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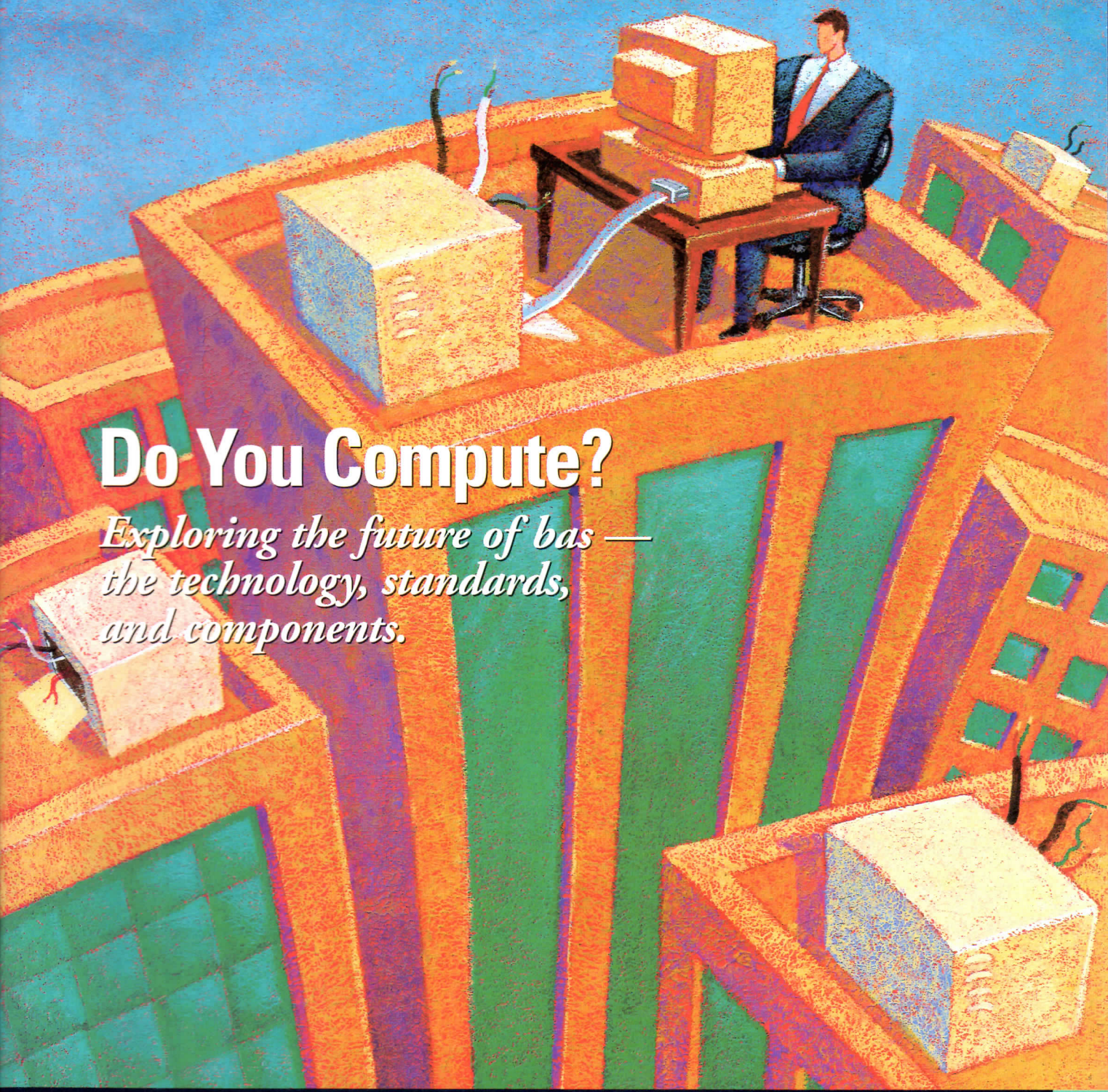

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PRACTICAL APPLICATIONS FOR INNOVATIVE HVACR MECHANICAL SYSTEMS ENGINEERS

CONDENSATE DRAIN LINES

The diameter, length, routing, drainage, slope, supports, and materials are all critical factors in the design of the condensate drain line. These specifications should be taken into account by the system designer.

BY WARREN TRENT, P.E., AND CURTIS TRENT, Ph.D.

EDITOR'S NOTE: *This is the sixth and final installment of articles devoted to the design of hvac systems that are free of health-threatening and property-damaging problems. This article is adopted from "Condensate Control," by authors Warren and Curtis Trent, in the* HVAC Systems and Components Handbook, *Second Edition, published by The McGraw-Hill Companies (Copyright 1998). This is being reprinted with permission of The McGraw-Hill Companies.*

The condensate drain line, which extends from the drain seal to the condensate disposal area, is the last link and a critical component in the condensate-removal system. It frequently is the source of serious condensate problems.

For successful drainage, this line must be carefully defined and clearly specified by the system designer.

Under no circumstances should this responsibility be left to the installation contractor.

CRITICAL DESIGN FACTORS

An acceptable drain line is simply one that has adequate flow capacity and offers minimum potential for flow blockage.

The following factors are critical to the design: diameter, length, routing, drainage slope, supports, and materials.

The diameter of the drain line must be equal to or greater than the exit diameter of the drain seal device. The line length should be the minimum possible, following the shortest path to the condensate disposal place (the shorter, the better). It should include the least possible number of elbows.

The line must be sloped away from the drain seal at a rate of *no less* than

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1/8-in./ft. Solidly fixed drain line supports must be provided at intervals that ensure that a uniform slope is maintained. This is designed to avoid dips in the line that can trap condensate and debris.

Drain lines may be constructed of PVC, copper, or steel piping. PVC and steel pipe must be Schedule 40 or heavier. Copper pipe must the Type L or heavier.

To avoid excessive dips in the drain line and prevent shifting of position, fixed supports should be provided as follows:

- PVC, 2 to 3 ft;
- Copper, 4 to 6 ft; and
- Steel, 8- to 10-ft intervals.

Clearly, a long and meandering condensate drain line requires careful engineering design and proper installation, which adds appreciable cost to the system. Where possible, consideration should be given to eliminating the drain line entirely.

For example, in rooftop installations, condensate flowing from the drain seal may be dumped onto the roof. Any potential roof problems caused by this arrangement should be assessed against the cost of installing the drain line, and the probable condensate drainage problems caused by the use of a drain line.

ECONOMIC FACTORS

The cost of the condensate drain line depends primarily on the type of pipe used. The unit cost of the pipe and the cost of installation are both important.

The unit cost of pipes differs substantially. The cost of PVC pipe is one-half to one-third that of steel. The cost of steel pipe is one-half to one-third that of copper. It follows, then, that copper pipe is four to six times more costly than PVC.

Installation costs consist of labor plus the material required for supporting the drain line.

The cost of labor involved in assembling PVC pipe is minimal. It consists of connecting slip joints with PVC cement, for which little labor is involved.

The closely spaced pipe supports required, however, add to both labor and material costs. Even so, a condensate drain line of PVC costs considerably less than either steel or copper.

The cost of labor required to assemble a copper drain line far exceeds that of one constructed of PVC. Each connection must be soldered and the necessary equipment must be transported to the installation site.

However, the costs of material for pipe supports and the cost of installing them are only about one-half that for PVC pipe.

The cost of labor necessary for assembling a steel drain line is even greater than for copper. Each connection must be threaded and screwed together. Equipment for cutting threads must be transported to the installation site.

These factors, plus heavy pipe, impose an extraordinary amount of labor on the installer. The cost of pipe supports and material are minimal.

In summary, when both pipe and installation costs are included, a drain line system with PVC pipe is the least expensive of the three. The cost of systems constructed with steel and copper pipe are about the same.

The installation cost of copper is lower, but the higher cost of copper pipe tends to offset the higher installation cost of steel pipe. In any particular application the cost difference between copper and steel systems may vary, depending upon the experience of the contractors involved.

Building owners and users sometimes prefer one material over others. Also, in some instances, local codes may prohibit the use of PVC. However, all of the major Mechanical Codes used in the United States permit the use of PVC.

SUGGESTED SPEC STATEMENTS

1. The diameter of the drain line must be equal to or greater than the exit diameter of the drain seal device. The line length should be the minimum possible, following the shortest path to the condensate disposal area. It should include the least possible number of elbows.

2. The line must be sloped away from the drain seal at a rate of no less than ⅛-in./ft.

3. Drain line supports must be fixed solidly in place and provided at intervals that ensure that a uniform slope is maintained, and that any dips formed in the line do not trap condensate and debris.

4. Drain lines may be constructed of PVC, copper, or steel piping. PVC and steel pipe must be Schedule 40 or heavier. Copper pipe must be Type L or heavier.

5. To avoid excessive dips in the drain line and prevent shifting of position, fixed supports should be provided as follows: PVC, 2 to 3 ft; copper, 4 to 6 ft; and steel, 8- to 10-ft intervals. **ES**

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