

Title: System Specification  
Document No. SPEA320  
Program: A320/A321  
Equipment: Zonal Drying system  
Manufacture: CTT Systems AB

Prepared by  
Engineering:



Date: 2007-02-16

Patrik Fernlund

Checked by  
Quality Manager:



Date: 2007-02-19

Maria Wester

Released by  
Engineering Manager:



Date: 2007-02-19

Ronnie Eriksson

This document has been produced by word processing, and any changes must be implemented through that system.

TABLE OF CONTENTS

	Page
Title Page	1
Table of Contents	2
Revisions	3
1. Introduction	4
2. Applicable Documents	4
3. System Description	5-6
4. System Performance	7
5. System Interfaces	8-9
6. Environmental Conditions	10
7. Certification and Qualification	11
8. Design	11
9. Maintenance and Test	12
10. Reliability	12
11. Quality Aspects	12-13
12. Storage and Handling	13

REVISIONS

Issue. Number	Description of Change	Para/Page	Approval/Date
I	First Issue	all	<i>PL</i> 2003-02-25
II	Change of values	2-4, 7, 8, 10	<i>PL</i> 2003-06-26
III	System updated with ZD type 2000-060. Values updated. Page 13 added.	4, 5, 7-9, 11 and 12	2007-02-19 <i>[Signature]</i>

## 1. INTRODUCTION

### 1.1 Scope

This system specification defines the design, performance and airworthiness requirements for a Zonal Drying system for the aircrafts Airbus A320. Conforming to this specification the Zonal Drying system meets the FAR/JAR Part 25.

## 2. APPLICABLE DOCUMENTS

### 2.1 Documents

FAR/JAR Part 25

RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment"

Design Specification Zonal Dryer 2000-060 Series	SPE 2000-060
Design Specification Control Panel 11233-000	CTTSPE-15

Surface Treatment with White Top Coat	STS 00-001-00
Surface Treatment with Green Primer	STS 01-002-00
Surface Treatment with Yellow Primer	STS 01-003-00
Surface Treatment with Black Top Coat	STS 97-003-00

### 2.2 Drawings

System Installation A320	FDB A320-00-2
System Installation A321	FDB A321-00-2
Zonal Drying Installation	FDB A320-11-1

Piccolo Ducting Installation	FDB A320-60-1
Piccolo Ducting Installation	FDB A321-60-1
Riser Ducting Installation	FDB A320-70-1
Riser Ducting Installation	FDB A321-70-1
Reg Air Ducting Installation	FDB A320-80-1
Reg Air Ducting Installation	FDB A321-80-1

Wiring Diagram	FDB A320-110-2
Control Panel Installation	FDB A320-111-2
Circuit Breaker Installation	FDB A320-112-3
Wire Routing Diagram	FDB A320-120-2

### 3. SYSTEM DESCRIPTION

#### 3.1 General

The Zonal Drying system keeps the humidity in the crown area at a level where it will reduce the condensation on the fuselage skin inner surface and stop water accumulation in insulation blankets.

The Zonal Drying system includes the following equipment's and components. See also Zonal Drying System Parts List:

Zonal Dryer  
Control Panel  
Filter Box  
Ducting System

#### 3.2 Component Description

##### 3.2.1 Zonal Dryer

The Zonal Dryer is installed in the right hand triangle area in forward cargo behind the lining. The Zonal Dryer is a cylinder formed dehumidifier of parallel flow absorption type where the active part is a glass fiber honeycomb rotor, which is impregnated with silica gel. Other components in the Zonal Dryer are a mixed flow, 11400 rpm, four pole fan designed for continuous operation, electrical heaters, a geared rotor drive motor, an electronic control box, and thermistor sensor and thermal switches for overheat protection.

The airflow from the fan at the inlet side of the unit is divided into two separate airstreams. About ~ 75 % of the total airflow is passing directly through the rotor. The air humidity is absorbed by the rotor silica gel, resulting in a dry (low water content) air stream, which is then leaving the Zonal Dryer through the dry air outlet.

The other ~ 25 % of the airflow, the regeneration air, is routed through the electrical heater, heated to ~ 140°C, before it passes through the rotor. The warm air will absorb the humidity in the rotor and then leave the Zonal Dryer through the regeneration air outlet. The rotor is slowly driven by an electrical AC-motor over a belt drive. This ensures that the rotor is regenerated continuously by the warm airflow, keeping the rotor absorption capacity at a high level.

The Zonal Dryer is controlled and monitored by a Control box. The Control box controls and monitors the Zonal Dryer functions concerning temperatures, voltage and phase conditions and performance in case of heater failure, and shall shut down the Zonal Dryer in case of abnormal conditions.

The Zonal Dryer Control Box is connected to the right re-circulation fan circuit via a relay in the 103VU relay box panel to enable the Zonal Dryer to shut down in case of smoke in cabin situation.

It also provide 28VDC power output enable signal from the ZDC for Humidifier provisional installation.

### 3.2.2 Control Panel

The Control Panel P/N 11233-000 is installed in the electrical equipment bay area. It controls the Zonal Dryer concerning ON/OFF-, Reset- and Test functions.

The Control panel displays the Zonal Dryer status via indicators for Fault condition, Reduced performance and Zonal Dryer operative.

### 3.2.3 Filter Box

A High Efficiency filter is fitted in a box mounted on an attachment beam installed close to the Zonal Dryer on the inlet side. The filter box is connected to the Zonal Dryer via a flexible lightweight duct. The filter reduces the amount of nicotine and bacteria passing through the Zonal Dryer.

### 3.2.4 Reg Air Ducting System

One reg air ducting system of rigid and flexible light weight ducts is connected to the Zonal Dryer lower outlet and routed AFT, through the triangle area and ends close to the aircraft re-circulation filter inlet. This means that the regenerated air is distributed back to the cabin through the ECS system.

### 3.2.5 Riser Ducting System

Two riser ducting system of flexible light weight ducts is routed from the dryer upper outlet up in one frame bay in the forward right hand side of the aircraft behind the sidewall panel and stowage bin up to the crown area.

### 3.2.6 Piccolo Ducting System

One piccolo system of rigid and flexible lightweight ducts is connected to the two riser ducts. The piccolo duct is route from the AFT door area to the FWD door area. Rigid ducts equipped with one tap off hose connector can be used if needed to make it possible to distribute out dry air to extra sensitive areas such as antennas and heavy structural areas.

#### 4. SYSTEM PERFORMANCE

The Zonal Dryer including filter and ducting shall have the following performance during standard atmospheric pressure, with an air inlet temperature of 23° C. Nominal input AC voltage and frequency is required.

*Note:*

*Ground condition airflows below are based on a simulated complete system pressure drop. Simulated cruise condition is run at a volumetric airflow on ground that compensates (simulates) a lower air density at cruise level.*

Inlet airflow (min):	350 m <sup>3</sup> /h (ground condition) 245 m <sup>3</sup> /h (simulated cruise condition)
Dry airflow (min):	260 m <sup>3</sup> /h (ground condition) 180 m <sup>3</sup> /h (simulated cruise condition)
Regeneration airflow (nom):	90 m <sup>3</sup> /h (ground condition) 67 m <sup>3</sup> /h (simulated cruise condition)
Temperature of dry airflow (nom):	35° C (simulated cruise condition)
Temperature of regeneration airflow (nom):	55° C (simulated cruise condition)

Nominal Drying Capacity at 1013 mBar, 23° C and airflow at simulated cruise condition:

<u>Inlet Air Conditions.</u>	<u>Dried Air Conditions</u>
15% RH, (2,6 g/kg) Dew point -4 ° C	2,6% RH, (0,9 g/kg) Dew point -17 ° C
25% RH, (4,3 g/kg) Dew point 2 ° C	4,3% RH, (1,5 g/kg) Dew point -11 ° C

## 5. SYSTEM INTERFACES

### 5.1 Mechanical Interfaces

The Zonal Drying system shall be installed in accordance with the following installation drawings:

System Installation A320	FDB A320-00-2
System Installation A321	FDB A321-00-2
Zonal Drying Installation	FDB A320-11-1
Piccolo Ducting Installation	FDB A320-60-1
Piccolo Ducting Installation	FDB A321-60-1
Riser Ducting Installation	FDB A320-70-1
Riser Ducting Installation	FDB A321-70-1
Reg Air Ducting Installation	FDB A320-80-1
Reg Air Ducting Installation	FDB A321-80-1

### 5.2 Electrical Interfaces

The Zonal Drying system has to be electrical connected to the aircraft 28 VDC and 115/200 VAC systems in accordance to the following CTT-System electrical drawings:

Wiring Diagram	FDB A320-110-2
Control Panel Installation	FDB A320-111-2
Circuit Breaker Installation	FDB A320-112-3
Wire Routing Diagram	FDB A320-120-2

The Zonal Drying system operates correctly under the below input conditions:

DC nominal voltage:	28 volt
DC voltage range:	22 – 30,3 volt
AC nominal voltage:	115/200 volts three phases
AC voltage range:	105 - 122 volt
Nominal AC frequency:	400 Hz
Frequency range:	380 - 420 Hz

### 5.3 Power Consumption

The Zonal Dryer with control system has the below maximum power consumption at nominal voltage condition and standard temperature.

Nominal DC Current:	0,3 amps.
Power Consumption:	2100VA (pf 0.97)
Maximum AC Inrush Current:	14,0 amps/phase.
Continues AC Current:	6,1 amps/phase.

### 5.4 Weight

The weight of the complete system including Zonal Dryer, Filter boxes, ducting and electrical equipment shall be less than 26 kg.

## 6. ENVIRONMENTAL CONDITIONS

The Zonal Drying system shall without malfunction or degradation of life be capable of meeting the requirements in this specification subjected to the environmental conditions specified in the document RTCA/DO-160 D. The categories as stated below apply for the different sections. Where N/A (not applicable) is indicated it is considered that a statement in the Qualification Test Procedure could exclude this requirement.

DO-160D Section	Category
4 Temperature and Altitude	A3
5 Temperature Variation	B
6 Humidity	A
7 Operational Shocks and Crash Safety	B
8 Vibration, standard random	S
11 Fluid susceptibility	F
13 Fungus Resistance	F
15 Magnetic effects	B
16 Power Input	A
17 Voltage Spike	A
18 Audio Frequency	A
19 Induced Signal Susceptibility	A
20 Radio Frequency Susceptibility	T
21 Emission of Radio Frequency Energy	M

## 7. CERTIFICATION AND QUALIFICATION REQUIREMENTS

### 7.1 Certification

The basis for certification of the Zonal Dryer System is applicable airworthiness requirements JAR/FAR Part 25.

### 7.2 Qualification

The Zonal Dryer is subjected to qualification tests as reported in the Qualification Test Report QTR2000-060.

## 8. DESIGN

### 8.1 Metals

Metals shall be of corrosion resistant type unless suitably protected to resist corrosion during normal service life. Dissimilar materials must be suitably isolated and protected to prevent corrosion. Magnesium shall not be used.

### 8.2 Flame Resistance

Any non-metallic materials shall meet the flammability requirements of JAR/FAR 25.853.

### 8.3 Surface Treatment

The Zonal Dryer and other Zonal Drying System sub-components shall on all applicable surfaces be surface treated according to the following specifications:

STS 00-001-00	Surface Treatment with White Top Coat
STS 01-002-00	Surface Treatment with Green Primer
STS 01-003-00	Surface Treatment with Yellow Primer
STS 97-003-00	Surface Treatment with Black Top Coat

## 9. MAINTENANCE AND TEST

The primary maintenance concept is CONDITION MONITORING. This applies for the complete system except for the inlet filter. The scheduled maintenance of this component has to be performed as laid down in the Maintenance Manual Supplement MMS A320.

The filter has to be replaced each 4,000 FH in smoking compartment and each 6,000 FH in non-smoking compartment.

## 10. RELIABILITY

### 10.1 Useful Life

The useful life the Zonal Drying system is 80,000 flight hours (FH), beginning entering the A/C service.

The useful life of the rotor in the Zonal Dryer is between 20,000 and 40,000 FH depending on operating condition.

Def.: Under given conditions, useful life is the time interval beginning entering the A/C service, and ending when failure intensity becomes unacceptable or when the system is considered not repairable as the result of a fault.

### 10.2 MTBF Figures

The MTBF for the Zonal Drying system shall not be less than 15 000 FH, considering correct maintenance.

### 10.3 Reliability/Safety Analysis

The failure modes for the system shall be analyzed and the results summarized in a FMEA for the system and a FMEA for the Zonal Dryer (system main equipment).

## 11. QUALITY ASPECTS

### 11.1 Quality Assurance

The quality aspects are laid down in CTT-Systems Company Quality Systems Manual. CTT Systems are certified against EASA Part 21, EASA Part 145 and EN 9100.

## 11.2 Acceptance Test

Before delivery, each equipment in the system has to be subjected to an Acceptance Test as specified in the equipment Acceptance Test Procedures ATPs. The results of these tests shall be recorded on Acceptance Test Reports ATRs. A copy of these reports accompanies the equipment at delivery.

## 12. STORAGE AND HANDLING

### 12.1 Storage

The storage life of the system equipment shall be 120 months at normal storage conditions.

**Special Terms:** Zonal Dryer Fan impeller shall be hand rotated every six months to maintain bearing grease conditions.

### 12.2 Handling

All system equipment shall be designed to withstand impacts, which may result from handling during removal/installation.