electrical distribution systems, lighting, motors, and even adjacent instrumentation. Many, if not most, data instrumentation systems are concerned with the measurement or detection of physical phenomena (or changes in them) that require periods of observation or measurement that range from a few milliseconds to several minutes or longer. Additionally, the signal levels are usually quite low. Normally power is supplied to these systems through isolation transformers. They are commonly required to be isolated from all other grounds to eliminate ground loops that may generate common mode voltages, but must be grounded at a single point on the secondary ground girdle. MIL-HDBK-419, Volume II, section 3.5.2 discusses the various methods for instrumentation grounds. If the manufacturer of the test equipment requires an instrument ground, then the manufacturer's procedures for its installation shall be followed. However, this ground must be isolated from all other grounds and bonded directly to the secondary-grounding girdle. Tests shall be performed to measure the resistance to the secondary ground girdle, which shall be one ohm or less. These grounds shall be tested during new construction, prior to the first use, after repair, and during the 24-month test of the lightning protection system. The test shall be performed by measuring between the instrumentation ground system and the secondary ground girdle with a meter capable of measuring one ohm ±10%.

5-5.3. STATIC GROUNDS. The purpose of the static ground system is to provide a conductive path to dissipate any static charges that may be generated. Paragraph 5-3.2 discusses the sources of electrostatic voltages. Examples of static ground devices are conductive floors, conductive table tops, conductive shoes, leg stats, wrist straps, and grab bars. The static ground system may be connected to structural steel (unless the structural steel is used as the lightning down connector), ground cones, buried copper plates, and rods driven into the earth. All of these items must be interconnected with the secondary ground girdle. However, static ground systems shall not be connected directly to gas, steam, or air lines (as these are static-producing items), dry sprinkler system piping, or lightning down conductors.

5-5.3.1. Conductive Floors. Conductive floors are mandatory (unless it is practical to use wrist straps for personnel grounding) in areas where personnel work with or are exposed to contact with the materials listed in paragraph 5-3.4 or other materials known to be static sensitive. When working on a weapon system that requires personnel grounding and conductive floors are used, conductive shoes or leg stats as described in paragraphs 5-5.3.2 and 5-5.3.3 shall be worn.

NOTE

It is only necessary to install the conductive floor where the operation is performed and not necessarily throughout the facility.

5-5.3.1.1. Specifications. Conductive floors shall be non-sparking material such as lead, conductive rubber, plastic conductive masonry material, or conductive composition material. Floors must comply with the following requirements:

a. The surface of the floor must be free from cracks and must be reasonably smooth. The surface material must not slough off, wrinkle, or buckle under normal conditions of use.

Conductive tiles are not recommended for use in areas where contamination can be caused by explosives dust. The large number of joints and the tendency of tiles to loosen provide areas where explosives dust can become lodged and which are not easy to clean under normal cleanup procedures.

b. The conductive floors must be compatible with the materials being processed.

c. Conductive floors shall be bonded to the secondary ground girdle.

WARNING

The minimum resistance may include the resistance of the shoes used. See paragraph 5-5.3.2.3.

d. The average resistance of the conductive floor shall be 1,000,000 ohms or less as measured by the methods described in c, below. The minimum average resistance of the floor shall be 5,000 ohms in areas with 110 volt service, 10,000 ohms for 220 volt service etc., as measured by the same technique.

5-5.3.1.2. Test Requirements. Conductive floors shall be tested at the time of installation and at least 24 months thereafter. In areas exposed to large variations in relative humidity, additional measurements should be made during times of lowest and highest relative humidity to ensure adequate floor conductivity. It is suggested that consideration be given to reducing the frequency of the testing to every seven months (or possibly more often in particularly dirty or dusty areas) for those areas where there is a good deal of traffic on the floor or when conductive shoes are worn outside the structure. The tests shall determine if floors meet the requirements of subparagraph a above. The results of these tests shall be maintained on file for at least five inspection cycles. It is recommended that test records be maintained for longer periods to provide better databases for trend analysis.

WARNING

Instruments for testing the conductivity of floors shall be used inside the room only if the room is free of exposed explosives and no exposed EED's are present. Otherwise, the test instrument shall be placed outside the room. In any case, the floor in the immediate area of the electrode contact shall be thoroughly cleaned of all explosive material, and the air shall be purged of explosive dust or flammable vapors.

5-5.3.1.3. Test Methods.

a. It is recommended that a sketch of the facility showing electrode locations for both the electrode-to-electrode and electrode-to-ground measurements be included in the grounding system test plan, just as is done for the resistance-to-ground and bonding resistance test points. Such a sketch will ensure that the measurements are made in the same area of the floor

from year to year so the data can be compared to determine trends. Figure 5-1 illustrates a typical sketch which can be developed for the conductive floor testing.

b. The floor shall be clean and dry and the room shall be free of flammable gas mixtures or explosive dusts.

c. Each electrode shall weigh 5 pounds and shall have a dry, flat, circular contact area 2½ inches in diameter. The contact area shall have a surface of aluminum or tin foil that is 0.0005 to 0.001-inch thick and is backed by a layer of rubber ¼-inch thick. The surface shall measure between 40- and 60-inch durometer hardness as determined by a Shore Type A Durometer (ASTM D-2240-68).

d. Resistance shall be measured with a suitably calibrated ohmmeter. The ohmmeter shall operate on a nominal open-circuit output voltage of 500 Volts direct current (Vdc), a short-circuit current of 5 milliampere (mA), and an effective internal resistance of 100,000 ohms ±10%.

e. To ensure that the measurements are not biased by the proximity of the electrode(s) to a grounded item, the electrodes for both the electrode-to-electrode and electrode-to-ground measurements must be located a minimum of three feet away from a grounded item such as a door frame, grounded ordnance handling equipment, or any grounded item resting on a conductive floor. Both electrode-to-electrode and electrode-to-ground measurements shall be made at five or more locations in each room and the results shall be averaged. For compliance with the requirements of paragraph 5-5.3, the average result shall be below the limits specified, and no value shall be greater than 5 megohms. All readings shall be taken with the electrode or electrodes more than 3 feet from any ground connection or from a grounded object that is resting on the floor. If the resistance changes appreciably with time during a measurement, the value observed after the voltage has been applied for 5 seconds shall be considered to be the measured value. It is recommended that a minimum of two ground reference points be used when conducting electrode-to-ground measurements. It is acceptable to use a single reference point for any case where it can be ensured that the reference point has a very low resistance connection to the secondary ground girdle.

NOTE

The above requirement is written around large conductive floors installed in production buildings, or the equivalent. It may not be practical to conduct five surface resistance (electrode-to-electrode) and/or resistance-to-ground measurements in a small test cell and still remain three feet away from all grounded items. In such cases, enough tests should be conducted to ensure that all parts of the conductive floor are tested. The justification for conducting less than the required number of electrode-to-electrode or electrode-to-ground measurements should be documented in the grounding system test plan.