Evaluation and Comparison of Common Patient Grounding Devices for Class B Monoplace Chambers

Authors:
Stacy Handley, BSN, ACHRN, CWCN, CHT
Mike Edwards, Senior Biomedical Technician,
Dick Clarke, CHT
Palmetto Health Richland, Columbia, SC,
National Baromedical Services, Inc.

The resistance between the chamber and the electrical ground shall not exceed 1 ohm

NFPA 99 20.2.7.4.1.3

Class B chambers with>23.5% O2: Electrical grounding of the patient shall be ensured by the provision of high impedance conductive pathway in contact with the patient's skin.
NFPA 99 20.3.1.5.3.2

Electrical current flows through the path of least resistance;
We do not want patient to be that path
<u>But</u> there needs to be a conductive pathway!

To prevent the accumulation of static electricity, total resistance of ground path to earth should be sufficient to dissipate charges.

1 megohm of resistance is considered adequate.
NFPA 77 7.4.1.3

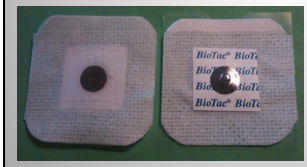
To protect the patient from electric shock, a ground cord should have a 1 megohm resistor built-in.

We used a 6' coiled, *relaxed retraction* ground cord.

Skin Contact Devices

A. Desco® metal wrist strap

B. Kendall BioTac® EKG electrode



C. Jewel® elastic wrist strap

Testing Method

Fluke Model #87 True RMS Multimeter

Last certified: 6-19-09

Next due: 6-16-2010

Tests conducted: 3-11-2010 2pm 72°F

Red and black multimeter lead set with banana plug and chamber ground jack. Chamber confirmed at 0 ohm. Each device tested 3 times in same method. Average score calculated.

Test Results

Per ANSI/ESD 20.20
Acceptable Pass Range
800k Ohms to 10 Megohms

A. Metal wrist strap	1.94 Megohms
B. EKG electrode	1.35 Megohms
C. Elastic wrist strap	1.74 Megohms

All Devices Passed

Acceptable Pass Range
800k Ohms to 10 Megohms

ANSI/ESD 20.20 requires wrist strap resistance testing prior to each use.

The **minimum** acceptable resistance is greater than 800k ohms. Should you get a red light indicating **LOW** resistance, the cause may be a bad cable, bad resistor, bad tester device.
Suggestions: replace cable and retest, check tester, calibrate tester annually.

The **maximum** acceptable resistance is less than 10 megohms. Should you get a red light indicating **HIGH** resistance, the cause may be dry skin, dirty or bad contact.
Suggestions: moisturize skin, change site

Reduces High Resistance

- Non-Flammable
- Safe in the chamber
- Improves wrist strap contact when dry skin may be cause of high resistance alarm

		With Hand Lotion
A. Metal wrist strap	1.94 Megohms	1.50 Megohms
B. EKG Electrode	1.35 Megohms	N/A
C. Elastic wrist strap	1.74 Megohms	1.57 Megohms

Other Considerations for Device Selection

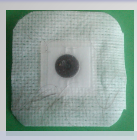
1. Skin Contact: amount of skin surface contact versus point of contact
2. Patient Comfort: adjustable sizing, damage to skin with frequent use
3. Infection Control: reusable, washable, disposable, cross contamination

Metal Wrist Strap



Pros: Deemed 'Superior' contact by industry
Maintains circumferential contact
Washable; is it really being washed correctly between patients?
Cons: Tight over big knuckles, gouges & pinches skin, pulls wrist hair
Loose fit on skinny wrists results in loss of skin contact
'Adjustable' but difficult; concern over staying secure once adjusted
Patient complaints leads to staff non-compliance in its use
Most expensive device; $70+ but reusable

EKG Electrode (as ground device)




Pros: Inexpensive, Disposable; Good Infection Control, Convenient placement

Cons: Not Intended Use as Grounding Device; Manufacturer will not support this practice. NFPA 77 7.6.3.3 specifies 'grounding bracelet' for patients.
Limited 'Point of Contact' skin surface (22mm x 12mm conductive gel)
Pulls hair, may cause skin irritation & breakdown if sites are not rotated
Adhesive not easily removed
If removed while in chamber, electrode will not re-adhere to skin

Elastic Wrist Strap

Pros: Metal threading allows for circumferential skin contact Adjustable size, comfortable, washable. Silver fibers are antimicrobial. Disposable after same patient treatment series, No patient cross contamination. Inexpensive; under $3 for elastic strap.

Cons: Thought to be less superior to metal wrist strap as grounding device. Fabric can soil.

Summary

The **Elastic Wrist Band** is our first choice for Patient Ground Device for the following criteria:

1. Compliant with NFPA 99 for patient grounding intent; falls within acceptable range
2. Compliant with NFPA 77 for intent of grounding bracelet
3. Maintains maximum skin contact
4. Best overall comfort
5. Disposable, one assigned to each patient
6. Inexpensive

- The **metal wrist band** would be our second choice since it also meets above criteria #1 and #2
- The **EKG electrode** is not an acceptable option due to criteria #2

Product Information

Elastic Wrist Band with 4mm stainless steel 'machined' stud.
Order enough to cover the maximum number of patients that can be treated in a single day.
ESD 'Jewel' item #22020 cost: $8.93 each
DESCO 'Jewel' item #09105 cost: $9.20 each

Replacement Elastic Strap The strap is disposed upon completion of patient's treatment series. Order enough for one for every patient.
ESD 'Jewel' item # 22130 cost: $2.47 each
DESCO "Jewel' item# 09140 cost: $2.97 each

Ground Cord with 6' coiled, relaxed retraction ground cord and 1 megohm resistor. Order at least one for each chamber.
ESD: Not available
DESCO item# 09480, cost: $13.24 each

Reztore Hand Lotion 8oz, safely eliminates dry skin that can cause high resistance for grounding.
ESD item #35665 cost: $5.21 each

DESCO www.desco.com (909) 627.8178
ESD www.esdsystems.com (508) 485.7390