**NASM CONSERVATION EXHIBIT DESIGN**

**AND**

**CONSTRUCTION GUIDELINES**

The purpose of this document is to assist designers in creating exhibits that help to preserve our unique and valuable collections. These guidelines are intended to serve as a starting point for ongoing discussions and review between NASM conservators and exhibit designers and fabricators at borrowing institutions.

Artifacts can be damaged by a variety of factors including: unsuitable placement, light damage, severe humidity and temperature fluctuations, improper physical support, and exposure to harmful vapors or gases from display materials. Significant research has been conducted to determine how these factors are responsible for sometimes-unseen damage to museum artifacts. The following recommendations are based on this research and are in keeping with current museum standards and practices.

Whenever an exhibition design calls for a material not specifically mentioned in this review, the NASM Conservation department will provide analysis and research on the material to ensure that it meets our archival standards.

**1. FLOOR LAYOUT and Artifact Placement**

Improper handling of artifacts can cause much damage. Barriers and/or exhibit cases should be employed to prohibit the handling, theft or vandalism of fragile and/or historically significant artifacts. In general at least a 48” distance should exist between a visitor and an artifact in order to deter handling by visitors. That distance is variable, depending on the height of the barrier.

1. The design of floor layouts should take into account existing heat sources, cooling systems and exposed pipes. When possible, artifacts and cases containing artifacts should be placed at least 36” from heating ducts and should not be placed beneath air conditioners or vents.
2. Carpets and the adhesives used to lay them can emit potentially harmful gases. Carpeting or other floor covering should be installed at least two weeks before artifacts are placed on display to allow chemicals to dissipate.
3. Vinyl flooring is not only difficult to maintain, but may also release harmful vapors into the exhibit space. If possible the use of vinyl should be avoided.
4. Ideally, large artifacts should not be displayed resting directly on the floor, but should be raised on low plinths to protect them from damage during floor cleaning.
5. The barriers and railings should incorporate gates or access panels that are easy for staff to open for cleaning, light bulb changing, movement of artifacts and other maintenance activities.

A minimum aisle clearance of 72” is suggested to allow for the movement of lifts and equipment throughout the exhibit.

**2. EXHIBIT LIGHTING RecomMendations**

Light is capable of causing irreversible damage to many artifacts. The type of damage caused by light exposure includes fading or darkening of paints and dyes. Light also sets up degradative chain reactions in the molecular structure of organic materials that may not be immediately apparent but will exhibit damage in the future. Ultraviolet energy from light causes the most rapid degradation, but it should be understood that all wavelengths are responsible for damage to artifacts. Light damage is also a cumulative effect and the exposure is determined by multiplying the luminance by the time of exposure. If the lowest recommended light levels are used, the artifacts and exhibit elements will be the least damaged over the life of the exhibit.

1. All light sources should be filtered to remove Ultraviolet (UV) allowing no more than 75 microwatts/Lumen.
2. Whenever it is possible, daylight should be minimized in display areas. If windows cannot be blocked, a variety of solutions are available to mitigate the adverse effects upon collections. These include: the use of louvers to divert light, filtering with UV film and diffusing light with screening, etc.
3. The infrared component of incandescent lighting causes heat, which can also damage artifacts.
4. All ballasts and transformers must be placed in a remote location rather than within exhibit case bases or vitrine lids to prevent heat build-up.
5. An overall low illumination in exhibit areas can allow specially lit cases or artifacts to visually stand out, even if they are illuminated to a low safe level.
6. Where practical, exhibit lights should not be located directly above artifacts. Gallery work lights that are located above artifacts should be left unused by leaving out the bulb or disconnecting the fixture.

***EXHIBIT CASE LIGHTS:***

1. Ideally, incandescent and fluorescent lights should not be placed inside exhibit cases. It can be difficult to evenly distribute light so that artifacts close to the source are not over-exposed. Also, the heat generated by traditional light sources can result in high temperatures and fluctuating humidity within the case. Routine maintenance of fixtures and changing of bulbs also increases the chances of physical damage.
2. There are many examples of successful exterior lighting of vitrines in museum exhibits with directed lamps. Lighting designers can mitigate the expected problem of glare.
3. Where lighting in cases is necessary, the best sources are fiber optic lighting and some types of light emitting diodes. Both sources emit minimal UV and heat.
4. For overhead interior case lighting, the fixtures must be confined to a separate compartment above the case. This compartment must be well ventilated, and sealed from the case interior via UV-blocking Plexiglas or safety glass. The ballast unit to power florescent bulbs or fiber optic bulbs must be outside this compartment to avoid heat build-up within the case.
5. Dichroic reflectors for incandescent lamps help to reduce the heat projected from these sources. (I.E. MR-16 lamps are available with dichroic reflectors).
6. The illumination level is dramatically affected by the proximity of the lamp to the object. As a rule of thumb, artifacts that are sensitive to light (e.g. paper, textiles, doped fabric, plastics, rubber and paintings), should be placed at least 18" from any light source.

## **General Recommended Light Levels**

Exposure limits in 10 years

|  |  |
| --- | --- |
| 50 – 100 lux\*  150,000-1,500,000 lux/hrs/10 years    For highly sensitive materials, duration of exhibition will be the limiting factor. | 1. *Most sensitive to light:* rubber, certain plastics, cellulose-based resins, costumes, textiles, dyed leather, banners, tapestries, prints, drawings, watercolors, stamps, manuscripts, color photo prints and transparencies, unprimed thinly colored paintings on canvas. |
| 100 – 200 lux  3,500,000-7,000,000 lux/hrs/10 years | 1. *Moderately sensitive to light:* oil and tempera paintings, lacquer ware, wood, certain plastics, furniture, horn, bone, colored ivory, black and white photographs. |
| 200 lux and higher  No time limits | 1. *Insensitive to light:* objects of stone, ceramics, glass, metals, certain plastics (be aware of heating effects from infrared sources). |
| \* 50 lux is most often cited in the literature as the acceptable light level for this category; however, some sources have chosen 100 lux as the lower threshold. Museum designers and curators generally prefer this higher value for reasons of color rendition and perception, so for sensitive materials, artifact rotations should be factored into exhibit planning. | |

This chart is from Conservation & Exhibitions by Nathan Stolow.

**3. EXHIBIT ENVIRONMENT**

The following are the recommended temperature and humidity levels that help to preserve collections. They can be maintained by a variety of methods including existing temperature and humidity control systems and by the addition of buffering materials to exhibition cases. Freestanding self-contained microclimate cases should be created or purchased for the display of rare humidity-sensitive collections.

These guidelines state that, at any time of the year, the exhibition environment can be anywhere in a psychrometric box bounded by 37% RH and 53% RH and 66o F and 74o F. See the figure 1 below. These recommendations consider the operational costs to the institution and the preservation concerns for the collection. Typically, during the winter months, the RH should be maintained in the lower range of 37% to 45% to prevent building condensation.



Figure 1. Environmental boxes.

**4. Exhibit CASE DESIGN & LAYOUT**

Both the security of artifacts and the accessibility of cases should be taken into account when designing layouts. Both artifacts and graphic elements require maintenance or replacement; therefore access should be simple for staff and challenging for “would be thieves”. Inside hinges, sealed glazing and locked access doors are some of the elements of a securely designed case. All simple screws and fasteners should be hidden. The installation of case alarms may be required for the display of rare and valuable artifacts (follow SI security guidelines). Artifacts or graphic/design elements should not block access and filter panels or doors.

Cases should prevent dust and pollution from entering and to allow no more than one air change/day, if possible. For sensitive artifacts, case designs should also include space for silica gel or Art Sorb (humidity buffer materials) as per specs determined by the volume of the interior space of each case. NASM Conservation staff will work with designers in developing appropriate plans for the use of silica gel.

***A. CompatibilitY***

The issue of incompatible artifacts is important in museum collections with a wide range of materials. The composition of some artifacts can actually damage other artifacts if they are displayed together in a sealed exhibition case.

1. For example rubbers and early plastics are inherently unstable, and may release vapors into the environment that can corrode metals. Cases containing many plastic (especially Cellulose Nitrate) or rubber artifacts should be filtered and well ventilated to remove the corrosive chemicals that are emitted from the artifacts themselves.
2. Some lubricants and greases contain natural components that become rancid as they age and will off-gas corrosive compounds.
3. Artifacts of wool, leather and feathers emit corrosive sulfur compounds therefore they should not be displayed in close proximity to most metals-especially silver.
4. Some wooden objects emit volatile organic acids that can damage paper, textiles or metals in contact with them.

***B. MOUNTS***

NASM Conservators and Exhibits staff will assess artifacts individually or by type to determine the configuration of mounts to be used, but the following generalizations will help with initial planning. Some loaned artifacts will be delivered with a custom display mount. In some cases NASM may require that a professional mount maker be contracted by the borrowing institution to fabricate mounts.

1. Artifacts will not be modified or permanently altered to accommodate mounting.
2. Artifacts should not be placed directly on painted surfaces. Pigment from the paint may transfer over time, or artifacts could stick to softened paint. Mylar, or Silicone Coated Mylar, can be utilized to separate an artifact and the surface it rests on.
3. If a metal artifact requires a metal mount, the mount should be coated, or a barrier placed between it and the artifact to avoid the possibility of abrasion or galvanic corrosion.
4. In general, artifacts should not be placed upon each other. They may suffer creases or folds or undergo permanent deformation as a result. Exceptions will be made on a case by case basis.
5. Fastening systems must be mechanical or based on secure but not tight friction. Adhesives or waxes cannot be used on artifacts for mounting.
6. Potential vibration and abrasion of the artifact should be minimized by the mount. This is accomplished by the nature of the mount's design and the material selected for construction.
7. Objects should be mounted in ways that avoid physical stress or unbalanced weight distribution.

**Paper Artifacts:**

1. All paper artifacts will be matted or backed with acid-free, lignin-free board.
2. Prints and drawings should be mounted using friction techniques such as Mylar corners, perimeter strips or channel mounts. The use of adhesive techniques such as hinging tape, starch pastes or spray adhesives should be avoided.
3. Posters, large prints and works of art on paper will be matted and framed to protect them. In general Mats are at least 1" larger than the artifact on each side, with the bottom margin slightly wider.
4. Booklets and pamphlets will be backed with acid free board and secured with Mylar corners.
5. Books and Magazines should be displayed on an angled support with a small a degree of incline or flat (this is the preferred method).
6. Original frames will not, in most cases, be altered.

**Textiles:**

1. Organic materials, especially textiles need to be well supported across as great an area as possible so that they do not sag or stretch.
2. In most cases, NASM staff will guide the fabrication of costume mounts. We recommend museum-quality mannequins constructed of inert materials (such as Ethafoam™), padded with polyester fiberfill or polyethylene foam, and covered with cotton fabric or nylon stockinet.
3. Flat textiles are rarely displayed folded; they should instead be displayed flat, hanging or rolled on acid-free board or acrylic tubes.

**Three dimensional Artifacts:**

1. Any small artifacts displayed in the open must be secured to prevent theft.
2. Hanging 3-D artifacts are placed in unusual jeopardy. It is preferable to support artifacts on mounts or stable surfaces. Hanging artifacts or display graphics above artifacts should be avoided when possible.
3. Hanging shelves do not provide sufficient stability for the display of artifacts.
4. If hanging is necessary (e.g. if the artifact was meant to hang), tested high-strength plastic-coated wire, or braided metal "flight line", with secure swage connectors and fasteners should be used.
5. In some cases, original clamps, strings, hooks and chains can no longer adequately support the artifact as they once did. Additional reinforcement may be required.

***C. MATERIALS***

Materials used in cases or around artifacts should be as inert as possible to avoid harmful interactions or vapors. Several organizations are currently collecting material testing data and making this information publicly available. Whenever designers wish to use display materials not specifically mentioned in this review the NASM Conservation department will analyze them to ensure that they are safe.

**1. GLAZING MATERIALS / VITRINES**

Glass or acrylic glazing may be used on cases. If natural light or ultraviolet (UV) containing light is on the exterior of the case, a UV absorbing acrylic or glass, or a filtering film must be used.

* **Plate Glass or Safety Glass**: Impact Resistant Safety Glass is recommended, preferably with Ultraviolet screen incorporated in laminate. Butacite® (E.L. Du Pont de Nemours & Co., Inc. – DE), a polyvinyl butyral sheeting, is a pliable, tough thermoplastic used as an interlayer in laminated safety glass. All Butacite® compositions are formulated to absorb all ultraviolet radiation from sunlight.
* **Plexiglas and Lucite**: Lighter than glass and formable. Use "UF-3", "UF-4", or "OP-2" grades, which have ultraviolet filters (check suppliers for clarity or yellowness of the above). UF-3 (Autohaas America – PA) removes 99.9% of UV light at 396 nm and below and partially blocks 396 – 400 nm. Other companies also produce UF-3 products and these will block a similar amount of UV light. OP-2 (Cyro Industries – NJ) removes 99.9% of UV light at 390nm and below and partially blocks 390nm – 400nm. Polymethylmethacrylate (Plexiglas) materials are impact resistant, but relatively easy to scratch. They may also build up static electricity which is not recommended for housing artifacts with powdery surfaces (e.g. pastels and degraded textiles).
* **Polycarbonate sheet (Lexan)**: Half the weight of glass; usually extruded, not cast; may have blue-gray tinge; high impact strength; resistant to temperatures of approximately 250oF; readily formed with heat, can be cut and machined available with UV absorbers. Polycarbonate naturally absorbs most UV radiation without additives.

###### 2. GASKETS AND SEALS

**RECOMMENDED:**

* **Teflon**
* **Closed cell neoprene**
* **Alcohol based silicone caulk**
* For replaceable seals in small spaces: “Gore-Tex Joint Sealant”, available in cords from 1/8 inch to 1 inch thick, 300 ft long rolls, is highly recommended because it is inert.
* For re-useable seals NEOPRENE closed- cell gaskets. (E.g.. Neoprene PRS 537-2-1d 3601 and Viton PRS 509 from the Presray Company, New York). Or EPDM foam strip gaskets manufactured by Resource Conservation Technology Inc, MD, 410/366-1146. Clean Seal (Silicone Gaskets, IN) and Silicone Gasketing (Resource Conservation technology, MD).
* For permanent seals: Caulking in cases should be a neutral curing, ammonia free, low VOC two part silicone or acrylic caulk. All of these should be given a three week aeration period before object installation. "GE Silicone II" or "GCE Construction Grade Silicone 1200" do not contain acetic acids, and provide a good seal.Dow Corning 3145 RTV and 748 Non-corrosive Sealant (Dow Corning Corporation, MI) and GE RTV 615 and GE SCS Silglaze II (General Electric Silicones) are two part neutral curing silicone caulks based on (poly)dimethylsilicone.

**NOT RECOMMENDED:** Gaskets made from:

* Natural rubber
* Most synthetic rubber
* Polyurethane foams
* Silicone caulking material containing acetic acid (smells like vinegar as it cures).

##### 3. CASE FRAMEWORK

**RECOMMENDED:**

* Aluminum and Steel - highly recommended:
  + - Metals are strong, non-flammable, emit no harmful vapors are recommended for structural support. Powder coatings or baked enamel finishes are recommended paint for steel (see COATINGS section for more information).
* **Wood:**
* Wood is one of the main sources of harmful vapors in display cases. Some are treated with inappropriate corrosive pesticides or flame-retardants.**\*ALL WOOD SURFACES EXPOSED TO THE INTERIOR OF DISPLAY CASES MUST BE COATED WITH AN APPROPRIATE VAPOR-BARRIER**. (See COATINGS section)
* Approved: well-seasoned, air-dried lumber. These varieties have been tested, and are safer: Yellow pine, other pines, spruce (EXCEPT SITKA SPRUCE), walnut, magnolia, mahogany, poplar, balsa, willow, elm (*ulmus sp.* American, European, and Japanese – not white *ulmus Americana*).
* Acceptable: Beech, birch (they may become more corrosive as they age), other softwoods.
* Unacceptable: Oak, Cypress, Douglas fir, Basswood, Sweet Chestnut, Sitka Spruce, Red Mahogany (Khaya), Teak, Western red cedar, cork.
* Specialty and tropical woods are becoming widely available. Few of these have been tested, but the conservation department will analyze and assess any samples provided. Avoid designing cases where the ENDGRAIN of the wood faces the interior of the case. More vapor is emitted faster from the cross-section of wood. See COATINGS section for information on sealing wood surfaces.
* **Some wood products or composites (e.g.. plywood, chipboard, particleboard, pardboard, Masonite).** These materials emit vapors from the wood that can damage artifacts. Formic acid & formaldehyde emissions from the adhesives used to bind the wood can also harm artifacts, particularly metals.

The following wood boards are approved for exterior case construction. As all wood products have the potential for off-gassing acids, any of these boards should be well sealed and not used on case interiors. If one of these wood products is used in a case interior it should not have a fire retardant and must be sealed either with a vapor barrier or a coating.

* Plywood preferably made with approved woods (see above) are best because they are made with "Phenol Formaldehyde" adhesives, not the more dangerous "Urea Formaldehyde" variety. Soft Plywood with an exterior adhesive system of phenol formaldehyde; if hardwood must be used, a phenol formaldehyde bonded hardwood with a hardwood veneer core should be requested; purchase plywood that is stamped as meeting ANSI/HPVA HP-1-1994 standards.
* MDO plywood is a form of overlaid plywood. What this means is that MDO plywood starts with a core of overlapping veneer, much like traditional veneer core plywood.
* HDO plywood is much like MDO plywood, except that the density of the fiber surface layer is much greater.
* **Medex®** (trade name for exterior grade Medium Density Fiberboard [MDF]) is a sustainable, moisture resistant, medium density fiberboard (MDF) panel utilizing a formaldehyde-free adhesive system and 100% post-industrial recycled wood fiber. Medex® is engineered for interior high moisture areas in nonstructural applications in place of sanded plywood and solid wood. Medex® gives the versatility of a superior composite panel with the strength and emissions of lumber and other grain wood products.
* **Medite® II** uses a Formaldehyde-free adhesive system, exceeds standard MDF physical properties, and is made of 100% recycled wood fiber.

**4. COATINGS**

TO ENSURE COMPLETE DRYING AND CURING, WE RECOMMEND THAT ALL PAINT AND PRIMERS IN DISPLAY CASES BE ALLOWED TO DRY FOR A MONTH BEFORE ARTIFACTS ARE INSTALLED. Paints may appear to be dry to the touch before all the water has actually escaped.

If it is necessary to use a wood product in the interior of the case, it should be coated with one of the following products. A zero or low volatile organic components (VOC) acrylic latex paint or two-part epoxy resin is recommended for the interior of the cases. Both coatings will require 3 weeks to aerate before installation of artifacts. Direct contact with the painted surface is not recommended due to possible transfer of components. Paint does not provide an effective barrier coating for wood products and this should be used in addition to vapor barrier coating or film when used on wood paneling inside cases. Oil or alkyd paints are not appropriate. All paints not listed in this document must be tested by the NASM Conservation unit.

**RECOMMENDED**:

* **OPAQUE, COLORED COATINGS AND PRIMERS:**
* A high-quality acrylic or vinyl-acrylic LATEX EMULSION such as "Regal Aquavelvet Eggshell 319” by Benjamin Moore which contains calcium carbonate which acts as an acid absorbing buffer on wooden substrates; In some instances a baked enamel finish may be desirable; specify a "cross-linked acrylic enamel" for cases.
* Interprotect 1000 (Interionational Paint Co. - NJ) is an example of a suitable two part epoxy paint (clear) and it provides a long term barrier but may not be visually appropriate as it is thick and glossy.
* Sancure 878 (BF Goodrich - MA) is an example of a waterborne polyurethane, 38% solids and has no additives or leveling agents added. It can have matting agents added.
* **CLEAR COATINGS, STAINS:**
* Highly recommended: Pratt and Lambert Acrylic Latex Varnish.
* Recommended, (but allow ample time to dry): Alcohol or Water-based stains (e.g.. "Goudey" brand); Shellac, in two or three coats. However, it may take months to release all solvents and provides a very poor vapor barrier for wood; High-build, moisture- curing polyurethanes which use xylene thinners have been tested, however we have no brand recommendation at this time.

**NOT RECOMMENDED**:

* Oil based paints; Alkyd Paints, Alkyd Sanding Sealers or casein paints. These take a long time to cure, and continue to emit solvents and corrosive vapors over time.
* Oil-based varnishes, oil-based stains; oil-modified polyurethane varnishes ("Varathane"); alkyd sanding sealers.

**5. FABRICS**

Any exhibit textiles used in cases must be made of known materials. Flame-retardants used on commercial fabrics can cause metals to corrode. Please specify fabrics, which are inherently fire-resistant. Dyed exhibit fabrics should be tested to ensure that they will not transfer colorants to artifacts.

**RECOMMENDED**: Pure, non-dyed, unbleached linen and cotton, not treated with corrosive fire-retardants and preferably washed to remove starches or gelatin sizing, Polyester Fabrics are usually safe; Acrylic felt; Japanese papers may sometimes be substituted to give the effect of silk. Test Fabrics offers a line of appropriate fabrics for museum displays.

* Buckram is a cotton wide-weave fabric heavily coated with water softening starch. This textile is used to form supports for textile objects and hats, base support for mannequins and for lighter weight fabrics objects.
* Cotton - White or unbleached. Wash before use to remove finishes and sizing. When washing, use soap with few additives and rinse multiple times. Do not use bleach or fabric softener. Muslin is most commonly used.
* Felt – acrylic or polyester, needle punched. Dyes may run and should be tested. If adhesive backed, adhesive should be an acrylic and never touch a collection item.
* Interfacing – polyester, non-woven material. Avoid iron-on variety.
* Polarfleece, polyester fabric – polyester. Test dyes for color fastness before using. Undyed cloth is more stable for long-term use. Wash before use to remove finishes and sizing. When washing, use soap with few additives and rinse multiple times. Do not bleach.
* Tyvek sheeting, #10, 14, 16 – non-woven, spun-bonded polyethylene sheeting. Strong, lightweight, smooth, flexible (#14 and #16 - #16 is pin perforated) or stiff (#10), no binders, fillers, buffers, low linting, resistant to water, chemicals and aging/ Some solvents cause swelling. Resist mildew. House wraps may contain UV stabilizers.

**NOT RECOMMENDED** (the following fabrics give off corrosive vapors): Wool (and wool felt), silk, PVC vinyl sheeting, real leather and suede, jute, cork, polyurethane foam-backed fabrics (including "Ultra suede", etc.), and fabrics made from grasses, bark and cane.

**6. BARRIER FILMS**

Acceptable vapor barrier films for exhibit case interiors include “Marvelseal”, “Aclar” and “Film-O-Rap”. These films can be adhered to a wooden substrate using heat or acrylic adhesives. Marvelseal®, a laminate of aluminum foil and any number of other sheet materials, can be ironed onto wood if one of the laminates is polyethylene.

**7. LAMINATES**

# High-pressure laminate materials such as “Formica” and “Wilson Art” can be used on platforms and exhibit case interiors if adequate precautions are taken to allow adhesives to off gas. Approximately one month is required. Moldable laminate materials should be avoided and all edges must be covered with laminate.

**8.** **BOARD**

All paper and board material in contact with artifacts must be ACID-FREE and LIGNIN- FREE. Other types of paper products will transfer acids to artifacts or cause corrosion and they will also deteriorate over time. Be cautious about the use of the term “Museum Grade” which occasionally contains bleaches, and other "stabilizers" which render them unsafe for use by museums.

**RECOMMENDED BOARD**:

* Paper Honeycomb, Corrugated paper board, Bristol board, mat board.
* "FOAMCORE" is available made with unbuffered acid- and lignin-free materials, but this must be clearly specified.
* "COROPLAST" is a lightweight plastic board that is safe (but static-prone).
* "SINTRA" board is available in many colors and has been tested to be stable, despite the fact that it is made of PVC.
* CORREGATED ALUMINUM PANEL

##### 9. TAPES AND FASTENING DEVICES

**RECOMMENDED:**

* "ISOTAC" 2-sided adhesive tape has been approved for attaching mounts and non-artifact graphics in cases.
* "MACmount" 2-sided, self-adhesive foam tape can be used for sticking graphic panels to backing boards. Tape is never applied directly to artifacts.
* Self-adhesive "VELCRO" strips are used in small pieces to attach matted two-dimensional artifacts to display panels. This system allows for the safe removal of paper artifacts from vertical panels. (However, some of the self-stick adhesives on the VELCRO may be unstable over time. We are currently advising "Velcro" strips with "Spectrum" (0172), or "Spectrum Plus" (0174) pressure- sensitive adhesive backing. It is also possible to get un-sticky Velcro and apply a stable adhesive.)
* Metal hobby cable or "flight lines", separated and padded from the artifact where it touches with polyethylene or silicone tubing (available from medical supply companies).
* Aluminum tape which is an aluminum foil carrier with acrylic adhesive. This can be used to seal seams and holes in Marvelseal or aluminum foil barriers or to seal off wood in narrow areas.
* Cotton tape which is woven (plain weave or twill weave), unbleached, and acid-free.
* Linen tape which is a linen cloth tape with water-soluble adhesive backing.
* Embroidery floss (cotton) can be less damaging than fishing line and is soft enough to not cut into most objects.
* Insect pins which are fine, nylon-coated pins (nickel-coated brass pins are stable, but thicker).

**NOT RECOMMENDED:**

* Monofilament is not recommended for most applications, and should never be used for hanging artifacts. It stretches over time, and may easily snap where it has been kinked.
* "TYGON" tubing is no longer recommended, because it is a plasticized PVC product, which emits corrosive vapors and may transfer plasticizers.

**10. ADHESIVES**

The following is a list of adhesives which have been tested previously and found to be acceptable. However, since manufacturers tend to change their formulations without notice, any adhesive chosen to be used in case construction and application of photomurals, text panels, etc should be submitted to conservation for testing prior to use. Generally acrylic based adhesives without plasticizers tend to be acceptable.

**RECOMMENDED:**

* -2000-NF Plus Blue Adhesive (with spray activator #1) is a water dispersed, activated adhesive.
* -3M Spray Mount 77 Adhesive is a dry application adhesive used for mounting photographs, prints, etc. to substrates.
* - 3M Instabond C is a permanent pressure adhesive used for mounting photographs, prints, etc. to substrates.
* Problematic adhesives are protein-based glues (animal), rubber-based or plasterized, cellulose nitrate, polyvinyl acetates, and urea formaldehyde adhesives. It is also preferable that hot-melt adhesives not be used inside the cases as they frequently are base on an ethylene-vinyl acetate (EVA) resin which has the potential to break down and off-gas acetic acid. If it is necessary to use one, 3M 3797, Bostik’s Temogrip 6330 and Evode Limited’s Evo-Stick 7702 are among the more stable ones.

##### 11. EXHIBIT PROPS

The following materials have proven to be unsafe in closed cases, and are

**NOT RECOMMENDED**:

* Flexible Polyvinyl chloride (PVC) sheeting or objects can leach out plasticizers and the vapors they emit during deterioration will cause metals to corrode, and other damage.
* Hair, fur, feathers, real food and straw can attract insects. (In many cases, it is possible to buy or make replacements)
* Bricks and concrete blocks hold moisture and contain dissolved salts, which can damage objects.
* "Found Objects” should always be tested and approved for use in museum cases.

**12. PADDING MATERIALS**

Rigid materials in direct contact with collections will usually cause damage: distortion, scratching, abrasion, tears, and chemical interactions. The common practice is to place a padding material between a rigid foam and the artifact. Often there is barrier layer on top of the padding and directly against the artifact.

**RECOMMENDED:**

* Backer Cord is extruded, closed-cell polyethylene foam. It is generally grey, pigmented with inert carbon.
* Ethafoam™ is a polyethylene open cell foam. This has rough edges and should be covered with acid-free tissue, soft Tyvek, or muslin to avoid abrading objects.
* Nalgene and Zotefoam® are closed cell polyethylene foams.
* Volara is a closed cell, polyethylene foam.
* Polyester quilt batting that is 100% polyester, needle-punched with no resin bonding. Polyester is non-hygroscopic.

**13. PAPERS**

As with the cardboards, pH is important so non-buffered acid-free tissue paper should be utilized.

**RECOMMENDED:**

* Unbuffered, acid-free, lignin-free, lightweight tissue paper. This is useful as a barrier layer between specimen and rough support material such as Ethafoam™ or polyester batting.
* Unbuffered or buffered, acid-free, 100% rag blotting paper.
* Unbuffered, acid-free, lightweight L-tissue or Lens tissue. This is useful as a barrier layer between specimen and rough support material such as Ethafoam™ or polyester batting.

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