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TechData Sheet

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Advantages and Disadvantages of Three-Layer Raised Computer Flooring

What is a three-layer raised computer floor versus a single-layer floor?

A traditional single-layer raised computer floor often combines three functions:

- Routing space for low-voltage signaling cables between computers.
- Routing space for high-voltage power cables to computers.
- Plenum to supply cool air to prevent computers from overheating.

A three-layer raised floor separates these functions into three separate layers:

- The top layer houses the low voltage signal cables.
- The middle layer houses the high voltage power cables.
- The lower layer is a sealed plenum with "chimneys" to supply cool air where required. See Figure 1.

Why a three-layered floor?

Single-layer floors have several inherent problems that limit their effectiveness as a plenum for distributing cooling air. The main problem is that since it is used to house signal cables and power cables, these cables obstruct the airflow resulting in local "hot spots." As equipment is moved, replaced, or added to; the abandoned cables are usually left in place resulting in increased clutter and air flow blockage over time.

Because single-layer floors are not sealed plenums, multiple air handling units (AHU) must be installed to effectively cool the entire room taking up costly floor space. These units distribute air in a fan-shaped pattern, which results in the floor having some areas that are over cooled and some areas that develop "hot spots." See Figure 2. Also, due to the fact that single-layer floors are not sealed plenums, some amount of cool air leaks out into areas where it is not required. This is especially true when floor panels are removed for maintenance or modification.

The three-layer floor has a sealed plenum to distribute cool air, which eliminates the problems with a single-layer floor. The three-layer floor can use a single AHU located outside the room. This AHU maintains the plenum under a slight static pressure (about 0.45" column of water). The "chimneys" can be placed where they are needed and moved as necessary when modifications are done to the room. These chimneys can also have a variable air volume (VAV) damper installed that is controlled by a computer local area network (LAN), which monitors the temperature of vital equipment and adjusts airflow accordingly.

Due to the increased cooling efficiency of the three-layer floor, the cooling "tonnage" of the system can be reduced, which results in considerable energy savings over the life of the system as well as reducing first time costs.

In addition to energy savings and first time cost savings, the three-layer floor is easier to modify when required than a single-layer floor. This is because the three-layer floor does not have stringers between the pedestals in the upper layer like the single-layer floor. The new cable can simply be laid in the cavity rather than strung under each stringer. Also since the three-layer floor has a sealed plenum and individual chimneys, modifications can be done to one area of the room without disrupting cooling air flow to other parts of the room when the floor panels are temporarily removed for maintenance or alterations as in the case with single-layer floors.

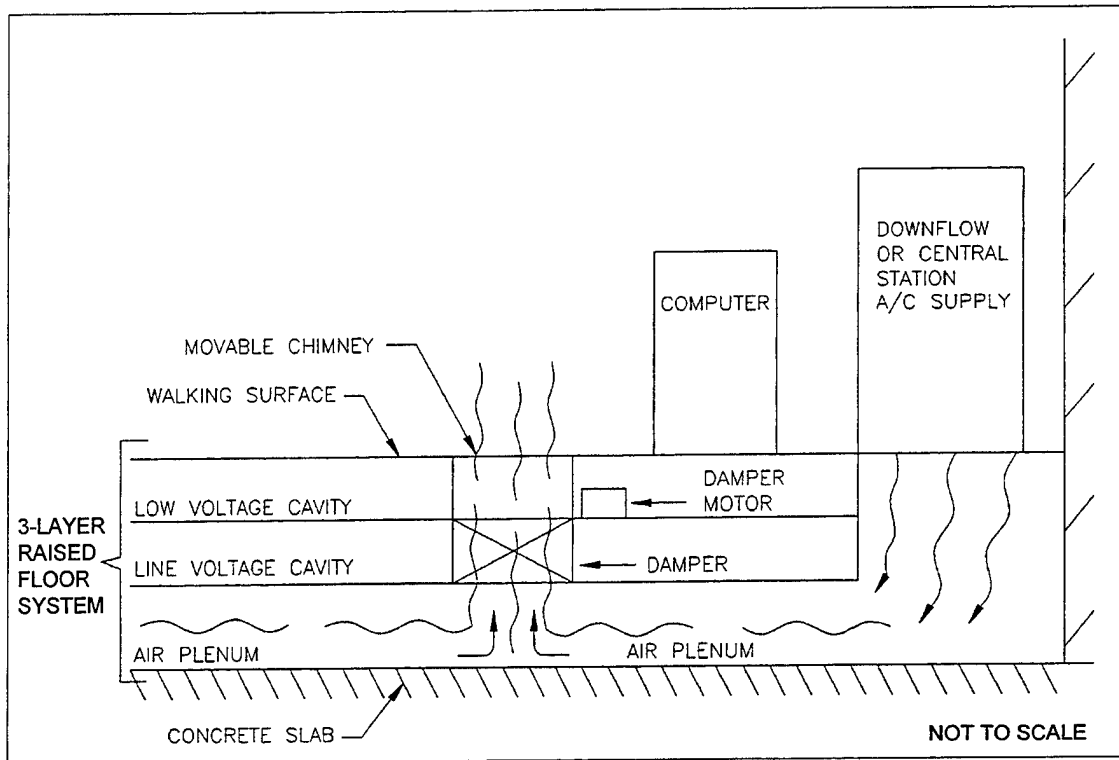


Figure 1. Lower layer of the floor is a sealed plenum with chimneys that supplies cool air where needed.

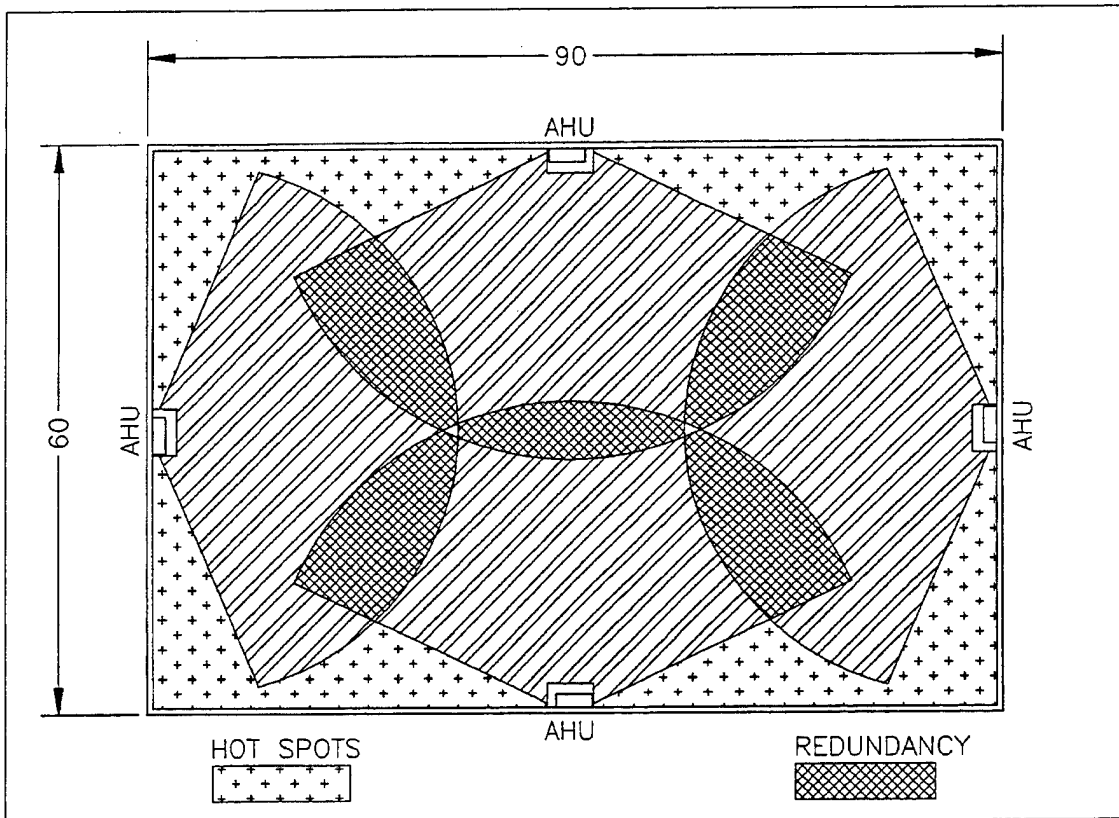


Figure 2. Air distribution patterns and redundancy limitations of a space using four air handling units (AHU) with an unobstructed traditional floor.

Another advantage to the three-layer floor is that the system itself is a UL approved wireway. What this means is that the electrical cables do not need to be installed in expensive conduits or be a costly fire resistant variety as required by the latest National Electrical Code (NEC) for single-layer floors. This requirement applies to low-voltage cables as well as power cables.

When should a three-layer floor be used?

A large computer room is suitable to a three-layer floor system because more cooling capacity can be eliminated while still adequately cooling the computer equipment. The

three-layer floor is more expensive than the single-layer floor - there is a minimum size below which three-layer floors are not cost effective with the single-layer floor. The breakeven size used by manufacturers is 4,000 ft².

As pointed out above, the three-layer floor is easier to modify than the single-layer floor, which may make it advantageous to install a three-layer floor if frequent changes to the computer room are anticipated.

For further information about whether a three-layer raised computer floor may be right for you, contact **Paul Kistler** at the Naval Facilities Engineering Service Center, Code ESC222, DSN: 551-1387, (805) 982-1387, or Internet: pkistler@nfesc.navy.mil.

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