ASHRAE 2004 THERMAL GUIDELINES FOR DATA PROCESSING ENVIRONMENTS

recommended range, particularly over the entire face of the equipment. In these situations, reasonable efforts should be made to achieve conditions within the recommended range. If these efforts prove unsuccessful, operation within the allowable environment is likely to be adequate, but facility operators may wish to consult with the equipment manufacturers regarding the risks involved.

2.2 Environmental Class Definitions

Compliance with a particular environmental class requires full-performance operation of the equipment over the entire allowable environmental range, based on non-failure conditions.

Class 1: Typically a data center with tightly controlled environmental parameters (dew point, temperature, and relative humidity) and mission critical operations; types of products typically designed for this environment are enterprise servers and storage products.

Class 2: Typically an information technology space or office or lab environment with some control of environmental parameters (dew point, temperature, and relative humidity); types of products typically designed for this environment are small servers, storage products, personal computers, and workstations.

Class 3: Typically an office, home, or transportable environment with little control of environmental parameters (temperature only); types of products typically designed for this environment are personal computers, workstations, laptops, and printers.

Class 4: Typically a point-of-sale or light industrial or factory environment with weather protection, sufficient winter heating, and ventilation; types of products typically designed for this environment are point-of-sale equipment, ruggedized controllers, or computers and PDAs.

NEBS: In accordance with Telcordia GR-63-CORE (Issue 2, April, 2002) and GR-3028-CORE (Issue 1, Dec, 2001); typically a telecommunications central office with some control of environmental parameters (dew point, temperature, and relative humidity); types of products typically designed for this environment are switches, transport equipment, and routers.

Product Operation: Product equipment is powered on.

Product Power Off: Product equipment is removed from the original shipping container and installed but not in use, e.g., during repair, maintenance, or upgrade.

Table 2.1 Equipment Environment Specifications

Class	Equipment Environment Specifications									
	Product Operation[a,b]							Product Power Off [b,c]		
	Dry-Bulb Temperature (°C)		Relative Humidity (%) Non-Condensing		Max. Dew Point (°C)	Max. Elevation (m)	Max Rate of	Dry-Bulb Temperature (°C)	Relative Humidity (%)	Max. Dew Point (°C)
	Allowable	Recommended	Allowable	Recommended						
1	15 to 32[d]	20 to 25	20 to 80	40 to 55	17	3050	5	5 to 45	8 to 80	27
2	10 to 35[d]	20 to 25	20 to 80	40 to 55	21	3050	5	5 to 45	8 to 80	27
3	5 to 35[d,e]	NA	8 to 80	NA	28	3050	NA	5 to 45	8 to 80	29
4	5 to 40[d,e]	NA	8 to 80	NA	28	3050	NA	5 to 45	8 to 80	29

a. Product equipment is powered on.
b. Tape products require a stable and more restricted environment (similar to Class 1). Typical requirements: minimum temperature is 15°C, maximum temperature is 32°C, minimum relative humidity is 20%, maximum relative humidity is 80%, maximum dew point is 22°C, rate of change of temperature is less than 2°C/h, rate of change of humidity is less than 5% RH per hour, and no condensation.
c. Product equipment is removed from the original shipping container and installed but not in use, e.g., during repair, maintenance, or upgrade.
d. Derate maximum dry-bulb temperature 1°C/300 m above 900 m.
e. With a diskette in the drive, the minimum temperature is 10°C.

NEBS[l]	5 to 40[g,h,i]	18 to 27[j]	5 to 85[g,i]	Max 55[k]	28[g]	4000[g]	NA	NA	NA	NA

f. The product operation values given for NEBS are from GR-63-CORE and GR-3028-CORE. GR-63-CORE also addresses conformance testing of new equipment for adequate robustness. Some of the test conditions are summarized below. For complete test details, please review GR-63-CORE.
Conformance test conditions (short-term) of new equipment:

Dry-Bulb Temperature	
Frame Level	–5°C to 50°C, 16 hours at –5°C, 16 hours at 50°C, (GR-63-CORE)
Shelf Level	–5°C to 55°C, 16 hours at –5°C, 16 hours at 55°C, (GR-63-CORE)
Max Rate of Change	0.5°C/min (GR-63-CORE)1.6°C/min (GR-3028-CORE)
Relative Humidity	5 to 90% 3 hours at <15% RH, 96 hours at 90% RH (GR-63-CORE)
Max Dew Pt	28°C (GR-63-CORE)

g. Requirements for continuous operating conditions that new equipment shall tolerate (GR-63-CORE). A feature or function that, in the view of Telcordia, is necessary to satisfy the needs of a typical client company is labeled "Requirement" and is flagged by the letter "R." The conformance testing described in footnote "f" is designed to ensure that equipment tolerates the specified continuous operating conditions.
h. Derate maximum dry-bulb temperature 10°C at and above 1800 m.
i. Also ANSI T1.304-1997 [4].
j. Recommended facility operation per GR-3028-CORE. No NEBS requirements exist.
k. Generally accepted telecom practice; the major regional service providers have shut down almost all humidification based on Telcordia research. Personal grounding is strictly enforced to control ESD failures. No NEBS requirements exist.