

The Care and Preservation Of

Historical Iron

BY CLARA DECK, CONSERVATOR

REVISIONS BY LOUISE BECK, CONSERVATOR

Introduction

Historical iron can be maintained for years of use and enjoyment provided that some basic care and attention is given to its preservation. The conservation staff of The Henry Ford have compiled the information in this fact sheet to help individuals care for their objects and collections. The first step in the care of collections is to understand and minimize conditions that can cause damage. The second step is to follow basic guidelines for care, handling and cleaning.

Please note - this fact sheet will present a brief overview of the care of iron objects, stressing good storage as the best method of preservation. It does not address the serious problems of preserving archaeological metals excavated from land or marine sites. People who collect Un conserved archaeological artifacts should be aware that those types of objects are rarely stable if left untreated and require significant specialist intervention. Please contact a conservator if you need assistance with conservation of these materials.

Iron is a common metal in historical collections. It is found in a variety of alloys, known as "ferrous metals", including wrought iron, cast iron and steel. Galvanized or tin-plated sheet is also a familiar material in historical collections. Ferrous metals are magnetic so the presence of iron can, therefore, be easily identified with the use of a magnet.

Types of Damage

Poor handling and inappropriate storage are the major causes of damage to iron artifacts and can result in corrosion and physical damage to the object. Inappropriate storage can refer to either storage in an area that is not properly environmentally controlled, or storage with inappropriate stresses placed on the artifact physically. Mishandling can result in breakage, bending or cracking. Cast iron, for example, is usually a relatively brittle material and will not bend as one might expect metals to do.

Corrosion is by far the most widely seen type of damage associated with metal artifacts. Active corrosion causes a continuous loss of metal from the object. Salts, oils and moisture can lead to metal corrosion, so if you handle metal artifacts with bare hands you risk



damaging them. Uncoated ferrous artifacts that have been kept clean and dry will usually develop stable surfaces. Stable surfaces may appear blue-black to brown, and are not scaling, flaking or pitting. This kind of compact rust may protect the object if it is left intact. Hand-forged tools, for instance, often have a dark, rough finish. Not all iron or steel was meant to be brightly polished and altering original surfaces may reduce the historical value of an object. Dark, stable surfaces may be considered "patinas". Collectors should be aware of any special finishes (i.e., tempering or bluing on firearms) that may be present as the correct color should inform the degree to which an object should be cleaned.

As mentioned above, orange rusty iron is often seen but may not be cause for alarm if the corrosion layer is continuous, relatively even and does not flake off easily. If you notice ongoing rusting and changes to the surface appearance, including paint loss, chances are the iron is actively corroding. Problem corrosion on iron artifacts usually appears as pits develop at active corrosion sites. This active corrosion is of concern, especially if it develops at joints between metal parts. Bright orange droplets or "sweating" forming on the metal surface indicate advanced active corrosion induced by high atmospheric humidity (above 70%) and the presence of salts.

Painted metal artifacts can usually withstand corrosion if the coating is not damaged. Where there are paint losses, corrosion progresses rapidly. If left untreated, and in a poor storage environment, the corrosion in this case will continue and eventually cause more severe paint losses.

Storage of Iron

As with most materials, proper storage is the first line of defense against damage for iron artifacts. Maintain an even, low humidity where metal objects are kept, ideally below 55 % relative humidity (RH). Prevent rapid fluctuations in either RH or temperature, as rapidly fluctuating temperatures will cause coatings to fail as the metal expands and contracts; this problem is most acute in the case of artifacts composed of sheet metal. In most homes, an even environment is difficult to ensure. Basements tend to be damp in the summer and therefore should not be used for the storage of metal artifacts. Humidity sensors are available through suppliers listed at the end of this document for those who wish to check conditions near their collections. Do not allow dust to accumulate on stored objects, as it can hold moisture and induce corrosion even where the ambient relative humidity is not high. You can protect your collection by storing it on shelves padded with inert foam (i.e., "Ethafom"). You may choose to drape plastic or cloth curtains around storage shelves to protect them from dust, but do not place iron artifacts in sealed plastic bags - the danger of moisture condensation on the metal outweighs the benefit of dust protection.

Handling of Iron

Most metal artifacts should not be handled with bare hands. Salts and oils from your skin can etch into uncoated metals and may even cause permanent damage. Handle your valuable collection with gloves. Nitrile gloves are preferable, as they protect the object but also prevent anything on the surface of the object from transferring to your skin. Lift objects from their center of gravity, and avoid lifting objects by limbs, handles, spouts or other extended areas; the metal may have developed unseen weakness' over time and could break if stressed further.

Cleaning & Care

If you choose to clean your iron artifacts, first consider the surface appearance you wish to achieve. The final appearance you are aiming for will determine which of the following steps you should take.

Cleaning – Dust must be removed from surfaces before further cleaning can take place. Vacuum clean all stable artifacts regularly, using a nozzle with a brush attachment. A bristle brush may help to raise dust from crevices. Any wet cleaning should employ deionized or distilled water only to avoid contaminating the metal with salts or other impurities.

Degreasing - The presence of degraded oils and grime may promote corrosion. You can degrease most uncoated metal artifacts with mineral spirits. (Please consult the manufacturer or Safety Data Sheet for complete safety requirements.) Wipe the surface in a small, inconspicuous area first to test for discoloration. After the solvent has evaporated, check for any undesirable effects (usually caused by residual dust or an old finish). Continue the cleaning process, using mineral spirits-dampened cloths to lift any grime. You may find that sharpened bamboo skewers, nylon bristle "parts brushes", craft stencil brushes or even toothbrushes are effective for cleaning crevices and joint areas. If straight mineral spirits isn't successful in removing the grime, a conservation-recommended surfactant, either Vulpex or Orvus, may be used. Vulpex is used in a 1% solution in mineral spirits; Orvus is often used in a 3% by weight solution in 50/50 mineral spirits and water. Once cleaned, rinse with clean mineral spirits to remove residual detergent. Ethanol may also be used to remove any residues from cleaning.

Corrosion Removal - On objects such as cast-iron stoves and rusty machinery, it is sometimes possible to remove encrustations of corrosion products by rubbing with steel wool pads or nylon "synthetic steel wool" pads and a light lubricating oil, or mineral spirits. Always start with the least aggressive method and work your way up. Large sewing needles,

scalpels or X-Acto knives can also be used to chip up or lift encrustations. Heavily corroded objects, original painted iron artifacts or those damaged by salts may require the assistance of a trained conservator.

Corrosion Inhibition of Bare Metal - If you are reasonably sure that there are no salt residues on your artifacts and you can remove the worst of the rust encrustations, it is possible to protect the surface with a variety of corrosion inhibitors. The simplest inhibitors are machine oils which inhibit rust by displacing water and moisture. Oils and greasy coatings may hold dust and grime to surfaces, so use sparingly, and check often. It also should be understood that most "inhibitors" will darken the surface of the artifact, and, therefore, are not right for all cases. Bright surfaces on machines and other objects that cannot be stored indoors may benefit from the application of a thick, waxy corrosion inhibiting oil such as "SP-400", made by CRC, or similar brush-on or spray-on products. "Rust converters" are another kind of commercial product designed to work on rusty metal by converting unstable corrosion into a stable, protective layer with the help of a latex-based coating. Some conservators are now recommending the following when a relatively even, lightly corroded surface will be preserved as-is: "Rust-Oleum Rust Convert", and "Extend". You may also choose to use a tannic acid treatment on the surface. Tannic acid forms a complex with iron oxides present on the surface, creating a passivating layer that can help to prevent future rust. The major caveat with tannic acid is that it produces a dark purple-ish surface appearance; if this will detract from your object, it is likely not a suitable choice. For further information on tannic acid treatment of iron, please see CCI Note 9/5.

Polishing - If you wish to return a steel object to its original, polished appearance, it is usually possible with a fair amount of elbow grease and a good polishing compound. We recommend "Autosol" for general purpose polishing. Test for the degree of polish you wish to achieve on a small inconspicuous part of the object. Buff on the polish with a clean rag or very fine steel wool for added abrasiveness. The surface must be rinsed with mineral spirits after polishing to remove any polish residues.

Coating - Choosing the appropriate surface finish is an important step in the preservation of iron artifacts because iron is a very reactive metal and usually needs the added protection of a coating, especially if it has no natural protective layer. The inhibitors and converters mentioned above may be considered as coatings. Sometimes traditional coatings are recommended, such as "Stove Black" for historical cast iron stoves. All surfaces must be carefully cleaned before any coating is applied. Other forms of coating, detailed below, are lacquering, painting, and waxing.

Lacquering - Polishing exposes fresh, reactive metal to the atmosphere and, therefore, to further corrosion. In rare cases, it may be appropriate to lacquer iron or steel. Since

lacquering requires the use of volatile solvents and spraying equipment, we recommend that this type of work be left to accomplished restoration professionals. No coating is impervious to moisture, and badly applied lacquer or paint can lead to worse corrosion.

Painting - It is rarely proper to repaint an original artifact. Museums and collectors recognize the value of preserving as many original surfaces as possible, even on old tools and machines. Original paint can tell a great deal about the use of objects and may retain decorative detailing under darkened varnish layers. Conservators can reveal and restore original paint in many cases. Some objects that were originally painted may have lost most of their finish (i.e., a large outdoor machine). In cases like these, painting may be a suitable method of preservation. Before preparing the metal for repainting, the first thing to do is to check in crevices, behind handles, maker's plates or doors for bits of the original paint. With even a small sample, and a good eye, you may be able to match new paint to the authentic color. If you choose to repaint and you have researched appropriate paint schemes, consider the additional benefits of "rust converters" explained above. If you do not use a product such as this, you will need to completely strip and solvent-clean your artifact to ensure any degree of paint adhesion. In either case, it is best to use primers and paint specifically formulated for use on metals.

Waxing - For most collectible iron artifacts, the best coating we can generally recommend is wax. Wax provides a relatively flexible coating that is easily applied and renewed. In most cases, The Henry Ford uses "Renaissance Wax" or another "microcrystalline" wax because it is inert and will not yellow over time. It is simply applied with a clean cloth and buffed out with a rag or bristle brush (shoe polish brushes are great for this purpose). Again, wax is not a suitable coating for all metal surfaces, especially where it is impossible to cover the whole object, or where the slightly glossy finish would be inappropriate.

Disaster Response

Metals are generally more robust than other historic materials (such as paper, textiles, and paintings), and are thus typically lower on salvage priority lists in the case of many disasters. In some disasters, such as fires, iron may not fare well – the combination of extreme heat causing disfigurement and the water used to put out the fire causing corrosion. When it is safe to perform salvage, the salvage of iron generally includes removing it from harm's way, drying it as best as possible to prevent corrosion from starting, and removing surface contaminants. Further discussion on disaster response can be found in The Henry Ford's conservation information sheet on that topic, and in various online resources.

SOURCES & SUPPLIERS

Mineral Spirits, Lubricating Oils, Steel Wool, Nylon Scrub Pads, Corrosion Inhibiting Coatings, Rust Converters:

- Hardware Stores
- Auto Parts Stores
- Industrial Supply Companies, such as Grainger – be aware these will be for large orders only.
- Chemical Supply companies, such as Aldrich Chemicals or Fisher Scientific.

Brushes, X-Acto Knives:

- Arts/Crafts supply stores

Waxes, Vulpex Soap:

- Restoration Products, Ltd.
<https://restorationproduct.com/>
- Conservation Resources International L.L.C.
<http://www.conservationresources.com/>
- TALAS
<https://www.talasonline.com>

Polishes, "Autosol":

- Hardware stores
- Jewelry or specialty hobby stores
- Direct from the manufacturer, <https://www.autosol.com>

Humidity Indicators:

- University Products
<https://www.universityproducts.com/>



IRON CARE BIBLIOGRAPHY

The National Trust Manual of Housekeeping
Sandwith & Stainton
Penguin Books Ltd.
536 Kings Rd
London, SW10 OUH 1984

The Thames and Hudson Manual of Metalworking
Peter Scott
Thames and Hudson Ltd.
London, 1978

The Care of Antiquities and Historical Collections
Bruce MacLeish
American Association of State and Local History,
AASLH Press
Nashville, Tenn., 1972

CCI Notes
Canadian Conservation Institute
Note 9/5
1030 Innes Road
Ottawa, Ontario, Canada

The Conservation of Antiquities and Works of Art
Plenderleith, H.J., & Werner. A.E.A.
Oxford University Press, London
2nd Edition, 1971

Corrosion and Metal Artifacts
Brown, Burnett, Chase, Eds.
U.S. Department of Commerce
Washington, D.C.
NBS Special Publication 479, 1977

Handbook: First Aid to Cultural Heritage in Times of Crisis
ICCROM
https://www.iccrom.org/sites/default/files/2018-10/fac_handbook_print_oct-2018_final.pdf

To Find a Conservator:

The American Institute for Conservation of Historic & Artistic Works
<https://www.culturalheritage.org/about-conservat>



