

# Memo

*date:* April 19, 2000

*to:* ES&H Coordinators and Building Managers

*from:* J.A. Curtiss, Laboratory Electrical Safety Officer

*subject:* Electrical Connections to Muffin Fans

Muffin fans are routinely used to provide forced air circulation in chassis, racks, and over individual components. These fans generally have plastic housings and have two terminals or two lead wires.

For muffin fans that are built into enclosed equipment, the enclosure provides one barrier layer to prevent contact with an energized conductor. The fan lead wires may be run without additional protection. Extending the lead wires through use of a crimped butt splice covered with shrink tubing is acceptable; however, the preferred arrangement is termination of the wires in a connector or at a terminal block which is covered to prevent inadvertent contact.

For muffin fans used to cool individual components mounted on beam lines or other equipment, the preferred method is to terminate the manufacturer's lead wires in a two-prong plug and to provide a mating connector which extends power to the vicinity of the fan. Two barrier layers to prevent contact with an energized conductor are generally required for electrical installations and the insulation over a wire provides one of the barriers. For enclosed equipment the enclosure provides the second barrier. For cables, the cable jacket provides the second layer. The above arrangement, with individual wires directly terminating in a plug, is acceptable only due to the limited length of the lead wires.

When it is necessary to extend electrical connections of muffin fan to the source of power, then the extension must provide a double barrier to contact with an energized conductor. The connections between the lead wires and the cable can be made in an electrical enclosure, or with crimp-connected insulated "barrel" splices between the fan lead wires and the wires in the extension cable. Make the splices by covering each individual splice with shrink tubing, and covering the assembly of the two connections with a single piece of shrink tubing. This arrangement provides multiple layers of insulation over the energized conductors and adds mechanical strength.

There are two options for the extension cable. Option A is use of a three-wire "S-Cord" and plug, with the green grounding conductor connected to the equipment at the fan location. Option B is extending only two wires using any "S-Cord" cable (zip-cord is not cable!) and terminating the cable in a two-prong plug. In addition, for this option, the object on which the valve is mounted must be adequately (and obviously) grounded to protect personnel in the event that a malfunction should cause a short of the energized wire to the equipment.