ELECTRONIC DATA PROCESSING CENTER BUILDING DESIGN CRITERIA

CONTENTS PAGE

1. GENERAL

1.01 This section covers recommendations for building design for new Electronic Data Processing (EDP) centers. While this section covers mainly the considerations involved in planning for the large-scale EDP center and large clusters of minicomputers, many of these considerations also apply to smaller centers. Existing EDP centers should be designed to incorporate these recommendations when a major addition or alteration is planned, dependent on the justifiable expenses.

1.02 This section is revised and reissued to include additional design standards for raised flooring systems, mechanical system energy conservation methods, and references to various Bell System standards. The classification of records and storage procedures have been omitted. Due to the extent of revision, revision arrows are not used.

1.03 Where local, state or OSHA (Occupational Safety and Health Act) regulations require higher degrees of protection, the legislated criteria should be followed.

1.04 The standard for the Protection of Electronic Data Processing Centers prepared by the National Fire Protection Association (pamphlet No. 75) will be quoted extensively throughout this text and may be used as a judgment guide for protection items not expressly covered in this section.

1.05 The computer equipment manufacturer's "Site Preparation Manuals" should be carefully adhered to.

1.06 Other references include:

(a) Section 760-120-150, "Electronic Data Processing Centers—Building Project Planning"

(b) Section 760-600-230, "Electronic Data Processing Centers—Firesafety Criteria"

(c) Section 007-590-200, "Computer Center Physical Security and Disaster Recovery Policy Statement and General Information."

2. SITE SELECTION

2.01 Section 760-230-150, "Selection of Building Sites for Central Offices," includes general site selection criteria such as scheduling, surface and subsurface conditions, zoning, and selection standards for comparison. Criteria to consider specifically for EDP centers follows.

2.02 Access to the site should be restricted. Safety and security are prime considerations. However, ease of access for trash removal and the delivery of equipment, supplies, and media must also be considered.

2.03 Considering the importance of an EDP center and the investment involved, the housing of the center shall be in a building of fire resistive or noncombustible construction. Section 760-630-400, "Compartmentation," defines these terms.

2.04 If the existing EDP center is housed in other than fire resistive or noncombustible construction such as a leased facility, an approved fire protection system shall be considered.

2.05 The relatively high costs associated with the physical preparation for an EDP system suggest that the equipment be installed in a Company-owned building rather than in leased quarters. Generally, it is not sound practice to expend a large sum for preparing a location where the possibility exists that the equipment might have to be relocated. Leased quarters which do not meet minimum standards and which cannot be economically upgraded should be eliminated from consideration.

2.06 The reliability and quality of electric power should be considered. Electrical requirements for EDP centers are discussed in Part 6.

2.07 Exposure to electromagnetic interference (EMI), or radio-frequency interference (RFI), capable of upsetting magnetic disks and tapes should be avoided. Supression measures may need to be made. Design standards are discussed in Sections 760-220-100, "RFI Shielding" and 760-220-110, "EMP Shielding."

2.08 The computer equipment area should be located so as to minimize the risk of exposure to fire, flooding, theft, and vandalism. Ease of access for the delivery of equipment, supplies, and media must be considered.

2.09 Location of the computer room within the building may affect environmental control. Unless an effective vapor barrier is installed, an outer wall of the building should not form a wall of the computer room, since the relative humidity of the computer room will be difficult to control. This is especially true if there are exterior windows in the wall since moisture may condense on them in cold weather. Other disadvantages to exterior windows are: airborne contamination may enter more readily, and security is more difficult to achieve.

3. CEILINGS AND PARTITIONS

3.01 The ceiling and partition characteristics for EDP areas are similar to telephone equipment areas, eg, ceiling and partition material finishes should be of a type that does not dust or flake. Acoustical treatment of ceilings is recommended in order to reduce the amount of noise, and should be of fire resistive material. The use of mineral type tile ceilings and the use of insulating pads or blankets with or without paper envelopes above a perforated ceiling panel are not recommended. This is due to the fact that particles of the material may fall into the machine area. If draperies or acoustical wall panels are used for soundproofing or decorative purposes, they should be made of a lint-free and fire resistive or flameproof material.

3.02 All building and finish materials in the computer room and related areas including walls, floors, partitions, acoustical treatment, insulation, raised floors, raised floor supports, floor covering materials and suspended ceilings should be noncombustible or Underwriters' Laboratories listed with a flame spread of 25 or less and a smoke developed rating of 50 or less.

3.03 Ceiling height requirements vary. Most systems require 9 feet of clear space from floor to ceiling, in addition to the space required if a raised floor is employed. Paragraphs 4.06 and 4.07 discuss raised flooring height requirements.

3.04 Vapor barriers are recommended to control moisture migration into and out of the computer area, since proper relative humidity maintenance is important to computer equipment operation. Ceiling tiles are available with integral vapor barriers. Floor slabs and wall partitions may be painted with sealants.

3.05 Penetrations through the ceiling, walls, or floor slabs should be sealed to prevent moisture migration as well as conditioned air loss.

3.06 Doors that access the EDP area should be gasketed to minimize air leakage. Double door configurations should be considered in high traffic areas.

3.07 The optimum insulating or "U" value should be provided in the wall and ceiling partitions surrounding the EDP area to effectively control the heat flow into and out of this area at minimum heating/cooling costs. The optimum "U" value may be determined as outlined in Section 760-310-100, "Building Envelope, Thermal Design." This value may also be computer generated from the TOPES "INSUL" program which is described in IL 80-02-243.

3.08 ***Fire Rated Partitions:*** Refer to Section 760-600-230, "Application Criteria for Electronic Data Processing Buildings," for minimum design standards. Tape vaults are considered as tape libraries. Fire ratings may be increased depending upon hazard threat and availability of duplicate tapes.

3.09 ***Fire Division Plan:*** A fire division plan included with each architectural floor plan as shown in Fig. 1 will reduce the possibility of unprotected openings in required fire partitions.

3.10 Noncombustible partitions extending from the raised floor to the suspended ceiling or less may be installed within the EDP center to provide security, isolate noisy areas or separate equipment having differing environmental requirements. This type of partition does not constitute a fire-rated partition. However, because of the exiting and air conditioning problems they may create, their use should be avoided.

4. FLOORS

Floor Loading

4.01 Minimum uniform design live loads are as follows. Refer to Section 760-200-020, "Design Loads for Telephone Buildings," for additional information.

(a) Administrative space—80 pounds per square foot

(b) Card storage area—200 pounds per square foot

(c) Computer area—100 pounds per square foot(structural floor)

(c) Computer area—250 pounds per square foot (raised floor).

4.02 The design of the slab and the framing system should be investigated, regardless of uniform floor loading, taking into consideration the concentrated load of each machine unit. Since the machine loads imposed on the slab vary with the type of equipment used, it would be impossible to list all the weights involved in the various configurations. Real Estate Management should verify the weight of each machine unit to determine the requirements for floor design.

4.03 Growth plans for EDP centers should take into consideration the additional weights involved for future equipment along with the weight of the initial equipment installed. Future equipment space should be designed to support ultimate floor loadings. Information Systems must be informed of and in agreement with equipment floor design loads.

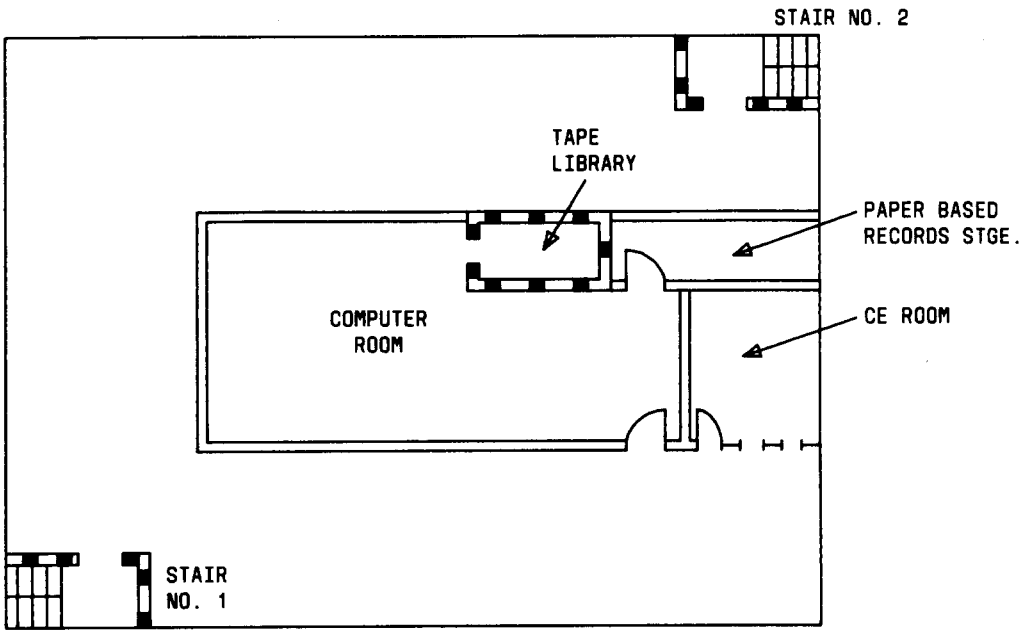
4.04 Additionally as equipment floor space becomes limited, the building engineer should track equipment layouts to insure floor loadings are not exceeded.

Floor Type and Construction

4.05 The various components of an EDP system are in most cases interconnected by means of large electrical cables. The fact that these connections are made at the base of the equipment and that the cable lengths are limited by circuit design requirements makes it necessary to place the cables below the finished floor level.

4.06 A flooring system designed to accommodate the electrical cables is therefore recommended. A raised floor system, ie, where the finished floor panels are supported on pedestals above the structural floor, is preferred to a "raceway" type floor. Raised floor systems are outlined in Section 760-200-110, "Design Criteria for Raised Floor Systems." If, in new construction, a depressed slab for access floors can be economically designed to allow for future growth and maintain required slab integrity, it should be considered since the need for ramps or steps may be eliminated.

4.07 In order to provide adequate space for cabling beneath raised floors, it is recommended that a raised floor assembly height of 12 inches be provided. Where the underfloor space serves both for cable distribution and as either an air supply or return plenum, the height should be 18 inches. For installations in earthquake zones 3 and 4, the preferred height is



COMPUTER FLOOR FIRE DIVISION PLAN

LEGEND:

1 HOUR

2 HOUR

NON RATED

- ALL OPENINGS AROUND CONDUIT & PIPES PASSING THROUGH FIRE PARTITIONS MUST BE GROUTED.
- ALL DUCTS PASSING THRU FIRE PARTITIONS MUST HAVE FIRE DAMPERS SECURELY ANCHORED.
- ALL FIRE PARTITIONS MUST EXTEND FROM STRUCTURAL FLOOR TO STRUCTURAL SLAB ABOVE.
- ALL DOORS AND FRAMES SHOWN IN FIRE RATED WALLS MUST BE RATED THE SAME AS THE WALLS.

Fig. 1—Computer Floor Fire Division Plan

limited to a maximum of 14 inches. However, additional heights may be permitted with specially designed pedestals.

4.08 Raised floors in earthquake zones 3 and 4 should be of the rigid grid support type, with pedestals that are strengthened and mechanically fastened to the structural floor under equipment areas. Refer to Section 760-200-110, "Design Criteria for Raised Floor Systems" and Section 760-200-023, "Earthquake Design Loads" for further information. Critical facilities in upper building floors of earthquake zone 2 may also require similar considerations.

4.09 Materials used for raised floors shall be in accordance with NFPA 75. In general, this requires the structural supporting members and floor panels to be of noncombustible material.

4.10 Supporting members should be directly affixed to the structural floor for maximum strength. Therefore, existing structural floor coverings should be removed before installing a raised floor system. If existing structural floor coverings are not removed, support pedestals should be mechanically fastened to the structural floor.

4.11 Two floor lifters shall be located in the Computer Room, conspicuously mounted and designated for fire emergency use.

4.12 Openings in raised floors for electrical cables or other use are to be protected to minimize the entrance of debris or other combustibles beneath the floor. This may be accomplished by noncombustible covers, grilles, perforated panels, or screens.

4.13 Electric cable openings in floors shall be made smooth or shall otherwise be protected to preclude the possibility of damage to the cables. Panel edge moldings are recommended at such openings. Cable opening covers will minimize entrance of debris beneath the floor and help control air circulation.

4.14 The entire raised floor, including the supporting structure, should be grounded following the computer manufacurer's recommendations and/or Section 802-001-196, "Protective Grounding Systems—Requirements for Data Processing Computer System Installation."

4.15 In existing construction where a combustible raised floor is used, it should be replaced with noncombustible construction dependent, of course, on the economics of such replacement. If the economic review favors leaving the combustible floor in, the following is recommended:

(a) Early Warning fire detectors shall be provided in the air space below to sound an audible and visual alarm, and to shut down all electrical power passing through the air space, and

(b) Air spaces below shall be subdivided by tight noncombustible bulkheads into areas not exceeding that required for one system, or, in any case, not more that 10,000 square feet.

4.16 When a raised floor serves as an air plenum, all wiring shall conform to the appropriate National Electric Code Article. In general, this requires branch-circuit supply conductors to receptacles must be enclosed in an approved metallic covering.

4.17 ***Vibration:*** The floor construction should be such that vibration from equipment is not transmitted to other, quieter areas. Floor vibration should be limited to 1 mil peak-to-peak amplitude in any direction. In no event shall the floor vibration exceed 10 mils peak-to-peak amplitude or accelerations in excess of 0.15 g's.

Floor Coverings

4.18 Floor coverings for raised panels should be selected for their ability to control dust and static electricity and for ease of maintenance. The computer manufacturer's engineering specification should be followed unless it is in conflict with Company standards. Floor coverings selected should be in accordance with Section 760-610-200, "Considerations for Interior Finishes and Furnishings." Panels with exposed metal edges are not recommended because of the possible electrical hazard.

4.19 The electrical resistance of the floor should conform to the computer equipment manufacturer's recommendations.

4.20 Carpeting is not recommended. Where carpeting is employed for noise control, or if it can be justified on the basis of reduced maintenance, the carpeting should be of the type that minimizes the effects of static electricity. Carpet tiles are recommended over raised floors requiring frequent access to subfloor areas.

4.21 Careful attention should be given to proper maintenance of the floor covering on a raised floor. When a laminated plastic floor covering is used, waxing is not required. To avoid trapping water under the raised floor, very limited amounts of water should be used for mopping or cleaning purposes.

5. ENVIRONMENTAL AIR HANDLING SYSTEMS

5.01 The EDP equipment areas require cool, well-filtered, humidified air. Room pressure should be kept higher than adjacent space to prevent dust infiltration. Generally, when the computer equipment is in operation, no external source of heat will be required. Heating may be required during phasing in of equipment, or during periods of extended computer shutdown.

5.02 Temperature control is an important environmental concern since the computer equipment is cooled by the surrounding room air, the overhead, or the underfloor air distribution system. The total heat load to be handled by the air conditioning system consists of the building load, outside air make-up, lighting, and personnel, in addition to the EDP equipment heat release. The heat dissipated by the EDP equipment will normally be the major component of the total heat load.

5.03 Heat dissipation data for the various EDP system components are available from the equipment manufacturers. It is recommended that a floor layout drawing of the EDP area be submitted to Real Estate Management by Information Systems, showing the BTU heat release for each component. This drawing is required to determine the total heat load and the proper air distribution system. The number of operating personnel should also be noted on the drawing, showing their normal operating locations.

5.04 ***Relative Humidity:*** High and low relative humidity extremes will impair proper operation of the equipment and electronic components. High humidity levels may cause condensation in the equipment. Low humidity levels, the more frequent problem, promotes static electricity which may destroy data stored on magnetic disks and tapes. Humidification is generally required during the winter months to replace moisture that migrates from the room, to add moisture to the outside ventilation air, and to replace the moisture removed during the cooling process. Rapid changes in humidity levels should be avoided due to the adverse affects such changes may have on punched cards, magnetic tapes, and other components used in electronic data processing.

5.05 ***Design and Operating Criteria:*** The environmental conditions to which computer equipment may be exposed may vary with each manufacturer. Environmental conditions for the major manufacturers are listed in Table A. There are two ranges of environmental requirements provided: RECOMMENDED and MAXIMUM ranges. The distinction between these ranges is shown on the psychrometric chart for IBM equipment, Fig. 2.

5.06 The RECOMMENDED range defines the range of ***design*** parameters to be used in the heat load analysis and selection of equipment AND the conditions to be maintained in the computer area during normal operation of the environmental systems. These are conditions which each manufacturer requires for his equipment to operate with an acceptable processing error rate.

5.07 The MAXIMUM range is defined as the range over which the equipment will function. However, when operating beyond the limits of the RECOMMENDED range, there is an increased possibility of processing errors and various mechanical difficulties, particularly in peripheral equipment.

5.08 ***Reliability:*** The environmental system must be reliable since failure to maintain proper operating conditions may result in substantial computer equipment downtime. The reliability of the environmental system is obtained by the use of high quality components and redundancy or a combination of both. The extent of reliability should be determined by the criticality of the EDP equipment. The degree of redundancy designed into the environmental system may ***range*** from the use of dual compressors in a cooling unit, each capable of handling one-half the load to safeguard against compressor failure, to having standby equipment available and capable of maintaining the space conditions under any and all possible failures. Standby equipment may include refrigeration equipment, air handlers, coolers, compressors, pumps, etc.

5.09 Standby equipment should only be considered for those EDP systems identified as being required to operate during long-term commercial power failure and which are provided with standby power.

TABLE A

COMPUTER SYSTEMS DESIGN AND OPERATING CONDITIONS

COMPUTER SYSTEM MANUFACTURER	RECOMMEND DESIGN AND OPERATING RANGE		MAXIMUM RANGE	
	HEATING	COOLING	HEATING	COOLING
Amdahl	65° FDB 35% RH	78° FDB 55% RH	60° F 20% RH	90° F 80% RH
Burroughs	65° FDB 40% RH	75° FDB 60% RH	60° F 20% RH	100° F 80% RH
Computer Console Inc.	65° F 35% RH	75° F 55% RH	60° F 20% RH	80° F 80% RH
Comten	67° F 35% RH	75° F 55% RH	62° F 35% RH	80° F 60% RH
Control Data Corp.	65° F 35% RH	75° F 55% RH	60° F 20% RH	90° F 80% RH
Data General	65° F 35% RH	80° F 55% RH	60° F 10% RH	100° F 90% RH
Datapoint Corp.	65° F 35% RH	80° F 55% RH	60° F 20% RH	90° F 80% RH
Digital Equipment Corp.	65° F 40% RH	75° F 60% RH	59° F 20% RH	90° F 80% RH
Formation Inc.	65° F 35% RH	80° F 55% RH	60° F 20% RH	90° F 90% RH
Harris Corp.	65° F 35% RH	80° F 55% RH	50° F 20% RH	90° F 80% RH
Hewlett Packard	65° F 35% RH	80° F 55% RH	60° F 20% RH	104° F 80% RH
Honeywell	65° F 40% RH	75° F 55% RH	60° F 30% RH	80° F 80% RH
Inforex	60° F 35% RH	80° F 55% RH	60° F 20% RH	90° F 80% RH
International Business Machines	65° F 35% RH	78° F 55% RH	60° F 20% RH	90° F 80% RH

TABLE A (Contd)

COMPUTER SYSTEMS DESIGN AND OPERATING CONDITIONS

COMPUTER SYSTEM MANUFACTURER	RECOMMEND DESIGN AND OPERATING RANGE		MAXIMUM RANGE	
	HEATING	COOLING	HEATING	COOLING
Lockheed Electronics	65° F 35% RH	78° F 55% RH	60° F 20% RH	90° F 80% RH
Microdata	65° F 35% RH	80° F 55% RH	60° F 20% RH	90° F 80% RH
Modular Computer System, Inc.	65° F 20% RH	80° F 55% RH	32° F 10% RH	90° F 90% RH
Mohawk Data Science	65° F 35% RH	80° F 55% RH	60° F 30% RH	90° F 80% RH
Sperry Univac	65° F 40% RH	75° F 55% RH	65° F 35% RH	80° F 70% RH
DISC STORAGE SUBSYSTEMS				
Memorex	65° F 30% RH	78° F 60% RH	60° F 20% RH	90° F 80% RH
Storage Technology Corp.	65° F 30% RH	80° F 60% RH	60° F 20% RH	90° F 80% RH

5.10 In the event of a partial environmental system failure, the continued functioning of the remainder of the environmental system may permit the operation of a major portion of the EDP system under all but the most adverse temperature and humidity conditions.

5.11 The refrigeration equipment for the EDP environmental system should be independent of other building systems, although it may be cross-connected to provide redundancy in an emergency.

5.12 ***Temperature and Humidity Recording Instruments:*** Experience in existing EDP installations indicate the value of installing temperature and humidity recording instruments in the computer room. Records of temperature and humidity may be useful in determining whether intermittent machine failures are due to adverse atmospheric conditions. Such records can also be used to determine whether a drying-out period is required after an air conditioning failure. The instrument should include a visual or audible alarm which will signal the fact that maximum temperature or humidity limitations are being approached, thereby permitting prompt corrective action.

5.13 ***Air Filtration:*** Air filters for use in air conditioning systems shall be of approved types that will not burn freely or emit a large volume of smoke or other objectionable products of combustion. The type of filters employed will depend on the level

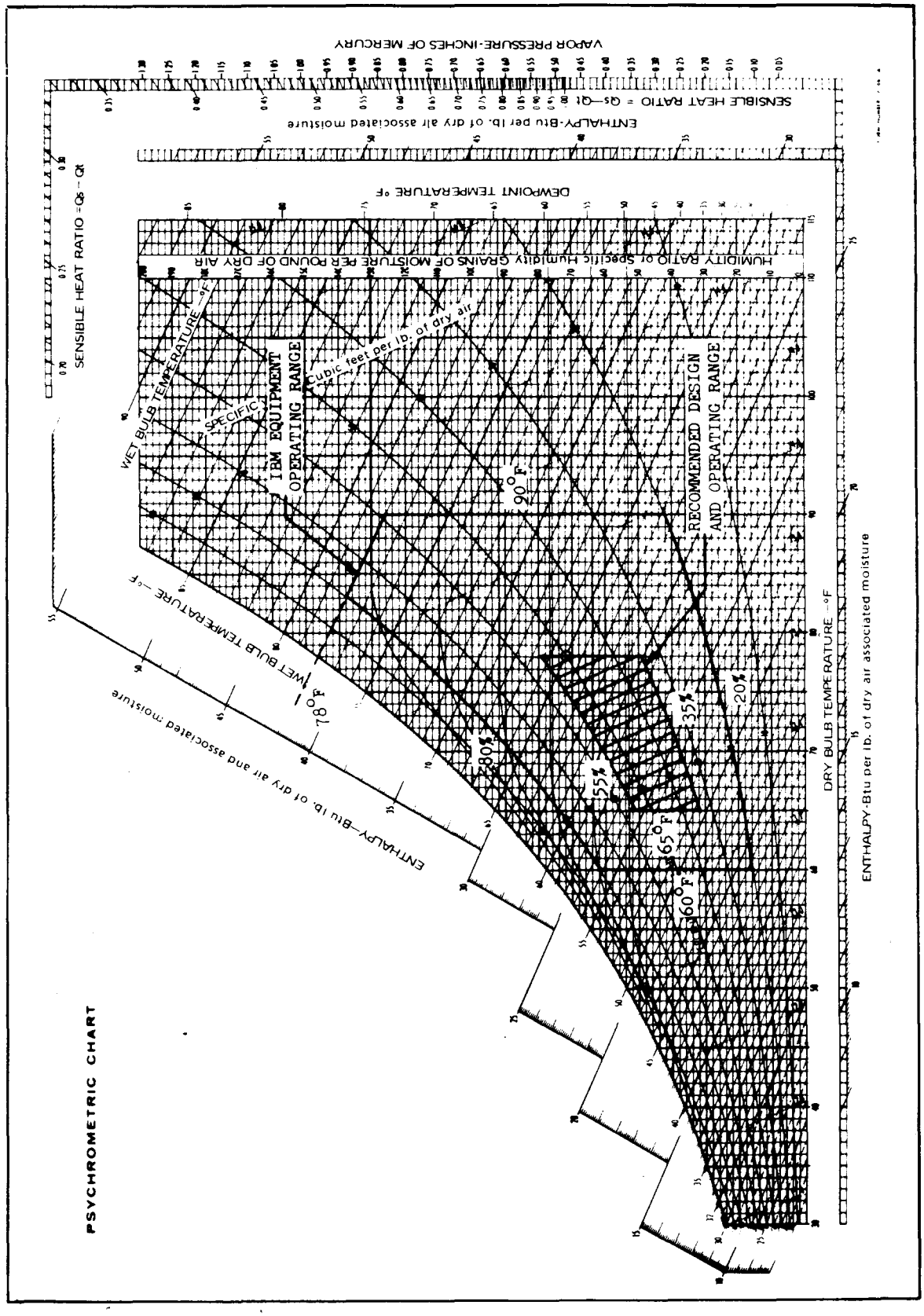


Fig. 2—IBM Psychrometric Chart

of air contamination in the area. Refer to Section 760-230-110, "Air Filtration," for filter selection criteria.

5.14 Air ducts serving other areas should not pass through the compartment containing the electronic data processing equipment. Where this is unavoidable, ducts serving other areas shall be provided with suitable Underwriters Laboratories (U.L.) listed fire dampers.

5.15 Air ducts serving other areas shall not pass through any computer records storage room.

5.16 All duct insulation, adhesive, linings, and/or coverings shall be noncombustible or have an Underwriters' Laboratories listing with a flame spread of 25 or less and a smoke developed rating of 50 or less. Refer to Section 760-640-100, "Considerations for Heating, Ventilating, and Air Conditioning Systems."

5.17 ***Air Distribution:*** Air distribution design is dependent upon the type of computer equipment, the location of the computer equipment with respect to the air supply, the ceiling height, and the comfort of the EDP operating personnel. The distribution system may provide supply air overhead, or more commonly due to the greater flexibility, from a raised floor plenum. Locations for the air supply diffusers and return air grilles should be suitably placed in order to avoid hot spots and excessive drafts but still provide adequate uniform cooling of the equipment. The computer system characteristics must be identified to enable selection of the proper air distribution system.

5.18 ***Storage Areas:*** All areas in which punched cards are used or stored should have relative humidity in the range of 30 to 65 percent. This is the optimum range for maintaining the best operating characteristics of punched cards. Even within this range, abrupt humidity changes should always be avoided. If working and storage areas of punched cards are not kept at the same relative humidity, cards should be given ample time, about 24 hours, to become acclimatized to the equipment room environment before using. This may be accomplished by providing storage facilities for current usage cards within the EDP equipment area.

5.19 The tape library, the customer engineering room, and the storage room for the paper stock and computer related supplies, located near or adjacent to the computer room, should be maintained at the same temperature and humidity level as the computer room.

5.20 ***Magnetic Tape:*** Where magnetic tapes are stored for short periods of time, the surrounding environmental conditions should be controlled within safe limits. Mylar tape should always be kept in a plastic reel case for protection from dust and physical damage. The temperature and humidity limits should not exceed 50°F to 90°F and 20 to 80 percent, respectively. If these limits should be exceeded, it is necessary to allow the tape to return to normal operating conditions for the length of time, up to 24 hours, that it exceeded these conditions. Heavy duty tape temperature and humidity limits should not exceed 40°F to 90°F and 20 to 80 percent RH.

5.21 Atmospheric conditions for long term storage of magnetic tape should not exceed a temperature range of 50°F to 110°F and relative humidity range of 20 to 80 percent. Under these conditions, the tape should remain in its plastic reel case and be conditioned to normal operating limits prior to its use.

5.22 ***Provision for Expansion and Rearrangements:*** Since computer technology is continually changing, the environmental air handling system must have sufficient flexibility to facilitate rearrnagements and modifications without completely rebuilding the system and without disruption to the computer operations. For example, valved branch connections in chilled water or condenser water piping may be initially installed to faciliate future rearrangements. To enable this, it is important for Real Estate Management to be advised as to ***both*** the initial and ultimate EDP equipment layout drawings or equipment lists.

5.23 ***Energy Conservation:*** Computer installations use large quantities of energy, thus energy conservation methods should be included in the design of the associated environmental air handling systems. Conservation methods may include one or more of the following:

(a) ***Heat Recovery:*** The transfer of computer room heat to other areas of the building for space heating and domestic hot water.

(b) ***Minimize Outside Air Intake:*** Mechanical systems should provide only enough outside air to satisfy personnel requirements. usually

less than 5 percent of the air quantities. Excessive outside air intake increases cooling in the summer and humidification in the winter.

(c) ***Humidification:*** Evaporative panel type humidifiers and water fog nozzles eliminate the use of electrical energy for humidification.

(d) ***Economy Cycles:*** The use of outside air, when temperatures permit, to cool. Outside air may be used directly as in an economizer cycle, or indirectly by cooling the condenser water. Economy cycles will reduce the use of refrigeration compressors for mechanical cooling. However, energy costs to maintain proper relative humidity may, in certain instances, be greater than the savings resulting from the decreased mechanical cooling. A review of weather data, computer loads, and energy utilization is required.

6. ELECTRICAL SYSTEMS

6.01 ***Power Requirements:*** The electrical service and distribution system and lighting for EDP centers should be designed in accordance with normal Bell System practices and standards, with the following special features for computers:

6.02 Electrical wiring in the computer equipment area shall be in accordance with NFPA 70, National Electric Code, Article 645, "Data Processing Systems."

6.03 Separate feeders for computer power should be run from the service switchboard. In the absence of protective power conditioning equipment, computer power, if practicable, should not be supplied by the same transformer that supplies transient-producing loads, ie, equipment that is turned on and off as part of its normal operation. Also, special care should be taken to insure that operating voltages are maintained at the design values (120 volts on a 208/120 V system, for example). See Section 790-100-660, "AC Power for Telecommunications Equipment," for specific recommendations on computer power. If Uninterrupted Power Supply (UPS) is to be provided, but not initially installed, adequate space should be provided for its future installation.

6.04 ***Master Disconnect Switch:*** A master disconnect switch should be located near exit doors of the computer room. This master switch, when activated, disconnects the power to all electronic equipment in the computer room and to the air conditioning system servicing that area. Air conditioning equipment which recirculates air within the EDP area only, may remain in operation to facilitate a Halon flooding system. Refer to Section 760-640-400, "Design Considerations for Halon 1301 Total Flooding Systems."

6.05 Grounding should conform to applicable portions of Section 802-001-180, "Protective Grounding Systems," and supplementary sections which contain the basic Bell System standards on protective grounding for ac electrical systems. Supplementary Sections 802-001-190, -191, -196*, and -198 are particularly relevant. The -196 section shall be used for Operations Support Systems (minicomputers) and may be used for larger computer systems ***with the concurrence of the computer supplier.***

6.06 ***Power Receptacles:*** The EDP equipment layout drawings and power requirements forwarded to Real Estate Management by Information Systems, should contain specifications for the ac power receptacles and/or connectors required to match the computer equipment. The location of the equipment must also be determined as equipment cord lengths are generally restricted.

6.07 For energy conservation, lighting systems should provide switching control flexibility to permit turning off lights in unoccupied areas.

7. FIRE PROTECTION AND DETECTION

7.01 The fire requirements for EDP buildings are recommended in Section 760-600-230, "Application Criteria for Electronic Data Processing Buildings."

7.02 ***Training:*** Key personnel should receive continuing instructions in:

(a) Alerting the fire department

(b) Evacuation of personnel

(c) Turning off all electrical power to the computer both under normal and emergency conditions

(d) Turning off the air conditioning to the area

*Check Numerical Index for availability.

(e) The location of and proper operation and application of all available fire extinguishing and damage control equipment including automatic detection and extinguishing equipment. Computer room personnel should be trained in the usage of portable fire extinguisher equipment. Section 770-340-100, "Principles of Firefighting and Use of Equipment," describes the types and usage of portable fire extinguishers.

8. WATER PROTECTION

8.01 In selecting the specific EDP room location within a building and in placing the equipment in the room the possible damage from steam or water leakage should be considered. Such damage may be caused by:

(a) Flooding condition originating outside the building

(b) Internal sources such as faulty plumbing, broken steampipes and waterpipes, or other leakage, condensation, etc, from above or nearby.

8.02 It is desirable to avoid locating steampipes and waterpipes over an EDP area. Where this is not feasible, precautionary measures should be taken to guard against possible damage due to accidental breakage, leakage, or condensation, eg, provide drip pans or troughs under the pipes and avoid placing the equipment directly below such pipes. Adequate floor drains should be installed to carry water away. As an additional precaution, the shutoff valves for pipes in the EDP area should be clearly identified and readily accessible to EDP personnel.

8.03 It is often necessary to pipe chilled water to the computer room. This water is used for self-contained air conditioning units and equipment components which are cooled by circulating chilled water through the units. This piping should be routed in such a manner so as to minimize water leakage coming into contact with critical electrical equipment. Similar precautions should be taken with pipes routing other coolants.

8.04 In earthquake zones 3 and 4, chilled water or liquid coolant piping should be provided with sufficient clearances when passing through raised floors, so as to prevent shearing. Also, the piping should be sufficiently flexible to allow for the relative motions that may occur between interconnected components.

8.05 Chilled water or coolant piping routes must not block cable pathways.

8.06 A water leakage or moisture detection and alarm system should be installed.

8.07 Consideration should be given to waterproofing the subfloor in the EDP area. The floors and roof over the EDP area should be watertight.

9. ALARM SYSTEM

9.01 An alarm system shall be provided for the EDP area which shall include the following items:

(a) Operation of early warning fire detection system (Section 760-650-100)

(b) Opening of emergency exit doors

(c) Opening of main door (after hours)

(d) Failure of ac power

(e) High and low temperature and humidity

(f) Failure of air conditioning system

(g) Failure of flow of liquid coolant

(h) Water leakage or moisture detection.

9.02 There should be an audible and visual appearance of each alarm in the EDP room. To the extent possible, each alarm should have a distinctive audible sound.

9.03 In addition to an appearance in the EDP room, the alarms should also appear in an attended area of the building such as the guard room or building maintenance area. If the building is unattended, provisions should be made to have the alarms also appear at a remote constantly attended location. Temperature alarms shall be set to alarm 5°F above the cooling recommendation and 5°F below the heating recommendation. Humidity alarms shall be set at the recommended operating conditions.

9.04 If the EDP center operates only when attended, the alarm system from the early warning fire detection system should register an audible and visual alarm in the event of fire, permitting those

trained and qualified to activate the manual shutdown switch capable of shutting down all EDP equipment. If the EDP center operates at any time when the equipment is unattended, the alarm system should shut down all machine power and/or air conditioning fans that serve the computer area.

9.05 The alarm system shall function whether using normal or emergency power.

10. SECURITY

10.01 In order to maintain the security of an EDP center, the number of access points should be limited and controlled. The control may be obtained by use of such devices as magnetic coded door locks, buffer zone entry areas, and electronic badge readers. Automatic locking doors must be equipped with fail-safe locks in case of power failure. Refer to Sections 007-590-200, 007-590-300, and 007-590-303 for more specific information.

10.02 The EDP centers should be windowless and wherever possible, centrally located within the building to permit maximum security.

10.03 Power and air conditioning rooms serving the EDP center should be locked as well as such items as circuit breaker cabinets. Consideration should be given to keying each room differently.