



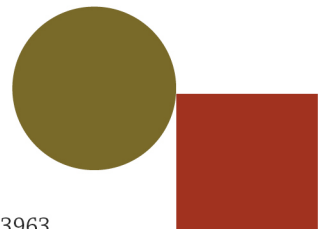
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Health Care Furniture Design Guidelines For Cleanability

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Suggestions for the improvement of this Guideline are welcome. The suggestions should be sent to email@bifma.org or BIFMA, 678 Front Avenue NW, Suite 150, Grand Rapids, MI 49504. Suggestions will be reviewed by the BIFMA Healthcare Furniture Subcommittee.



Foreword and Acknowledgements

The *HEALTHCARE FURNITURE DESIGN GUIDELINES FOR CLEANABILITY* referred to throughout this document as the “Guideline”, covers the terminology, typical cleaners, and recommendations to evaluate the furniture resistance to degradation when exposed to the typical cleaners.

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1. Scope

The purpose of this Guideline is to provide guidance to furniture manufacturers and healthcare professionals in understanding typical cleaners, disinfectants, cleaning methods, and performance of furniture when exposed to these cleaners and disinfectants. It is the intent of this guideline to bring the recommended manufacturers' standards in line with existing practices and typically used cleaners. This guideline offers standard test methodologies and specific performance recommendations to which manufacturers can test; and to which users may evaluate relative product performance. This guideline also provides product design considerations that support effective cleanability of healthcare furniture products.

This Guideline applies to seating, tables, carts, storage and other furniture products as used in healthcare patient care. This Guideline also applies to furniture intended for use outside of patient care areas in healthcare environments as furniture is often used interchangeably between patient care and non-patient care areas. These guidelines are not necessarily applicable to health care areas such as offices or administrative areas.

This Guideline does not apply to healthcare products considered to be 'equipment' (patient lifts, beds, transfer benches, wheelchairs and other products covered by IEC 60601).

This guideline does not purport to address the effectiveness (i.e., the level of disinfection) of any cleaning agent or cleaning process. Guidance is available in the reference section for specific cleaning and disinfection protocols recommended by the American Hospital Association. Only the effect on the subject material (textile, plastic, finish, etc.) is assessed by the methodologies within this guideline.

It is the intent of this guideline to ensure compatibility of the health care setting's cleaning and disinfecting agents with the items and surfaces to be cleaned. Materials and finishes must be compatible with hospital-grade detergents, cleaners and disinfectants for best results.

Authors of this Guideline consider furniture to be 'Non-critical' per the Spaulding Classification System (See Definitions). Non-critical items such as furniture come in contact with intact skin but not mucous membranes.

The test for resistance of furniture to cleaners is based upon typical cleaning of one time per day and a furniture life of 7 years. This furniture life is based on input from a variety of health care professionals; furniture is often replaced based on aesthetic/appearance considerations needed to maintain a perception of cleanliness and clinical credibility within a facility. This life is not necessarily based on the structural durability of the products.

2. Product Assessment

Designing products for the healthcare environment has unique challenges as the needs from facility to facility are varied. Therefore, this Guideline is intended to provide direction to manufacturers, specifiers, and users of healthcare furniture, but is not a mandate of conformance. The test guidelines are primarily 'should' rather than 'shall' given the unique needs in the healthcare environment. Manufacturers, specifiers, and users should determine relevant requirements based upon their specific needs.

3. Background

Note: In addition to those stakeholders listed in the Foreword and Acknowledgements, guidance is also taken from:

- “CDC Guidelines for Disinfection and Sterilization in Healthcare Facilities” by Healthcare Infection Control Practices Advisory Committee (HICPAC), Chapel Hill, NC (2008)
- “Guidelines for Environmental Infection Control in Healthcare Facilities” by (HICPAC), Atlanta, GA (2003)
- “Best Practices for Environmental Cleaning for Prevention and Control of Infections - In All Health Care Settings” by the Provincial Infectious Diseases Advisory Committee (PIDAC), Toronto, Canada (2009)
- “Practice Guidance for Healthcare Environmental Cleaning: The Essential Resource for Environmental Cleaning and Disinfection,” 2nd ed., Association for the Healthcare Environment of the American Hospital Association, (2012)

Health care settings are complex environments that contain a large diversity of microbial flora, many of which may constitute a risk to the clients/patients/residents, staff and visitors in the environment. The consequences of transmission of microorganisms within a health care setting may be more severe. High-touch environmental surfaces of the health care setting hold a greater risk than do public areas of non-health care organizations, due to the nature of activity performed in the health care setting and the transient (chair-to-chair, for example) behavior of patients with heightened susceptibility, bacterial colonization among clinical staff, employees, patients and visitors within the health care setting, which increases the likelihood of direct and indirect contact with contaminated surfaces. Transmission involves:

- a) presence of an infectious agent (e.g. bacterium, virus, fungus) on equipment, objects and surfaces in the health care environment;
- b) a means for the infectious agent to transfer from patient-to-patient, patient-to-staff, staff-to-patient or staff-to-staff; and
- c) presence of susceptible clients/patients/residents, staff and visitors.

In the health care setting, the role of environmental cleaning is important because it reduces the number and amount of infectious agents that may be present and may also eliminate routes of transfer of microorganisms from one person/object to another, thereby reducing the risk of infection. There are five parameters, which influence the effectiveness of cleaning and disinfection: contact time, temperature, concentration, mechanical action, and pH. Upholstery cleaning presents different challenges than other surfaces, primarily due to the wide variety of textile fibers, porosity, durability, and stain resistance.

Furniture manufacturers are interested in these factors as they impact the design, geometry, materials, finishes/textiles, and mechanisms used, in the overall cleanability of furniture.

4. Definitions/Terminology

Notes:

- Refer to BIFMA PD-1 Mechanical Test Definitions for related terms not included in this guideline. Otherwise, the common dictionary definition shall be used for terms not defined in this section or in BIFMA PD-1. In case of a conflict between the definitions in this guideline and PD-1, the definitions in this guideline shall apply.
- Some of these definitions were taken from “CDC Guidelines for Disinfection and Sterilization in Healthcare Facilities” by Healthcare Infection Control Practices Advisory Committee (HICPAC), Chapel Hill, NC (2008), and from “Best Practices for Environmental Cleaning for Prevention and Control of Infections - In All Health Care Settings” by the Provincial Infectious Diseases Advisory Committee (PIDAC), Toronto, Canada (2009). Other definitions were provided by the authors of this guideline.
- These terms are provided for reference as they are often used in health care settings. Inclusion within this section does not necessarily mean they are used within the text of this guideline.

Alcohol-based Hand Rub (ABHR): A liquid, gel or foam formulation of alcohol (e.g., ethanol, isopropanol), which is used to reduce the number of microorganisms on hands in clinical situations when the hands are not visibly soiled. ABHRs contain emollients to reduce skin irritation and are less time-consuming to use than washing with soap and water.

Antimicrobial Products: substances or mixtures of substances designed to destroy or suppress the growth of harmful microorganisms, whether bacteria, viruses, or fungi on inanimate objects or surfaces. These products are typically used for two purposes:

- a) Disinfect, sanitize, reduce or mitigate growth of development of microbiological organisms.
- b) Protect inanimate objects (floors, walls and/or furniture), industrial processes or systems, surfaces, water, or other chemical substances from contamination, fouling, or deterioration caused by bacteria, viruses, fungi, protozoa, algae, or slime.

BIFMA: Business and Institutional Furniture Manufacturer’s Association, a not-for-profit trade association of furniture manufacturers and suppliers.

Chemical Sterilant: Kills spores with prolonged exposure times (3 – 12 hours).

Cleanability: The ability to be cleaned, easily and without damage. To be maintained in an unsoiled appearance.

Cleaning: The removal of visible soil (e.g., organic and inorganic material) from objects and surfaces that normally is accomplished manually or mechanically using water with detergents or enzymatic products. Thorough cleaning is essential before high-level disinfection and sterilization because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes. See also *Disinfection, Sterilization*. Note: high-level disinfection and sterilization is not covered by this document. Only hospital-grade surface sanitizer use for low- or intermediate-level disinfection is covered.

Cleaning Residue: the material left behind following the cleaning or disinfecting of surfaces. Residue tends to be left or will build up if the cleaning agent is left to air dry (contact time is passed) or used incorrectly.

Coated Fabrics: A textile or similar substrate that is surfaced with one or more layers of a film-forming polymer such as vinyl or polyurethane.

Construction Clean: Cleaning performed at the end of a workday by construction workers that removes gross soil and dirt, construction materials and workplace hazards. Cleaning may include sweeping and vacuuming, but usually does not address horizontal surfaces or areas adjacent to the job site.

Contamination: The presence of an infectious agent on hands or on a surface such as clothes, gowns, gloves, bedding, toys, surgical instruments, patient care equipment, dressings or other inanimate objects.

Detergent: A synthetic cleansing agent that can emulsify oil and suspend soil. A detergent contains surfactants that do not precipitate in hard water and may also contain protease enzymes (see *Enzymatic Cleaner*) and whitening agents.

Discharge Cleaning: See *Terminal Cleaning*

Disinfectant: A product that is used on surfaces or medical equipment/devices, which results in disinfection of the equipment/device. Disinfectants are applied only to inanimate objects. Some products combine a cleaner with a disinfectant. See also *Cleaning, Sterilization*.

Disinfection: The inactivation of disease-producing microorganisms. *A process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects.* Medical equipment/devices must be cleaned thoroughly before effective disinfection can take place. See also, *Disinfectant, Cleaning, Sterilization*.

- **Low-Level Disinfectant:** agent that destroys all vegetative bacteria (except tubercle bacilli), lipid viruses, some non-lipid viruses, and some fungi, but not bacterial spores.
- **Intermediate-Level Disinfectant:** agent that destroys all vegetative bacteria, including tubercle bacilli, lipid and some non-lipid viruses, and fungi, but not bacterial spores.

Double Cleaning: Repeating a cleaning regimen immediately after it has been done once. Double cleaning is not the same as cleaning twice per day.

Enzymatic Cleaner: A pre-cleaning agent, which contains enzymes that break down proteins, fats and carbohydrates, such as blood, body fluids, secretions and excretions from surfaces and equipment. Most enzymatic cleaners also contain a detergent. Enzymatic cleaners are used to loosen and dissolve organic substances prior to cleaning. Protease enzymes break down proteins, lipase proteins break down fats and amylase enzymes break down starches and carbohydrates.

Germicide: An agent that can kill microorganisms, particularly pathogenic or disease causing

germs.

Hand Hygiene: A general term referring to any action of hand cleaning. Hand hygiene relates to the removal of visible soil and removal or killing of transient microorganisms from the hands. Hand hygiene may be accomplished using soap and running water or an alcohol-based hand rub (ABHR). Hand hygiene includes surgical hand antisepsis.

Hand Washing: The physical removal of microorganisms from the hands using soap (plain or antimicrobial) and running water.

Hazardous Material (Chemical) Spills: Any spill of a material that requires specific or specialized handling or methodologies as part of the clean-up protocol. These hazardous materials can include chemicals, cleaning agents, medicines/medications/chemotherapy agents, etc.

Hazardous Material (Biological/Blood-Borne) Spills: Any contamination by biological secretion/excretion such as blood, body fluids and fecal material that require specific or specialized handling methodology as part of the clean-up protocol.

Health Care Environment: People and items which make up the care environment (e.g., objects, medical equipment, staff, clients/patients/residents) of a hospital, clinic or ambulatory setting, outside the immediate environment of the client/patient/resident. See also, *Environment of the Client/Patient/Resident*.

Health Care Facility: A permanent or mobile facility that supports the delivery of health-related services. A health care facility does not include a client/patient/resident's home or physician/dental/other health offices where health care may be provided.

High-Touch Surfaces: High-touch surfaces are those that have frequent contact with hands. Examples include all seat surfaces except the underside and base, table top surfaces, cart top surfaces, and fronts of cabinets.

Hospital Clean: The measure of cleanliness routinely maintained in client /patient /resident care areas of the health care setting. Hospital Clean is 'Hotel Clean' with the addition of disinfection, increased frequency of cleaning, auditing and other infection control measures in client/patient/resident care areas.

Hospital-Grade Disinfectant: A low-level disinfectant that is registered by the EPA for pesticidal control of microorganisms, which pose a threat to human health. Hospital disinfectants are tested by the EPA after release into the market to verify antimicrobial claims and chemical formulations. The list of products found to be efficacious by the EPA is given here: <http://www.epa.gov/oppad001/atp-product-list.pdf>.

Hotel Clean: A measure of cleanliness based on visual appearance that includes dust and dirt removal, waste disposal and cleaning of windows and surfaces. Hotel clean is the basic level of cleaning that takes place in all areas of a health care setting.

Infection: The entry and multiplication of an infectious agent in the tissues of the host.

Asymptomatic or sub-clinical infection is an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms. Symptomatic or clinical infection is one resulting in clinical signs and symptoms (disease).

Infectious Agent: A microorganism, i.e., a bacterium, fungus, parasite, virus or prion, which is capable of invading body tissues, multiplying and causing infection.

Low-Level Disinfection (LLD): Level of disinfection required when processing non-invasive medical equipment (i.e., non-critical equipment) and some environmental surfaces. Equipment and surfaces must be thoroughly cleaned prior to low-level disinfection.

Low-Touch Surfaces: Surfaces that have minimal contact with hands. Examples include the underside of seating surfaces, chair bases, underside and legs of tables, underside and base of carts, and backside and inside of cabinets.

Manufacturer: Any person, partnership or incorporated association that manufactures and sells medical equipment/devices under its own name or under a trade mark, design, trade name or other name or mark owned or controlled by it.

Medical Equipment/Device: Any instrument, apparatus, appliance, material, or other article, whether used alone or in combination, intended by the manufacturer to be used for human beings for the purpose of diagnosis, prevention, monitoring, treatment or alleviation of disease, injury or handicap; investigation, replacement, or modification of the anatomy or of a physiological process; or control of conception.

Noncritical Medical Equipment/Device: Equipment/device that either touches only intact skin (but not mucous membranes) or does not directly touch the client/patient/resident. Reprocessing of noncritical equipment/devices involves cleaning and may also require low-level disinfection (e.g., blood pressure cuffs, stethoscopes, furniture).

Permeability: As used here; the resistance that a material or combination of materials provides to the penetration of liquids to the other side of the material or combination of materials.

Non-porous: Surfaces or barriers that are impermeable to moisture. Typically these include surfaces such as plastics, laminates, some wood finishes, non-perforated coated fabrics (e.g., some vinyl and polyurethanes) and metals (including coated/finished). Barrier materials such as membranes, films, laminations, etc., may also be considered non-porous.

Safety Data Sheet (SDS): A document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with a chemical product. It also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. SDSs are prepared by the supplier or manufacturer of the material.

Spaulding Classification System to Levels of Disinfection: Instruments and items for patient care are divided into three categories based on the degree of risk of infection.

Critical: High risk of infection, used on tissues that are sterile or in the vascular system.

Spores must be eliminated by sterilization. Examples of this equipment include surgical instruments in surgery.

Semi-critical: Items that come into contact with mucous membranes or non-intact skin. Examples are respiratory therapy equipment, GI endoscopes, bronchoscopes, etc. These items must be free of all microorganisms although small numbers of bacterial spores may be present after high-level disinfection.

Non-critical: Items that come in contact with intact skin but not mucous membranes. Examples include: blood pressure cuffs, crutches, bedrails, bedside tables, and patient furniture. Most non-critical reusable items can be disinfected where they are used and do not need to be transported to a central processing area.

Sterilization: Destroys or eliminates all microorganisms using chemical and physical means.

Terminal Cleaning: The thorough cleaning of a client/patient/resident room or bed space following discharge, death or transfer of the client/patient/resident, in order to remove contaminating microorganisms that might be acquired by subsequent occupants and/or staff.

Workstation: A group of furniture items and components where a person performs work.

5. Cleaning Agents/Disinfectants Typically Used for Healthcare Furniture

At the time of writing of this Guideline, the materials listed below were those most commonly used in healthcare facilities and are specifically covered by this guideline in the cleaning evaluation methodologies and criteria. The typical concentrations given should be used for testing for generic products. If other concentrations are expected to be used, those concentrations should be evaluated by the method given below. *If the evaluation methodologies and criteria given in this guideline are used for other cleaning/disinfection agents the manufacturer's instructions for use (IFU) should be followed. Any deviation from concentrations or reagents used for testing should be noted in any test reports or conformance statements.*

Notes:

- Cleaning Agents/Disinfectants should be approved by the appropriate department(s) within the healthcare facility. These may include: Infection Prevention and Control, Environmental Services, and Safety.
- By law, all applicable label instructions on EPA-registered¹ products must be followed. If the user selects exposure conditions that differ from those on the EPA- registered product label, the user assumes liability for any injuries resulting from off-label use and is potentially subject to enforcement action under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).
 - o The following website lists all post-market hospital-grade disinfectants that have been tested by the EPA: <http://www.epa.gov/oppad001/atp-product-list.pdf>
 - o The following website gives EPA's complete list of disinfectants registered as effective against various pathogens: <http://www.epa.gov/oppad001/chemregindex.htm>
 - o Acute care hospitals are required to use EPA registered disinfectants intended for health care use.
 - o See this list of all disinfectants registered with specific microorganism claims: <http://www.epa.gov/oppad001/chemregindex.htm>.
 - o Note that not all registered products have been tested and confirmed by the EPA as efficacious against their pre-market label claims. Only those products listed by the EPA above as "Agency Confirmed Efficacy" in post-market testing should be considered for materials compatibility testing.
 - o Furniture manufacturers are encouraged to test surface materials using products that are EPA registered hospital-grade disinfectants.
- Cleaning residue left by cleaning agent residue may continue to degrade surfaces and shorten their life and/or affect their appearance. Manufacturers may recommend a final rinse with a clean damp cloth to remove residue.
- Any specific cleaning materials (including name brands) given in the list below are given for purposes of testing consistency only. They are not given as recommendations or endorsements.
- Contact/dwell time for any cleaning/disinfecting agent is important and will typically vary depending on the IFUs (Instructions For Use) provided by the manufacturer.

¹ EPA-registered germicides should be used for disinfecting surfaces. EPA lists products that have been tested and certified as efficacious against particular panels of pathogens. List D -- *Registered Antimicrobials Effective Against Hepatitis B Virus and Human HIV-1*, includes products tested against duck hepatitis B virus (DHBV) as a surrogate for HBV. Additional lists of interest include EPA's List C -- *Registered Antimicrobials Effective Against HIV-1* and List E -- *Registered Antimicrobials Effective Against Mycobacterium spp., Hepatitis B Virus, and Human HIV-1*.

5.1 Bleach: sodium hypochlorite² in a 5.25 - 6.25% dilution is an intermediate level disinfectant (use label recommendation for mixing bleach with water – typical is 10:1 water to bleach). Bleach is one of the few agents that are registered and tested as effective against *Clostridium difficile*, although hydrogen peroxide and chlorine dioxide has also been tested by the EPA as efficacious. See this list of all disinfectants registered with *C. diff.* claims: <http://www.epa.gov/oppad001/cdif-guidance.html>; note that not all registered products have been tested as efficacious against their pre-market label claims.

5.2 Hydrogen Peroxide: in a 3.0% solution, sometimes accelerated with acid, hydrogen peroxide can be either a low or intermediate level disinfectant, depending on the specific product formulation. Some peroxide products meet the EcoLogo product labeling requirements and may be used in green cleaning programs adopted by healthcare facilities to meet green building certification requirements. Hydrogen peroxide plasma or misting applications are not covered in this guideline.

Note: Some recommend a sporicidal surface disinfectant that contains a combination of hydrogen peroxide and peracetic acid. It is provided in a concentrate cartridge that is loaded into a dispenser that delivers a ready-to-use dilution of this disinfectant. EPA registration number = 1677-237.

5.3 UV lights: The wavelength of UV radiation ranges from 210 to 328 nm (2100 to 3280 Å) at 2-6 mw/cm². 200-280 nm is typically considered to be the UVC range. (The maximum bactericidal effect of Ultraviolet light occurs at 254 nm. Cycle time exposures are determined by the lamp manufacturer, and lamps should not be used in the presence of humans).

5.4 Alcohol: Isopropyl and ethyl alcohol at 55-70%, and usually used in combination with quaternary ammonium salts or as 70% isopropyl alcohol, can be effective against *Mycobacterium tuberculosis*. See this list of all disinfectants registered with specific microorganism claims: <http://www.epa.gov/oppad001/chemregindex.htm>. (Alcohol is limited in use but is typically used when it's convenient, for example – alcohol wipes might be in the room and a staff person will use them for minor cleaning).

5.5 Quaternary Ammonium (Quats): low level disinfectants that will kill most bacteria, viruses and fungi. Some Quats alone without phenolics or alcohol may not be effective against *Mycobacterium tuberculosis*, but are commonly used as the routine disinfectant product in healthcare applications. Quaternary ammonium compounds effectively remove and/or inactivate lesser-resistant microorganisms such as *Staphylococci aureus*, vancomycin-resistant *Enterococcus*, *P. aeruginosa*] from surfaces. Refer to the EPA registered products listed on their website for specific claims. (One such product is PDI Hospital Disinfectant Cleaner).

- The following website gives EPA's complete list of disinfectants registered as effective against various pathogens: <http://www.epa.gov/oppad001/chemregindex.htm>

5.6 Phenolic: intermediate level disinfectants that are effective against *Mycobacterium tuberculosis*; however, due to toxicity and environmental concerns they are being phased out of common use. Refer to the EPA registered products listed on their website for specific claims.

² Sodium hypochlorite solutions with a range of 5,000 -- 6,150 ppm (1:10 v/v dilution of household bleaches marketed in the United States) to 500 -- 615 ppm (1:100 v/v dilution) free chlorine are effective at deactivating a broad spectrum of pathogens depending on the amount of organic material (e.g., blood, mucus, and urine) present on the surface to be cleaned and disinfected.

- The following website gives EPA's complete list of disinfectants registered as effective against various pathogens: <http://www.epa.gov/oppad001/chemregindex.htm>

5.7 Steam: The vapor into which water is converted when heated. In healthcare, steam may be used to get rid of bed bugs and other infestations, and/or other infectious agents in upholstered furniture.

5.8 Chlorine Dioxide: intermediate level disinfectant in a 2.0 - 5.0% concentration. Although effective against C. diff., its use is not widespread in healthcare applications. Refer to the EPA registered products listed on their website for specific claims.

Note: For Sections 6 – 8, testing should be conducted in an environment of 70 deg +/- 6, and 50% RH +/- 15%. Samples should be preconditioned for at least 4 hours prior to testing. Deviations from the temperature, humidity, and preconditioning parameters should be noted in the test report.

6. Screening of Finishes to Liquid Cleaner Resistance

6.1 Applicability

This test applies to all non-porous furniture materials subject to cleaning/disinfection in the healthcare setting. This test does not apply to woven textile surfaces or coated fabrics. See Section 7 for coated fabrics.

6.2 Purpose of Test

The purpose of this test is to evaluate the ability of furniture surfaces to withstand the application of liquid cleaners/disinfectants.

6.3 Test Setup

Prepare the surface for testing by cleaning with a clean damp cloth (distilled water) and allow it to dry. Place the test sample on a level surface. If the surface geometry of the product does not allow for testing per the following procedure, representative samples of the finish/substrate combinations may be used. Each reagent used for testing should be at the manufacturer's ready to use concentration or dilution as specified in their Instructions For Use, but conforming to Section 5.

6.4 Test Procedure

6.4.1 Place a one-inch square 100% cotton cloth on the surface to be tested. For each reagent listed, apply enough of the reagent to saturate the cloth or paper (use of an eye-dropper or pipette is recommended).

- Distilled water (control)
- Bleach (diluted 10:1 water-to-bleach from bleach concentrate per 5.1)
- Hydrogen Peroxide
- Quaternary Ammonium (diluted per manufacturer's instruction*)
- Alcohol - Isopropyl
- Phenolic (diluted per manufacturer's instruction*)

* Manufacturers may also want to consider effect of full-concentration applications for information only – no acceptance criteria.

6.4.2 Immediately cover the reagent with a 2 in. diameter watch glass.

6.4.3 Allow the reagent to remain covered for 15 minutes.

6.4.4 Remove the watch glass and remove the reagent with a clean cloth.

6.4.5 Wipe the test area with a clean cloth and distilled water.

6.4.6 Allow the surface to air dry for 1 hour.

6.4.7 Evaluate the product to the acceptance level in 6.5.

6.5 Acceptance Level

The reagents should not affect the color of the surface. There should be no tackiness to the surface or softening of the surface/finish as compared to the unreacted surface. There should be no cracking or crazing of the surface.

For products with an initial Gloss reading of 20 or greater, a gloss change of up to 25% is acceptable. For example, products with an existing gloss reading of 40, should not fall below 30. (60-degree Glossmeter)

For products with an existing Gloss reading of 20 or less, a gloss change of up to 5 points is acceptable.

7. Screening of Coated Fabrics to Liquid Cleaner Resistance

Note: The Association for Contract Textiles (ACT) has created the following test method as a possible tool for determining the effect of liquid cleaners on coated fabrics.

7.1 Applicability

The following is a suggested protocol for the testing of cleaners and/or disinfectants on coated fabrics. The test method outlined is to evaluate the material's relative resistance or compatibility to specific cleaners and/or disinfectant chemistries and is not an approval or recommendation of said cleaners and or/disinfectants.

This test method is not intended to replicate a 'real world' scenario as there is no way to predict use (or misuse) of cleaners and/or disinfectants within an environment.

7.2 Purpose of Test

The purpose of this test is to evaluate the ability of coated fabrics used for furniture surfaces to withstand the application of liquid cleaners/disinfectants.

7.3 Test Setup (See Figure 1)

Each test will require one petri dish 3.5" x 3/4" in size or a bowl with similar size dimensions.

Cut two square samples slightly larger than the diameter of the container. For example a 4"x 4" sample when using a petri dish. Label each sample in the bottom left corner with the type of material and name of cleaner/disinfectant. Place one of the square samples on top of the petri dish or bowl. The material should create a slightly concave surface or "depression" that will allow the liquid cleaner/disinfectant to stay in place and be in constant contact with the test material. (see below for examples) Retain the second sample of the test material to use as the control.

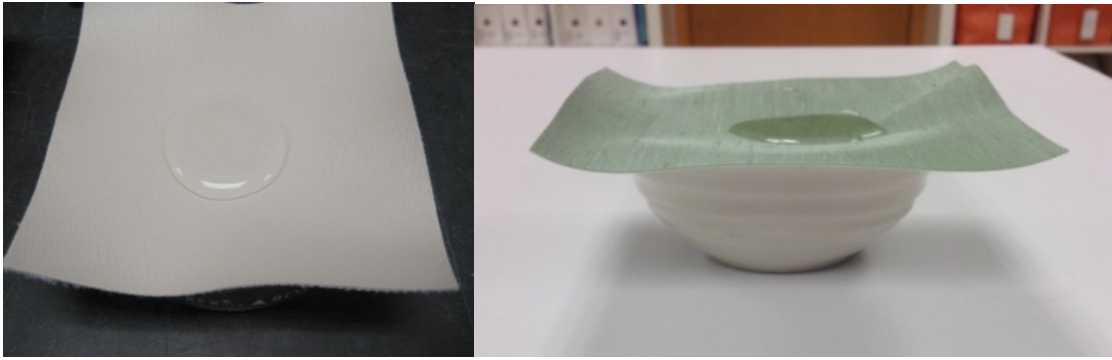


Figure 1 – Liquid Cleaner Test Application

Obtain a minimum of 12.5 ml of each cleaner/disinfectant to be tested.

- Each application will require 2.5 ml (approximately ½ teaspoon).
- For test utilizing wipes wring them out to collect the liquid (use gloves).
- Each cleaner/disinfectant used for testing should be diluted according to manufacturer's instructions found on the label.

A consistent light source (i.e.; light booth, fluorescent light, etc.) should be used for the duration of the test to conduct visual evaluations after each cycle.

7.4 Test Procedure

7.4.1 Pour 2.5 ml of cleaning solution directly onto center of test material. Let the specimen sit for one day (or until liquid is fully evaporated). After the specimen is completely dry, conduct a visual evaluation and note any changes in appearance.

7.4.2 Repeat this procedure until completing a total of five cycles.

7.4.3 After the fifth cycle perform a clean water rinse and wipe dry with a clean white cloth.

7.4.4 Cut the test specimen in half so that the center of the exposed specimen can be compared directly to the control sample.

7.4.5 Conduct a final visual evaluation using the control sample for comparison and rate the test specimen using the criteria below.

7.5 Acceptance Level

After each application, the test specimen should be compared to the control sample for visual differences such as:

General Appearance (in some instances this may include gloss) –

- No effect -- no change in color or surface finish.
- Slight effect -- a change in color or surface finish only visible at certain angles or directions.
- Moderate effect -- a change in color or surface finish visible from all angles and directions, but does not appreciably alter the original condition of the specimen.
- Severe effect -- a change in color or surface finish, which obviously and markedly alters the original condition of the specimen.

General Appearance – Not acceptable beyond slight effect as noted above.

Discoloring – Not acceptable beyond slight effect as noted above.

Cracking or peeling – Not acceptable

Bubbling - Not acceptable

8. Resistance of Furniture to Steam Exposure

8.1 Applicability

This test applies to all furniture items/materials including textile-covered surfaces subject to steam exposure for purposes of killing pests.

8.2 Purpose of Test

The purpose of this test is to evaluate the ability of furniture surfaces to withstand steam applications.

8.3 Test Setup (See Figure 2)

Prepare the surface for testing by cleaning with a clean damp cloth and allow it to dry. Place the test sample on a level surface.

The test shall include:

8.3.1 NEMA cup found in NEMA LD-3 Section 3.5.

8.3.2 Heating apparatus to heat the cup.

8.3.3 Structure to hold the material ½-inch above the cup.



Figure 2 – Steam Exposure

8.4 Test Procedure

- 8.4.1 Follow the general guidelines given in NEMA LD-3 Section 3.5. Place 350 ml of distilled water in a NEMA vessel found in Section 3.5.
- 8.4.2 Place the cup filled with water on a hot plate, until the water is at a vigorous boil.
- 8.4.3 After steam is rising from the vessel, place the material ½ inch from the top of the container.
- 8.4.4 Time the steam exposure to 30 seconds. It will be evident that steam is in contact with the surface by condensation forming on the surface.
- 8.4.5 After 30 seconds remove the sample from the steam exposure and wipe any remaining water away with a dry paper towel.
- 8.4.6 Allow the surface to dry completely. After one hour evaluate the appearance of the surface according to the following:

No effect -- no change in color or surface finish.

Slight effect -- a change in color or surface finish only visible at certain angles or directions.

Moderate effect -- a change in color or surface finish visible from all angles and directions, but does not appreciably alter the original condition of the specimen.

Severe effect -- a change in color or surface finish, which obviously and markedly alters the original condition of the specimen.

8.5 Acceptance Level

The test surface shall show no more than a slight effect.

9. Resistance of Furniture to UV Lights

9.1 Applicability

This test applies to all furniture materials subject to UV wavelength disinfection in the healthcare setting. (An alternate to this test is to subject the sample(s) to 40 hours per ASTM G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials. Recommendations – Cycle 11 (except Irradiance is 1.10) Wavelength 420 nm; Irradiance 1.10 +/- 0.03; Relative Humidity 30%, and Black Panel Temp 63 C).

9.2 Purpose of Test

The purpose of this test is to evaluate the ability of furniture surfaces to withstand UV wavelength disinfection.

9.3 Test Setup

The test apparatus shall include:

9.3.1 A germicidal light source capable of providing radiant energy in the spectral UVC wavelength region (200-280 nm), with the majority of the radiation at 254 nm.

9.3.2 A cabinet or otherwise means to isolate the light source and a mounting surface with uniform irradiation for sample exposure.

9.3.3 Overhead white fluorescent lights with bulb(s) positioned parallel to the line of sight and providing an intensity of 800 to 1100 lux (75 to 100 ft-ca) on the specimen surface.

9.3.4 A spectrophotometer if CIE L*a*b* readings are desired.

9.4 Test Procedure

Apply a UVC light source to achieve 291 kJ/m² (+/- 15 kJ/m²) radiation within 12 to 24 hours. GE G36T5 UVC lamp applies 500 uW/cm² irradiation at 16 inches to achieve this dose in 16 hours. Any similar UVC germicidal light source is satisfactory.

9.4.1 Measure the light intensity after a warm up period sufficient to achieve stable irradiation. Determine the exposure time necessary to achieve 291 kJ/m². Sper Scientific UVC Light Meter, Model 850010, or similar is satisfactory to measure irradiation.

9.4.2 Establish initial L*a*b* readings if color values are used. For wood surfaces identify the location so that subsequent readings may be made in the same location.

Disregard if only visual assessment is used. Uniform color surfaces may be measured in exposed and unexposed areas after the exposure, if desired.

9.4.3 Cover approximately 1/2 the sample with aluminum foil or other mask across the grain for wood surfaces. Sample size of 100 mm x 200 mm (4 in. x 8 in.) is suggested.

9.4.4 Up to four samples may be tested at once by placing the unmasked ends of the four samples together in a 200 mm x 200 mm (8 in. x 8 in.) sample area centered under the lamp. Placing the samples within this area minimizes the irradiation variation to +/- 5%. Expose the sample in UVC light until 291 kJ/m² (+/- 15 kJ/m²) is achieved.

9.4.5 Establish final L*a*b* readings as appropriate. For visual assessment position the conditioned sample on a table and view it at an eye-to-sample distance of approximately 750-900 mm (30-36 in.) and at an angle of approximately 45-75 degrees from the horizontal plane. The sample shall be rotated in the horizontal plane and viewed from all directions. Direct sunlight or other angle light sources, which can accentuate or minimize the effects, shall be avoided.

9.4.6 The light resistance shall be reported as one of the following:

- a. No effect—no change in color or surface gloss.
- b. Slight effect—a change in color or surface gloss visible only at certain angles and directions.
- c. Moderate effect—a change in color or surface gloss visible at all angles and directions but does not notably alter the original condition of the specimen.
- d. Severe effect—a change in color or surface gloss, which markedly alters the original condition of the specimen.

9.5 Acceptance Level

The test surface shall show no more than a slight effect by visual assessment. The test surface shall show a delta E of 2.0 or less.

9.6 Background UVC Germicidal Exposure

The Centers for Disease Control (CDC) recognizes that UVC light, wavelength 200-280 nm, has a germicidal effect on microorganisms and its use has widespread commercial acceptance as a method to disinfect bacteria, viruses, mold and spores¹. Peak germicidal effectiveness occurs at 254 nm by damaging the DNA of microorganisms and rendering them unable to replicate. Typically germicidal low-pressure mercury vapor lamps have a peak output of 254 nm and are commonly used in commercial portable disinfection systems.²⁻³ Several companies produce UVC disinfection systems and many studies have shown the effectiveness of using this technique to kill harmful microorganisms⁴.

Studies applied UVC doses of 12,000 uWs/cm² to 36,000 uWs/cm² achieved in times

ranging from 15 to 50 minutes to achieve Log 2-4 kill rates of MRSA, VRE, and *Clostridium difficile*⁵⁻⁸. *C. difficile* is recognized as a primary pathogen causing healthcare associated infections and is among the most difficult to disinfect⁹. Killing *C. difficile* may be considered a benchmark for effective disinfection. One time UVC exposure to kill *C. difficile* is in the order of 0.8 kJ/m² [10]. This is at the high end of reported UVC disinfection doses; therefore this dose should be sufficient to kill nearly all pathogens at a Log4 kill rate. Seven years has been proposed for the life statement for the Healthcare Furniture Cleaning Guideline (BIFMA H1-201X). Weekly exposure for 7 years gives a total germicidal dose of 291 kJ/m². Therefore, a total exposure of 291 kJ/m² using a germicidal lamp operating at 254 nm output is suggested to represent germicidal exposure to be addressed by the Healthcare Furniture Guideline.

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8. American Air and Water, UV Irradiation Dosage Table:
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9. Elimination of *Clostridium difficile* by Illumination? Surface Disinfection by Ultraviolet Light Treatment: http://www.tru-d.com/docs/Elimination_of_clostridium_difficile_by_illumination.pdf
10. Email from Deborah Martinez, Executive Director, International Ultraviolet Association, 11/21/13.

Appendix 1: Furniture Cleanability Design Considerations

Surfaces in Health Care Settings

- a) Non-upholstered surfaces should be capable of being easily cleaned; minimize surface joints and seams.
- Joints and seams complicate effective cleaning, creating organism reservoirs that can further the spread of contact transmitted healthcare associated infections.
 - A space between the chair back and seat can facilitate cleaning.
 - Nonporous, smooth solid surfaces such as laminate or poly resin products facilitate effective cleaning. Textured surfaces may result in additional cleaner dwell time or cleaning cycles, however, they may also decrease skin/surface contact area, which may lead to decreased bacterial transmission.
 - Finishes on hard surfaces that are scratched or chipped allow for accumulation of microorganisms and make them more difficult to clean and disinfect. For that reason, the use of “self-edge” laminate, which can easily chip, is discouraged in healthcare environments.
 - Furnishings must be able to withstand cleaning and be compatible with clinical practice and hospital-grade detergents, cleaners and disinfectants.
 - Organic substrates (e.g., unfinished wood) should be avoided in hospital areas with immunocompromised patients; all exposed wood surfaces should be sealed/finished such that they are and remain non-porous.
 - Surfaces that require high levels of cleaning/disinfecting, such as armrests, should have large radii along edges.
 - Inside radii on adjacent (cove) surfaces to avoid entrapment of materials and permit effective cleaning; larger inside radii are preferred.
 - Abutting surfaces should have minimal radii to avoid creation of crevices that are difficult to clean. Example – adjacent worksurfaces.

- Effective cleaning can be facilitated using support surfaces that can be cleaned from both sides, and/or by using materials that do not absorb or hold fluids/moisture, etc. Seating support surfaces using slings, mesh and similar materials are encouraged for such use. Such surfaces also allow for effective cleaning of undersurfaces and support structures.
- Exposed unsealed particleboard is susceptible to moisture and bacteriological contamination and is discouraged in healthcare environments.

b) Upholstered Furniture (or Surfaces) in Patient Care Areas

- The following types of high-performance (durable, stain-resistant and easy-to-clean) upholstery fabrics are currently used extensively in healthcare patient spaces. These fabrics can be, and are being, aggressively cleaned and disinfected with a wide range of popular disinfectants. Fabric supplier recommendations and limitations—in conjunction with healthcare facilities and their infection-control specialists or advisors (e.g., Centers for Disease Control) and housekeeping staff—determine appropriate use according to the demands of each specific space.
 1. Coated fabrics such as PVC (vinyl), PU (polyurethane), composites, silicone.
 2. Woven fabrics treated with stain-resistant finishes and fluid barriers that are designed to prevent moisture and liquids from penetrating the fabric.
 3. 100% polyester woven fabrics that utilize high-energy dyes, stain-resistant finishes (or both), with fluid barriers.
- Upholstered surfaces used in patient care areas should be impervious (non-porous); untreated (non-high performance) woven fabrics should not be used.
- Upholstered surfaces should be durable and resist tearing, peeling, cracking or splitting; damaged surfaces are more difficult to clean effectively.
- Upholstered furniture in patient care areas should be covered with fabrics that are fluid-resistant, non-porous and can withstand cleaning with hospital-grade disinfectants; microorganisms have been shown to survive on porous fabrics such as cotton, cotton terry, nylon and polyester, and on plastics such as polyurethane and polypropylene.
- Upholstery fabrics that are flatter (or have minimal texture) are preferable and easier to clean.
- Surfaces should also be uninterrupted whenever possible. Avoid crevices, reveals, piping, zippers and other areas that trap dust, dirt and other contaminants.
- If zippers are used, barrier materials should be considered (behind the zipper) to minimize liquid penetration into the cushioning/filling materials, and sealed zippers should be encouraged.

c) Ease of maintenance and repair:

- Products should be designed for ease of cleanability. Where possible, parts (cushions, arm pads, etc.) should be easily removable and/or have removable covers to facilitate cleaning or replacement.

d) Other

- In some instances, products may be subjected to heat or steam to eradicate pests (bed bugs, etc.). The construction and materials used in such products should be moisture resistant (impervious) to avoid damage to the internal components and mechanisms of the products. Consideration should be given to the fastener and component materials and/or finishes to prevent rust and corrosion if they are exposed to moisture and/or cleaning materials.
- The application of hooks & loop style fasteners should be carefully designed to facilitate cleaning (eg, make cushions easily removable for cleaning). Inappropriately designed fastening systems may compromise the cleanability/maintainability of furniture (may collect debris, moisture, etc., and not be easily disinfected).
- The use of antimicrobial inhibitors in materials and finishes is an emerging technology that is currently under investigation. No recommendation is given.
- Stain blocking finishes may be utilized, but are no substitute for good cleaning practices/routines.
- Manufacturers cleaning instructions geared to actual use and clinical practice should be provided for all product materials and finishes.

Appendix 2: Summary of Changes from the October 6, 2014 Edition

- 5) Referenced specific departments in the first note.
- 5.1) Added a reference to hydrogen peroxide.
- 5.2) ‘Hydrogen Peroxide’ was ‘Peroxide’ in the heading.
- 5.2) ‘green building certification requirements’ was ‘green certification requirements’
- 5.2) Added Note.
- 5.6) Deleted (One such product is Wexcide 128).
- 5.8) Deleted (One such product is International Dioxide’s Anthium Dioxide).
- 7) Modified the test section extensively per recommendation by ACT. Woven removed from Applicability note. The test was 14 days and is now 5 days, yet is a slightly tougher test.
- 9) Added recommendation to use Cycle 11 for ASTM G155.

Appendix 1.a. Added self-edge sentence

Appendix 1.a. Added unsealed particleboard sentence.