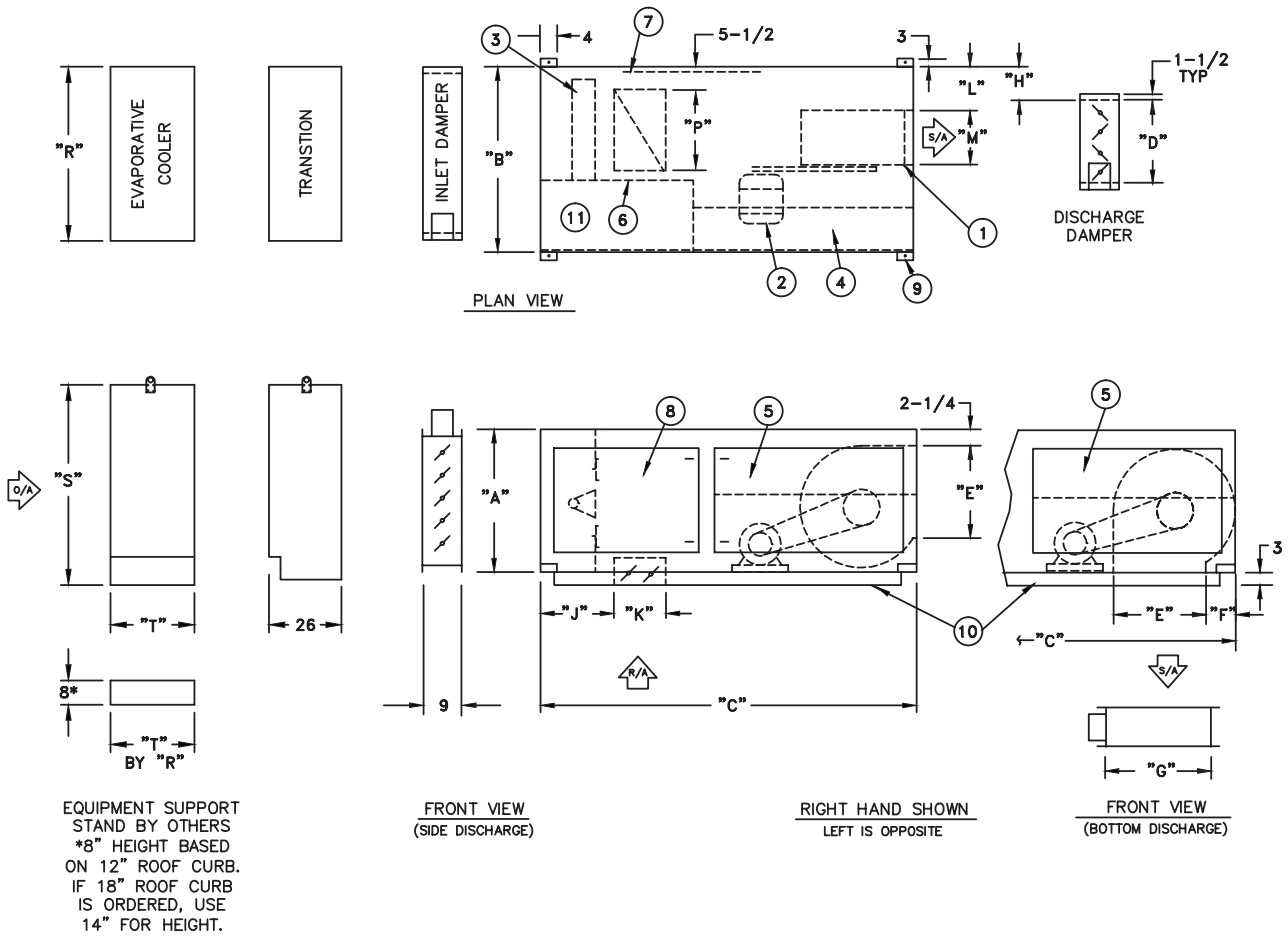
# Dimensions

## DFC-120 Through 122 to WCD-100

C000530A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| DFC-120 | 48 | 78 | 96 | 29½ | 24⅞ | 13³⁄₁₆ | 28¼ | 10⁵⁄₃₂ |
| DFC-122 | 48 | 78 | 96 | 29½ | 27⅜ | 13³⁄₁₆ | 28¼ | 11¹³⁄₃₂ |
| Model | Dimensions | | | | | | | |
| | J | K | L | M | P | R | S | T |
| DFC-120 | 19 | 14¼ | 12⅜ | 25¹⁄₁₆ | 48 | 56 | 56 | 30 |
| DFC-122 | 19 | 14¼ | 12⅜ | 27⁹⁄₁₆ | 48 | 56 | 56 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

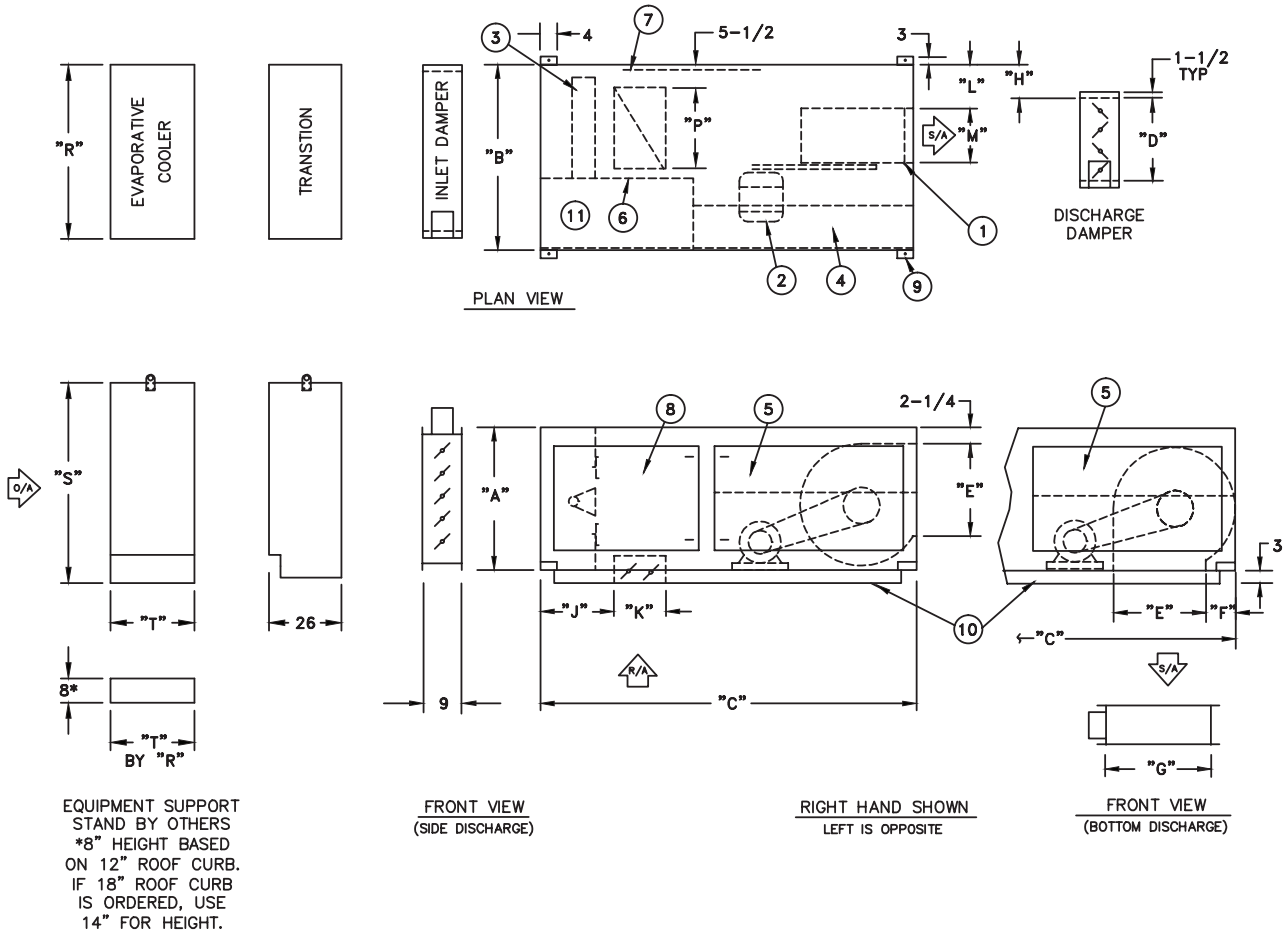
# Dimensions

## DFC-122 to WCD-130

C000530A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| DFC-122 | 48 | 78 | 96 | 29½ | 27⅜ | 13³⁄₁₆ | 28¼ | 11¹³⁄₃₂ |
| **Model** | **Dimensions** | | | | | | | |
| | J | K | L | M | P | R | S | T |
| DFC-122 | 19 | 14¼ | 12⅜ | 27⁹⁄₁₆ | 48 | 60 | 62 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

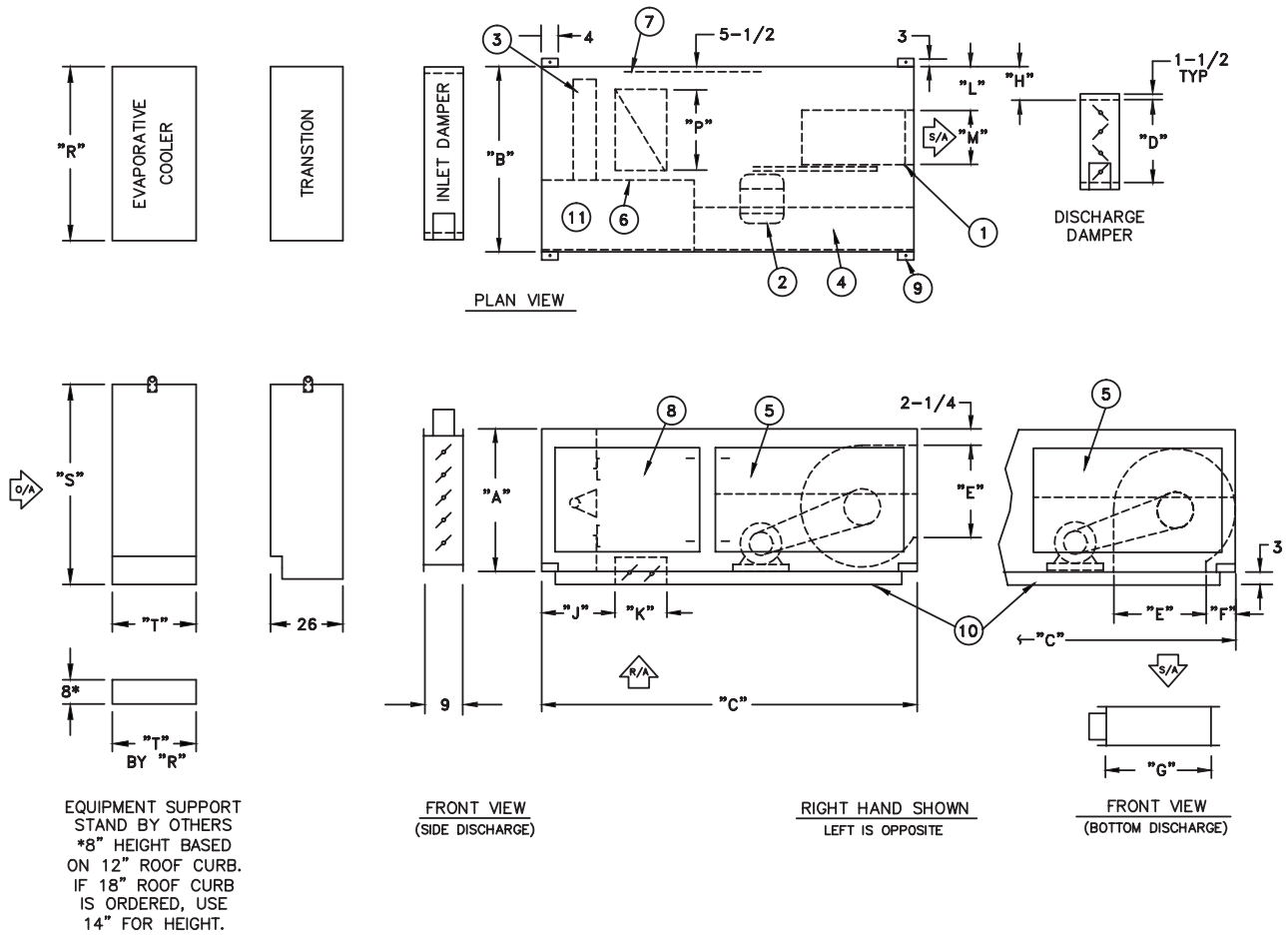
# Dimensions

## DFC-122 Through 125 to WCD-210

C000530A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| DFC-122 | 48 | 78 | 96 | 29½ | 27⅜ | 13³⁄₁₆ | 28¼ | 11¹³⁄₃₂ |
| DFC-125 | 60 | 91 | 96 | 38⅞ | 31⅜ | 17⁹⁄₁₆ | 37¾ | 11¹¹⁄₁₆ |
| Model | Dimensions | | | | | | | |
| | J | K | L | M | P | R | S | T |
| DFC-122 | 19 | 14¼ | 12⅜ | 27⁹⁄₁₆ | 48 | 75 | 75 | 30 |
| DFC-125 | 12⁵⁄₁₆ | 20¼ | 15⅜ | 31½ | 49 | 75 | 75 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

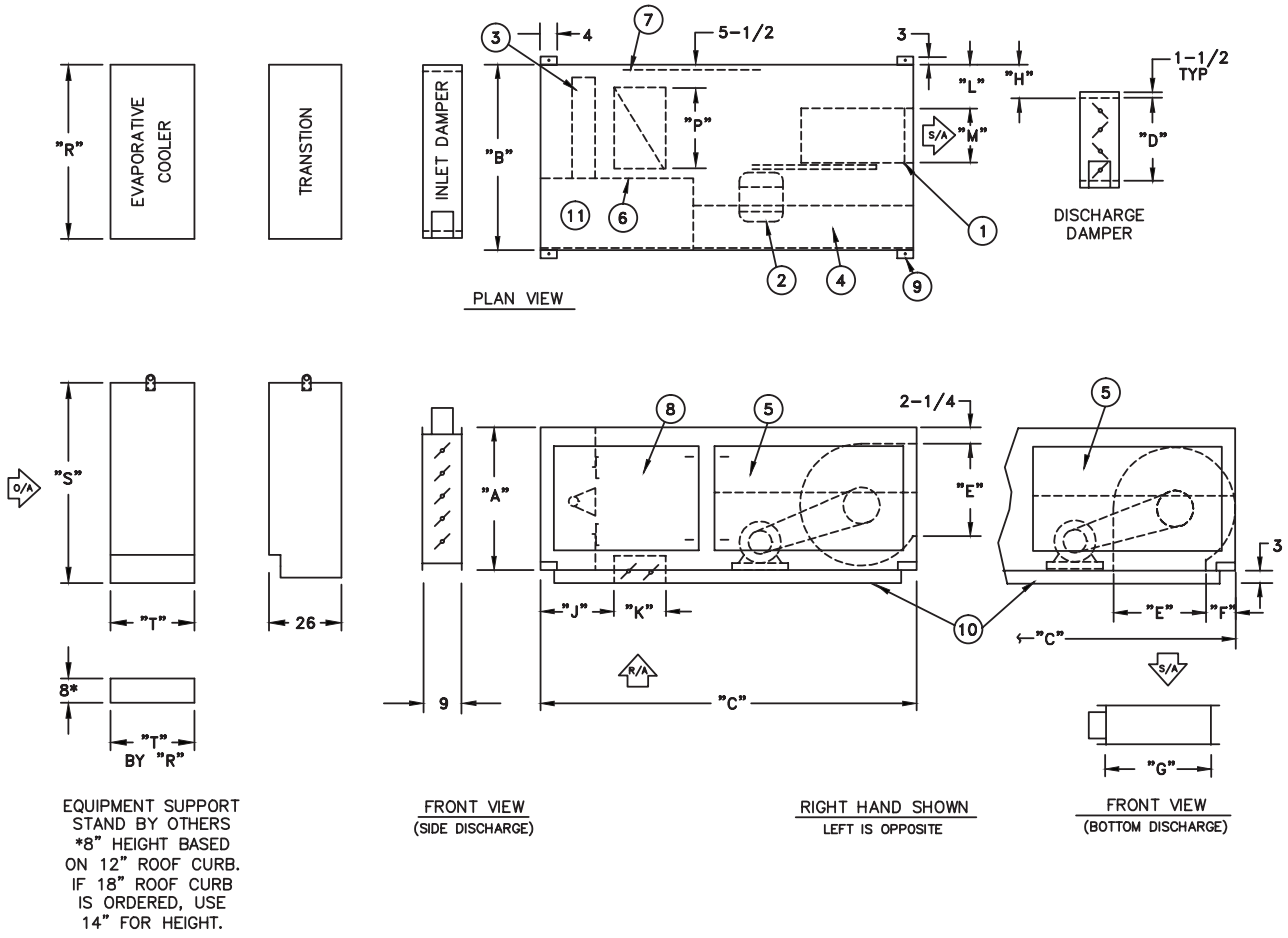
# Dimensions

## DFC-130 to WCD-300

C000530A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




EQUIPMENT SUPPORT STAND BY OTHERS *8" HEIGHT BASED ON 12" ROOF CURB. IF 18" ROOF CURB IS ORDERED, USE 14" FOR HEIGHT.

| Model | Dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| DFC-130 | 60 | 91 | 96 | 38⅞ | 36⅞ | 17⅜₁₆ | 37¾ | 14⅞₁₆ |
| **Model** | **Dimensions** | | | | | | | |
| | J | K | L | M | P | R | S | T |
| DFC-130 | 12⅝₁₆ | 20¼ | 15⅜ | 37 | 49 | 96 | 86 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

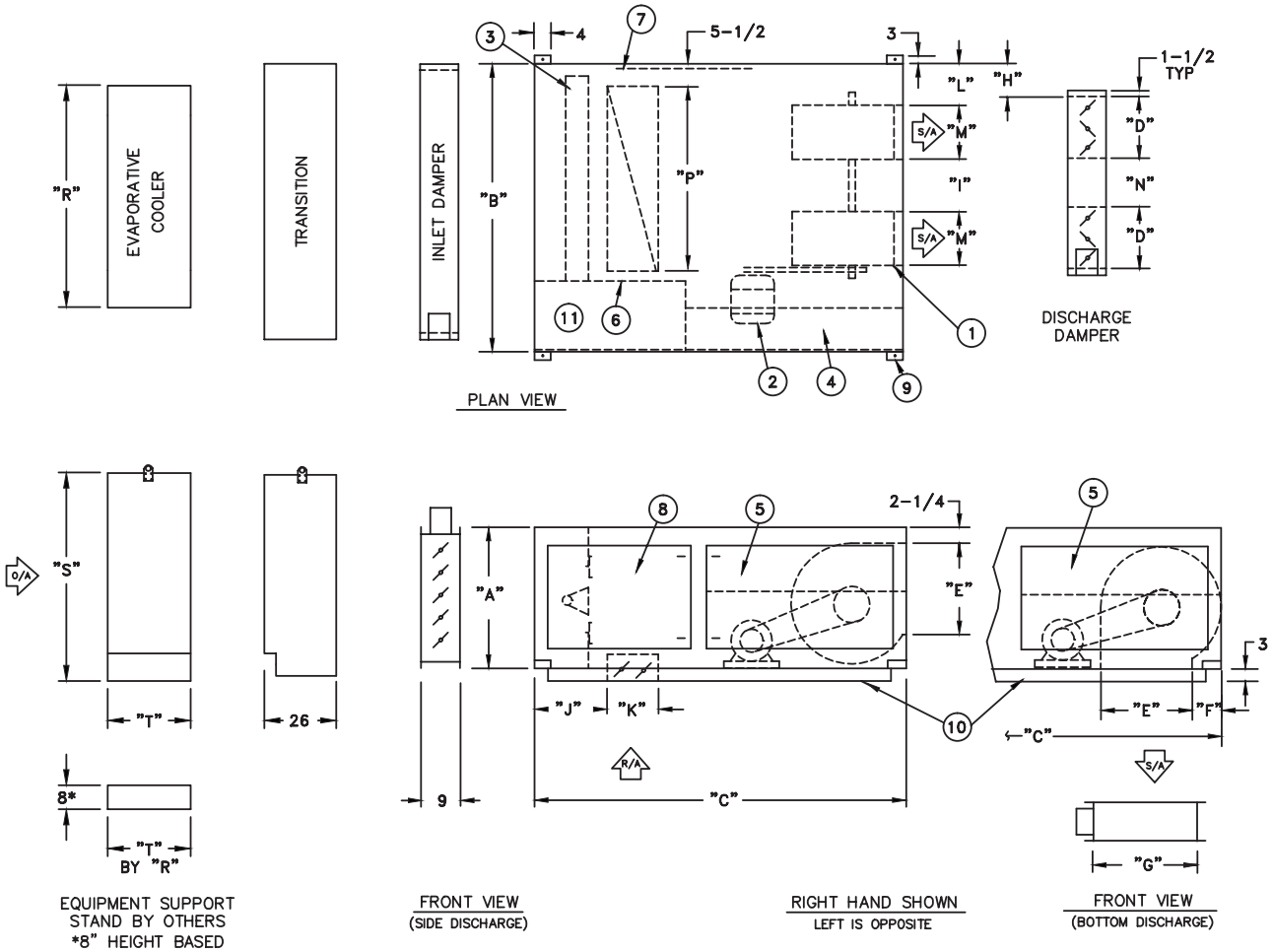
# Dimensions

## DFC-215 Through 218 to WCD-130

C000531A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| DFC-215 | 36 | 94 | 77 | 23 15/16 | 16 | 12 3/8 | 19 7/8 | 5 3/8 | 22 1/4 |
| DFC-218 | 36 | 94 | 77 | 23 15/16 | 19 | 12 3/8 | 19 7/8 | 6 15/16 | 16 |
| Model | Dimensions | | | | | | | | |
| | J | K | L | M | N | P | R | S | T |
| DFC-215 | 19 | 14 1/4 | 7 7/8 | 18 15/16 | 14 | 65 3/4 | 60 | 62 | 30 |
| DFC-218 | 19 | 14 1/4 | 7 7/8 | 22 1/16 | 14 | 65 3/4 | 60 | 62 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

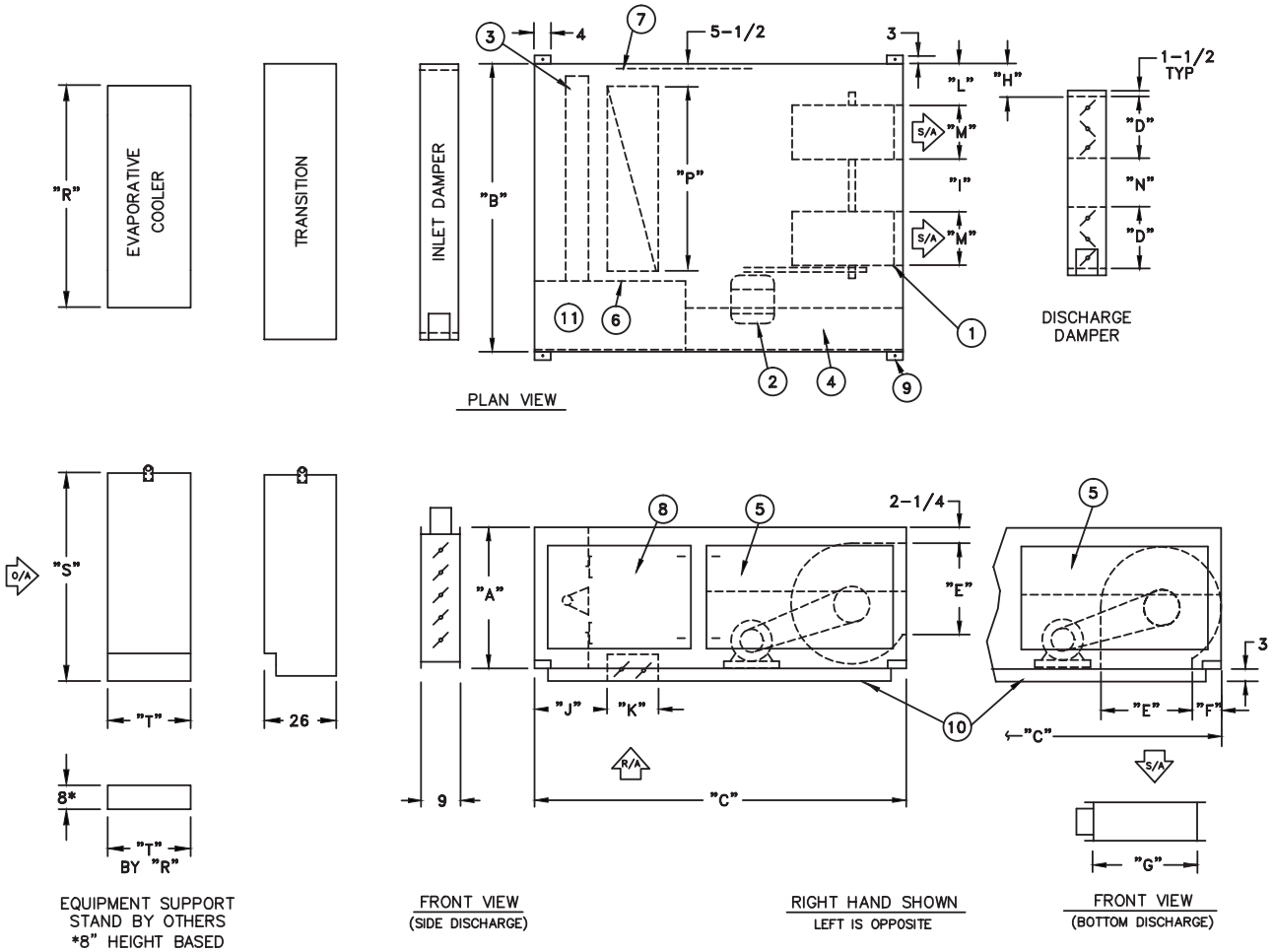
# Dimensions

## DFC-218 Through 220 to WCD-210

C000531A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| DFC-218 | 36 | 94 | 77 | 23 15/16 | 19 | 12 3/8 | 19 7/8 | 6 15/16 | 16 |
| DFC-220 | 48 | 130 | 96 | 29 7/16 | 24 7/8 | 13 3/16 | 28 1/4 | 10 3/16 | 29 5/8 |

| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | J | K | L | M | N | P | R | S | T |
| DFC-218 | 19 | 14 1/4 | 7 7/8 | 22 1/16 | 14 | 65 3/4 | 75 | 75 | 30 |
| DFC-220 | 19 | 14 1/4 | 12 3/8 | 25 1/16 | 22 5/8 | 87 3/8 | 75 | 75 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

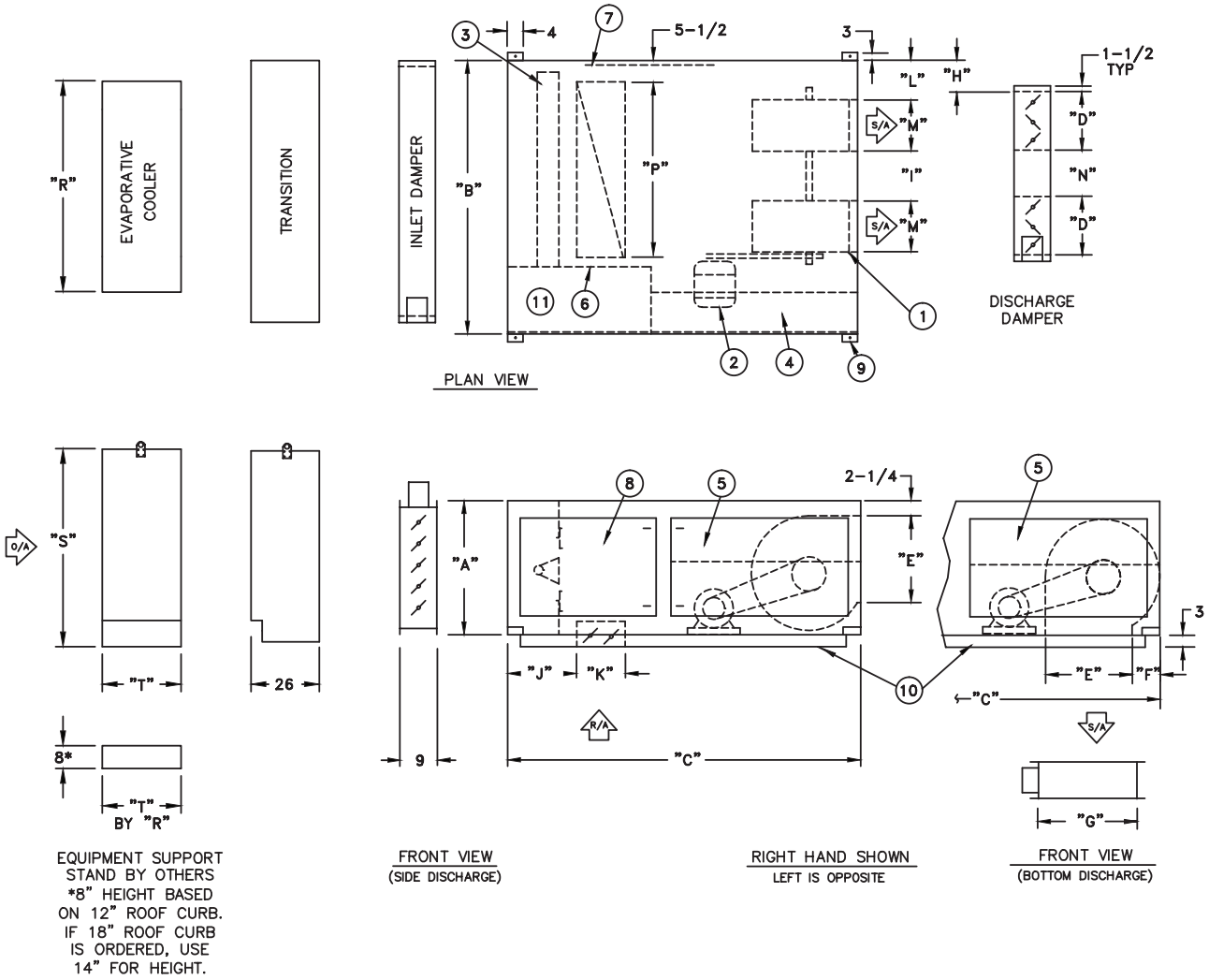
# Dimensions

## DFC-220 Through 225 to WCD-300

C000531A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| DFC-220 | 48 | 130 | 96 | 29 7/16 | 24 7/8 | 13 3/16 | 28 1/4 | 10 3/16 | 29 5/8 |
| DFC-222 | 48 | 130 | 96 | 29 7/16 | 27 3/8 | 13 3/16 | 28 1/4 | 11 7/16 | 24 5/8 |
| DFC-225 | 60 | 154 | 96 | 38 7/8 | 31 3/8 | 17 9/16 | 37 3/4 | 11 11/16 | 37 5/8 |

| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | J | K | L | M | N | P | R | S | T |
| DFC-220 | 19 | 14 1/4 | 12 3/8 | 25 1/16 | 22 5/8 | 87 3/8 | 96 | 86 | 30 |
| DFC-222 | 19 | 14 1/4 | 12 3/8 | 27 9/16 | 22 5/8 | 87 3/8 | 96 | 86 | 30 |
| DFC-225 | 12 5/16 | 20 1/4 | 15 3/8 | 31 1/2 | 24 5/8 | 111 3/8 | 96 | 86 | 30 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

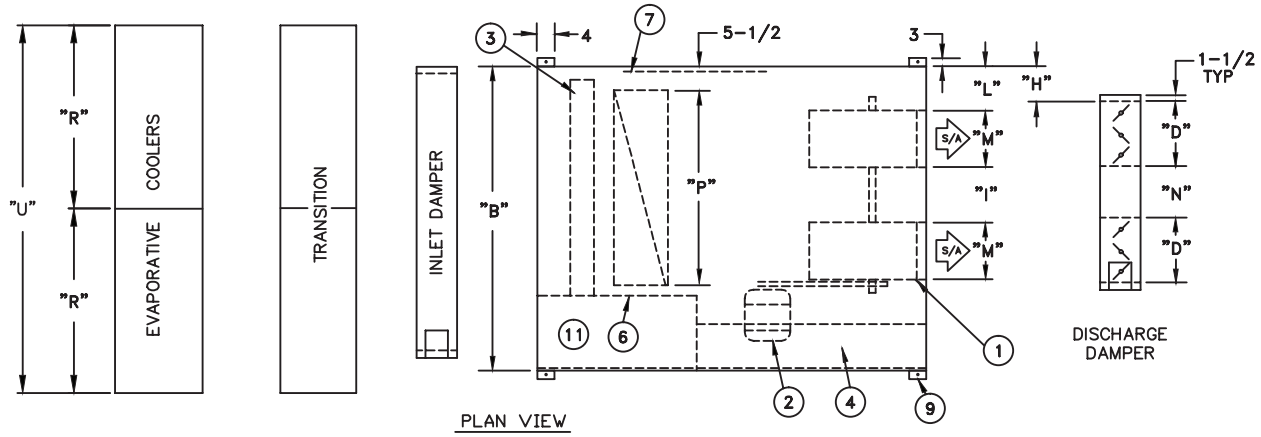
# Dimensions

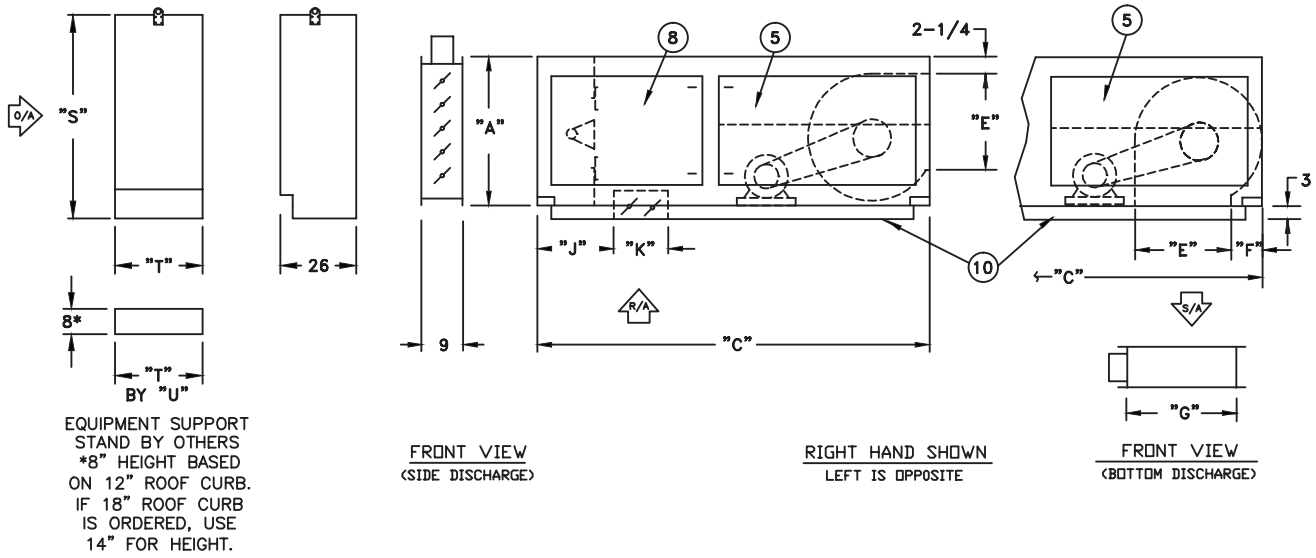
## DFC-225 to 2) WCD-210

C000532A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| DFC-225 | 60 | 154 | 96 | 38⅞ | 31⅜ | 17⁹⁄₁₆ | 37¾ | 11¹¹⁄₁₆ | 37⅝ |
| **Model** | **Dimensions** | | | | | | | | |
| | J | K | L | M | N | P | R | S | T | U |
| DFC-225 | 12⁵⁄₁₆ | 20¼ | 15⅜ | 31½ | 24⅝ | 111⅜ | 75 | 75 | 30 | 150 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

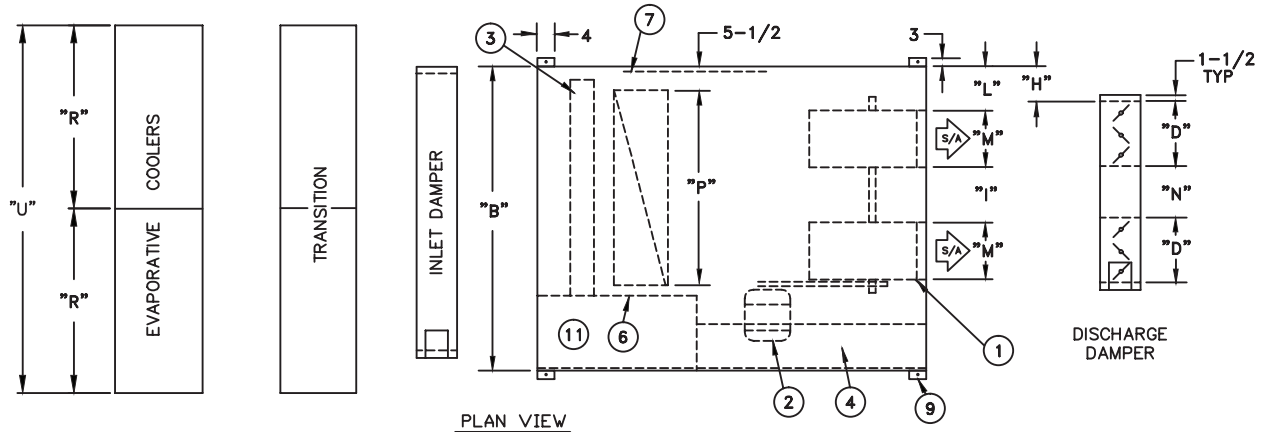
# Dimensions

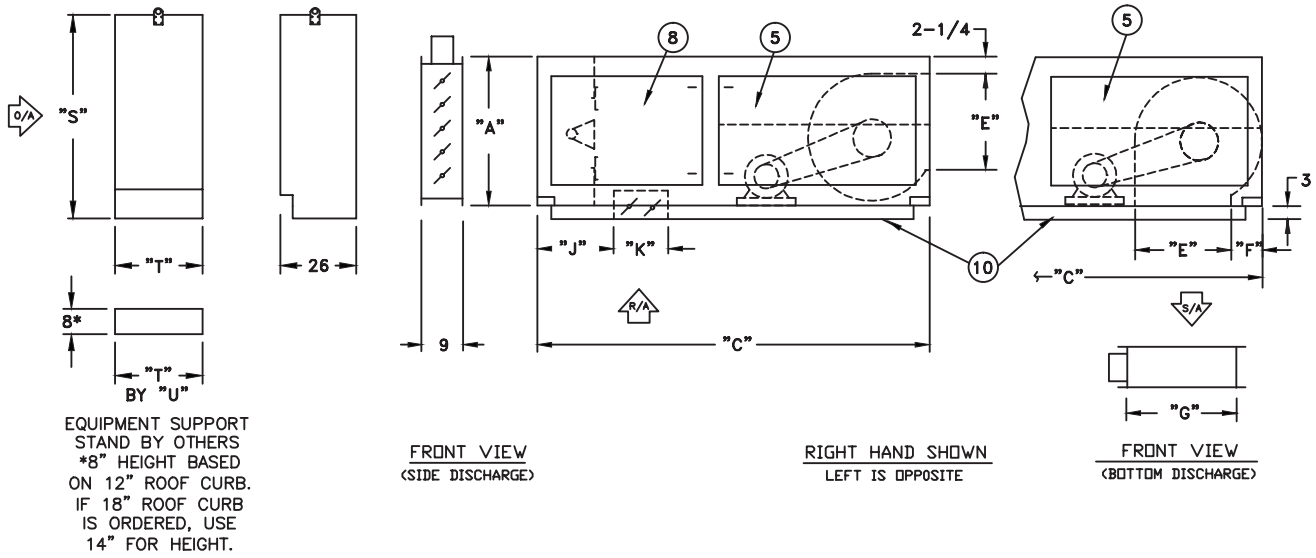
## DFC-225 Through 230 to 2) WCD-300

C000532A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment




| Model | Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| DFC-225 | 60 | 154 | 96 | 38⅞ | 31⅜ | 17⁹⁄₁₆ | 37¾ | 11¹¹⁄₁₆ | 37⅝ |
| DFC-230 | 60 | 154 | 96 | 38⅞ | 36⅞ | 17⁹⁄₁₆ | 37¾ | 14⁷⁄₁₆ | 26⅝ |

| Model | Dimensions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | J | K | L | M | N | P | R | S | T | U |
| DFC-225 | 12⁵⁄₁₆ | 20¼ | 15⅜ | 31½ | 24⅝ | 111⅜ | 96 | 86 | 30 | 172 |
| DFC-230 | 12⁵⁄₁₆ | 20¼ | 15⅜ | 37 | 24⅝ | 111⅜ | 96 | 86 | 30 | 172 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

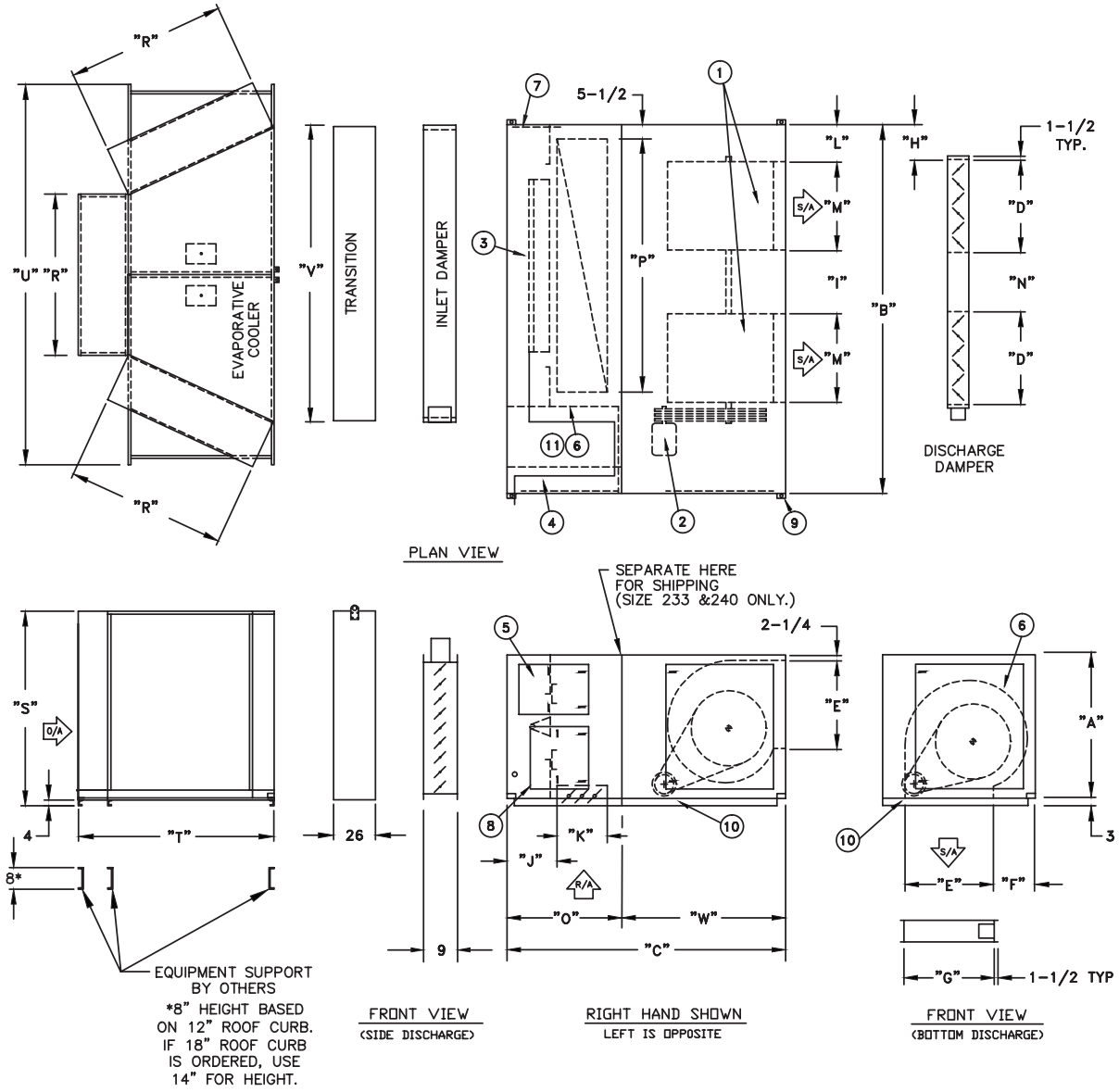
# Dimensions

## DFC-233 Through 240 to 3) WCD-300

C000533A

**UNIT COMPONENTS**

1. Centrifugal supply fan
2. Fan motor
3. Line burner
4. Control cabinet
5. Hinged control cabinet access door
6. Observation port
7. Access door
8. Access door (piping compartment)
9. Lifting lug
10. Unit base
11. Manifold compartment



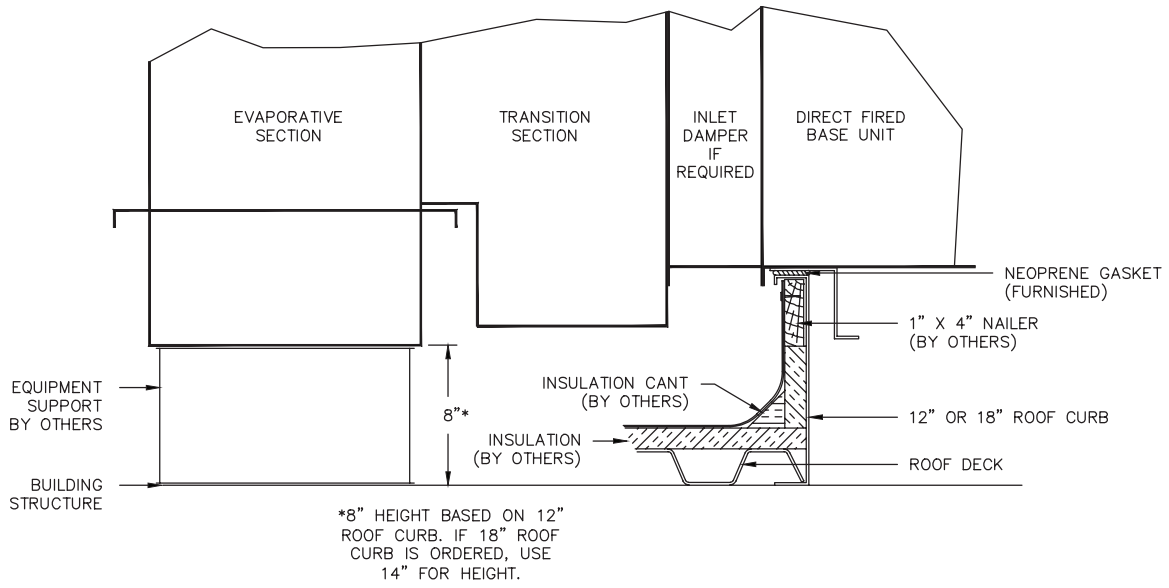

| Model | Dimensions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K |
| 233 | 68 | 175 | 117 | 41¾ | 43 1/16 | 19 7/16 | 44 | 16 1/16 | 36 | 20 | 20¼ |
| 240 | 79¼ | 210 | 131 | 55¾ | 41 | 33 | 42 | 19 1/16 | 39⅞ | 20 | 20¼ |

| Model | Dimensions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | M | N | O | P | R | S | T | U | V | W |
| 233 | 17 | 39⅞ | 34⅛ | 45 | 130 | 96 | 90 | 123⅝ | 197⅝ | 139¼ | 72 |
| 240 | 20 | 53⅞ | 38 | 45 | 166 | 96 | 90 | 117¾ | 228⅞ | 174⅛ | 86 |

**NOTE:** All dimensions in inches subject to manufacturing tolerances.

## Typical Roof Support Detail

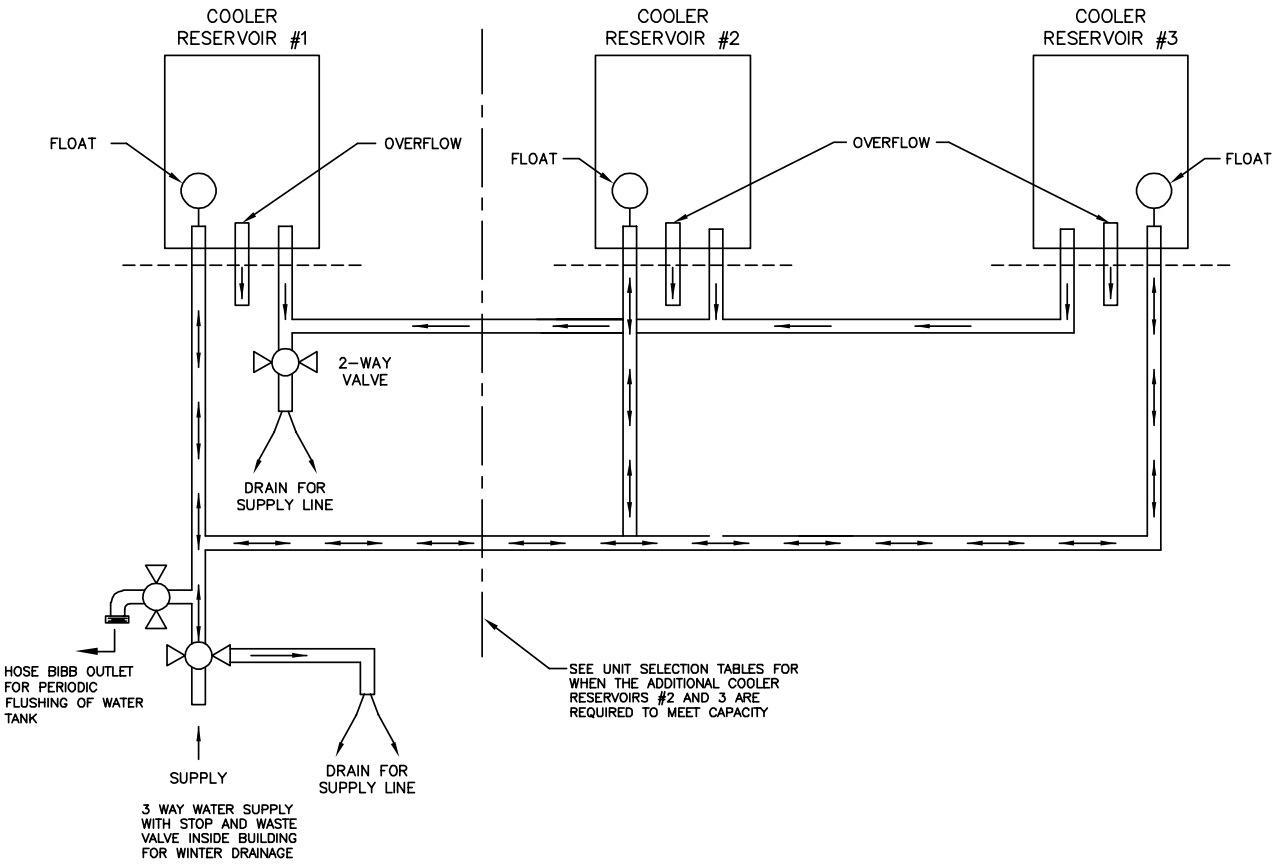
C000534A




WCD modules are not curb mountable. If the DFC is to be curb mounted, an equipment support stand or rails must be provided by others. See above drawing for details.

## Plumbing Recommendations

C000542




### Supply

Each unit requires a 3/8" IPS water supply line to each float valve assembly. Units with two float valve assemblies may be supplied from a 1/2" IPS water supply line. Units with three float valve assemblies may be supplied from a 3/4" IPS water supply line.

### Maintenance

It is recommended that the supply piping system include one hose bibb outlet, conveniently located on the roof, to facilitate periodic flushing of the water tanks.

### Freeze Protection

The main water supply line should include a stop-and-waste valve inside the building for winter draining.

### Drain

Each unit is equipped with a 1" drain connection. A 1" gate valve may be attached directly to the unit. Drain piping of waste water must meet local codes. In some cases, it is convenient to carry the 1" drain line down into the building with the valve located at an accessible point to facilitate frequent tank draining.

# Weights and Model Designation

## Approximate weights

Turbocell Series

| | WCD-70 | WCD-100 | WCD-130 | WCD-210 | WCD-300 | (2) WCD-210 | (2) WCD-300 | (3) WCD-300 |
|---|---|---|---|---|---|---|---|---|
| NET WT. | 194 | 218 | 240 | 351 | 559 | 702 | 1118 | 1677 |
| OPERATING WT. | 593 | 695 | 759 | 1016 | 1597 | 2032 | 3194 | 4791 |
| TRANSITION WT. | 150 | 170 | 240 | 290 | 320 | 570 | 630 | 880 |

## Model Designation

**DFC - 225 - HRB - 2 - WCD - 300**

**Type of Unit**

**DFC Model Size**
**109 215**
**112 218**
**115 220**
**118 222**
**120 225**
**122 230**
**125 233**
**130 240**

**Unit Configuration**
**HRS - Horizontal, Right Hand, Side Discharge**
**HRB - Horizontal, Right Hand, Bottom Discharge**
**HRT - Horizontal, Right Hand, Top Discharge**
**HLS - Horizontal, Left Hand, Side Discharge**
**HLB - Horizontal, Left Hand, Bottom Discharge**
**HLT - Horizontal, Left Hand, Top Discharge**

**Quantity of Evaporative Sections**

**Type of Evaporative Unit**
**WCD - Turbocell**

**Size of Evaporative Unit**
**WCD**
**70**
**100**
**130**
**210**
**300**

# Formulas For Estimating

## Definitions

***Dry Bulb Temperature:***
Atmospheric temperature as measured by a standard thermometer.

***Wet Bulb Temperature:***
Temperature recorded by thermometer with wet sock over bulb in moving air stream. A measuring instrument which has a thermometer in this arrangement is a sling psychrometer. The wet bulb temperature is the lowest temperature to which air can be cooled by evaporation.

## Abbreviations

| | | | | | |
|---|---|---|---|---|---|
| A | = Filter area, sq. ft. | FPM | = Feet per minute | OWB | = Outdoor wet bulb temp. |
| Em | = Blower motor voltage | GPH | = Gallons per hour | PF | = Power factor |
| Ep | = Pump voltage | Im | = Blower motor amperage | SE | = Saturating effectiveness |
| FF | = Phase factor (1 for 1Ph., 1.73 for 3 Ph.) | Ip | = Pump amperage | CFM | = CFM rating of evaporative air unit |
| | | ODB | = Outdoor dry bulb temp. | | |

## Formulas

| Desired | Formula | Example |
|---|---|---|
| Leaving Air Temp. | ODB - SE (ODB - OWB) | 95 - [.87 x (95 - 66)] = 70°F(1) |
| Exhaust Fan Rating (2) (positive room pressure) | 0.9 (CFM) | 0.9 (6000) = 5400 CFM |
| Exhaust Fan Rating (negative room pressure) | 1.1 (CFM) | 1.1 (6000) = 6600 CFM |
| Relief Opening (3) | CFM/250 | 6000/250 = 24 sq. ft. |
| Water Evaporation | (CFM/1000) x (ODB - OWB)/10 | (6000/1000) x (95 - 65)/10 = 18 GPH |
| Daily Operating Cost | $\frac{(Ip \times Ep) + (Im \times Em \times FF)}{1000} \times PF \times (HRS./DAY) \times (\$/KW\text{-}HR)$ | $\frac{(5 \times 115) + (2.5 \times 460 \times 1.73)}{1000} \times 0.7 \times 8 \times \$0.07 = \$1.01$ |

***NOTES:***

*1) The 87% efficiency used in the example is the Turbocell minimum efficiency as determined by factory tests. With proper maintenance, the high efficiencies remain constant throughout the life of the unit.*

*2) Air removal is an important factor in maintaining comfort in an evaporative cooling system. Air removal will prevent an uncomfortable build-up of humidity while keeping the air in circulation. An exhaust fan is highly recommended. In areas such as restaurant kitchens or hotel laundry rooms where odors should remain in the room when doors are opened, the exhaust fan should be sized approximately 110% of the make-up air rating. This will create a negative room pressure, thus causing the air movement to be into the room rather than out when the doors are opened. In other cases, such as a coin operated laundry, where it is desirable to greet customers with a cool breeze upon opening the door, the exhaust fan should be sized approximately 90% of the make-up air unit. This will create a positive room pressure, which will cause the air movement to be out of the room when doors are opened. This will also help prevent outside air from entering.*

*3) When an exhaust fan is not used, the formula will determine the free area that must be provided from open windows, doors, etc.*

# Wiring Diagram

## ECS Evaporative Cooling System

C000631

**COMPONENT IDENTIFICATION**

CB–09 CONTROL CIRCUIT TRANSFORMER BREAKER

FL–02 HIGH TEMPERATURE LIMIT SWITCH
FL–05 SUPPLY AIR FIRESTAT (OPTIONAL)
FL–06 RETURN AIR FIRESTAT (OPTIONAL)
FU–10 CONTROL CIRCUIT FUSE
FU–24 EVAP PUMP MOTOR FUSE

GA–03 COMBINATION CO & NO2 DETECTOR (OPTIONAL)

KP–01 KEYPAD /DISPLAY MODULE (OPTIONAL)

LT–05 BURNER ON LIGHT (REMOTE)
LT–15 FAN ON LIGHT (REMOTE)
LT–31 COOLING ON LIGHT (REMOTE)
LT–59 CLOGGED FILTER LIGHT (REMOTE)

MP–05 DAMPER CONTROL POTENTIOMETER (OPTIONAL)
MP–15 UNIT ENABLE POTENTIOMETER

MT–01 MAIN SUPPLY FAN MOTOR
MT–12 DISCHARGE DAMPER MOTOR (OPTIONAL)
MT–13 INLET DAMPER MOTOR (OPTIONAL)
MT–14 MIXING BOX DAMPER MOTOR (OPTIONAL)
MT–80 EVAP PUMP MOTOR

OL–01 MAIN FAN MOTOR OVERLOAD

PS–04 LOW GAS PRESSURE SWITCH (OPTIONAL)
PS–07 HIGH GAS PRESSURE SWITCH (OPTIONAL)
PS–10 HIGH VELOCITY SWITCH
PS–11 LOW VELOCITY SWITCH
PS–12 CLOGGED FILTER SWITCH (OPTIONAL)

PT–13 BUILDING PRESSURE TRANSDUCER (OPTIONAL)
PT–15 FLOW STATION PRESSURE TRANSDUCER (OPTIONAL)

RE–02 FLAME SAFEGUARD RELAY
RE–09 FLAME FAILURE RELAY
RE–12 CLOGGED FILTER RELAY (OPTIONAL)
RE–14 HOLDING RELAY (OPTIONAL)
RE–26 ELECTRONIC RELAY
RE–27 BURNER STATUS RELAY
RE–28 BURNER ENABLE RELAY
RE–34 COOLING ENABLE RELAY
RE–35 COOLING INTERLOCK RELAY
RE–56 SAFTEY CIRCUIT STATUS RELAY
RE–57 UNIT ENABLE RELAY
RE–65 FAN STATUS RELAY
RE–75 FLAME SUPERVISION SWITCHING RELAY
RE–78 INTERLOCKING RELAY (OPTIONAL)
RE–80 LOW ALERT RELAY (OPTIONAL)
RE–81 HIGH ALERT RELAY (OPTIONAL)
RE–90 ALARM STATUS RELAY

RS–01 RESISTOR 1K OHM
RS–02 RESISTOR 2K OHM
RS–03 RESISTOR 4.02K OHM
RS–04 RESISTOR 8.06K OHM
RS–11 RESISTOR 10 OHM

ST–01 MAIN SUPPLY FAN MOTOR STARTER

SW–01 MAIN DISCONNECT SWITCH (OPTIONAL)
SW–09 AUXILLARY UNIT ENABLE (BY OTHERS)
SW–18 DAMPER MOTOR END SWITCH (OPTIONAL)
SW–72 100 PERCENT OUTSIDE AIR SWITCH (BY OTHERS)
SW–77 PROOF OF VALVE CLOSURE SWITCH (OPTIONAL)
SW–80 PUMP MOTOR DISCONNECT SWITCH
SW–81 WATER LEVEL CUTOFF SWITCH
SW–82 AUTO – DRAIN SWITCH (OPTIONAL)

TC–81 EVAP FREEZE STAT (OPTIONAL)

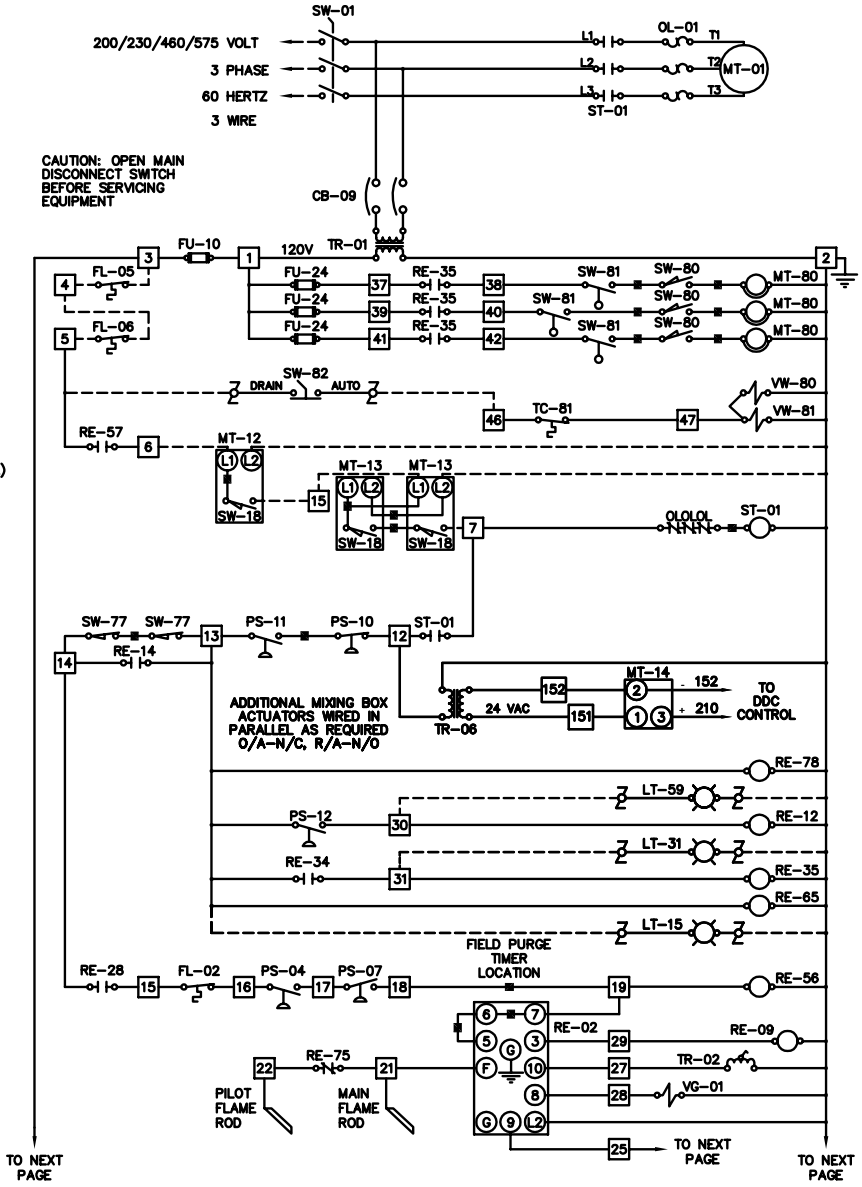
TR–01 CONTROL CIRCUIT TRANSFORMER
TR–02 IGNITION TRANSFORMER
TR–04 MODULATING VALVE TRANSFORMER
TR–05 LOW VOLTAGE TRANSFORMER
TR–06 DAMPER MOTOR TRANSFORMER (OPTIONAL)

TS–01 OUTSIDE AIR TEMPERATURE SENSOR
TS–02 SPACE TEMPERATURE SENSOR (OPTIONAL)
TS–03 DISCHARGE AIR TEMPERATURE SENSOR

UC–01 UNIT CONTROL MODULE

VG–01 PILOT GAS VALVE
VG–02 MAIN GAS VALVE
VG–03 AUXILARY GAS VALVE
VG–04 NORMALLY OPEN VENT VALVE (OPTIONAL)
VG–07 MODULATING GAS VALVE

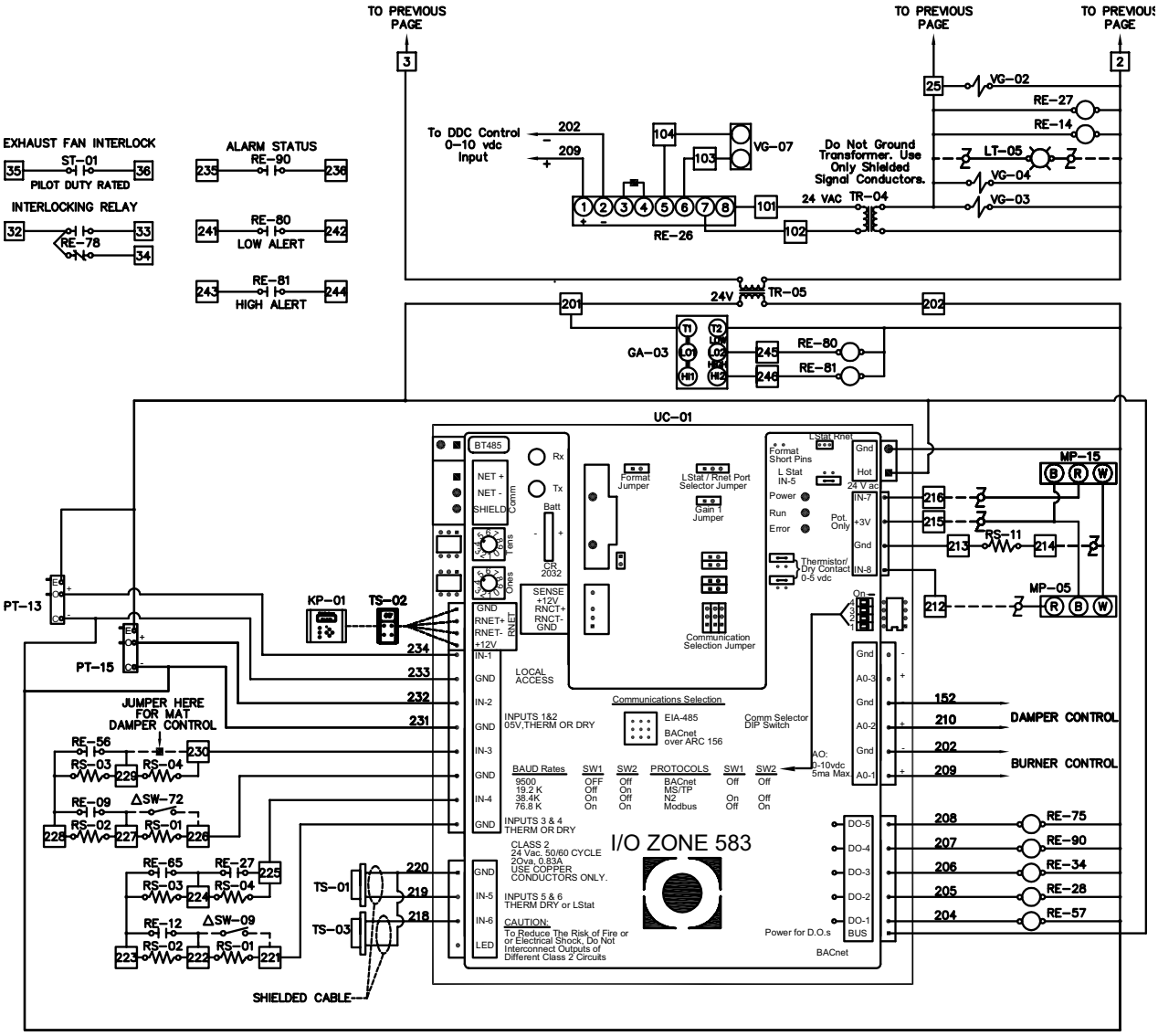
VW–80 DRAIN VALVE (OPTIONAL)
VW–81 3 WAY FILL VALVE (OPTIONAL)



# Wiring Diagram

## ECS Evaporative Cooling System

C000631



Applied Air

## Turbocell

1.0 The evaporative cooling unit shall be weatherproof and self-contained. It consists of component parts as listed in the following paragraphs.
Units shall be the Turbocell as sold by Applied Air located in Dallas, Texas, or approved equal.

### 2.0 Cooling Compartment

2.1 Cooling compartment shall contain the Turbocell Water System, float valve, overflow and drain connections. Cooling compartment to be built separate from the burner/blower compartment, and no water is to flow into the burner/blower compartment at any time. Cabinet of the cooling compartment to be fabricated from 304 stainless steel with hat channel stiffeners for tank support. Cooling media shall be easily removable from the air entering side. A service panel shall permit easy access to pump, float and water regulating valve.

2.2 Cooling media to be Turbodek - 12" deep fluted cellulose, high efficiency evaporative media, impregnated with insoluble anti-rot chemical. Maximum air velocity through cooling media shall not exceed 700 FPM.

2.3 Turbocell Water System shall produce a fine spray action which uniformly saturates the 12" deep Turbodek media. Turbocell system to include a submersible pump with U.L. listed, hermetically sealed, dielectric oil-filled motor and Buna-N seal. Horsepower rating of pump shall not be less than 1/4 hp. Pump to be centrifugal type with strainer to prevent the intake of solid matter. Pump assembly shall discharge into a distribution manifold fabricated from heavy-duty PVC pipe with metered orifices. A water regulator valve shall be installed in the distribution manifold and will permit field adjustment of water flow over media. A manual metering valve shall be installed in the distribution manifold allowing continuous bleed-off, thus minimizing the build-up of minerals and salts. The Turbocell Water System assembly shall be available for single phase, 115 or 230 volt operation. Blower shall be capable of operating with water system off, permitting unit to function as a ventilator.

2.4 A brass float valve shall maintain a constant water level in the Turbocell tank.

2.5 Cooling unit to have a minimum saturating effectiveness of 87 percent when the outside air dry bulb temperature is greater than 90°F. Saturating effectiveness is defined as:

$$SE = \frac{T_1 - T_2}{T_1 - T_3} \times 100$$

where: $T_1$ = outside air, dry bulb temperature, °F
$T_2$ = leaving air, dry bulb temperature, °F
$T_3$ = outside air, wet bulb temperature, °F

| MEDIA SPECIFICATIONS | | |
|---|---|---|
| CONDITION | TURBODEK | FIBERDEK |
| maximum water temp. | 130°F | 165°F |
| maximum air temp. | 300°F | 300°F |
| ph range | 6-9 | 5-10 |
| dry weight | 2.4 lb/ft $^3$ | 4.5 lb/ft $^3$ |
| wet weight | 5.6 lb/ft $^3$ | 9.0 lb/ft $^3$ |
| operating weight | 8.0 lb/ft $^3$ | 11.4 lb/ft $^3$ |
| water flow rate (gpm/sq. ft.) | 1.5 | 1.5 |

### 3.0 Transition Section

3.1 The transition section shall be fabricated from heavy gauge G90 bright spangled galvanized steel. The casing shall be weatherproof and be built separate from the evaporative section. The transition section shall match the evaporative section with the burner/blower section without the need for field modifications. The transition shall incorporate a sloped interior to direct the airflow from the evaporative section to the burner/blower section.

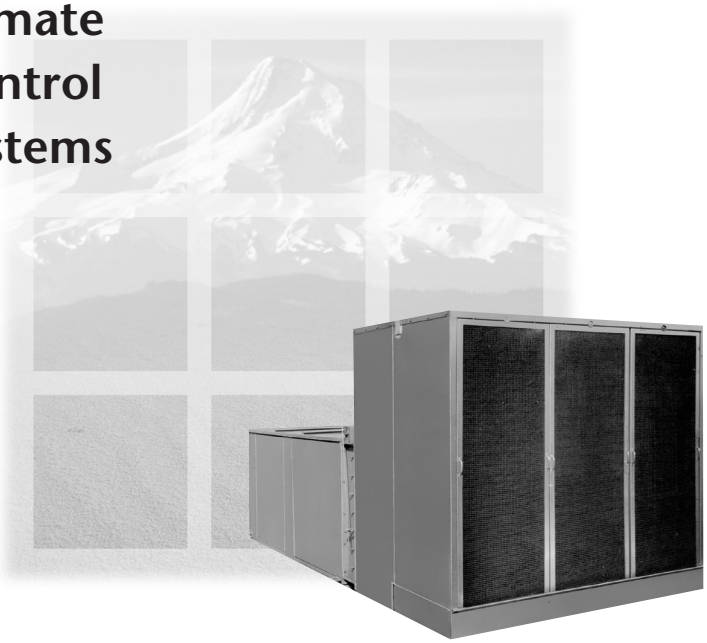
Turbocell is a broad name used to describe our Turbodek and Fiberdek evaporative pads. Turbodek is made from a special cellulose paper, impregnated with insoluble anti-rot salts and rigidifying saturants. Fiberdek is made from large glass fibers bound together by inorganic, noncrystalline fillers and is UL approved with a UL900, Class 2 rating up to 12" depth.

The unique cross fluted design of the pads induces a highly turbulent mixing of air and water for optimum heat and moisture transfer. The internal geometry of the pad – a "built-in-angle" – continually directs the water to the air entry side. This results in:

1. Much higher cooling efficiency - up to 90% in the 400-500 FPM velocity range in a typical 12" depth of Turbodek, or slightly higher with Fiberdek.
2. Much higher face velocity - because of the "built-in-angle", the maximum air velocity without water carryover is approximately 700 FPM for Turbodek. This compares to approximately 200 FPM for conventional pads!
3. Self-cleaning design - Turbodek pads are unaffected by atmospheric dust or sand. When the recirculating water is turned on, especially without air flow, the water flushes the surface areas, with the greatest concentration at the entering side where debris normally accumulates. This also serves as protection against mineral buildup.

Applied Air

# Climate Control Systems



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