



Historic England

Conserving War Memorials

Case Study: The Surface Treatment of Bronze Statuary

First and Second World Wars Memorial,
Bootle, Merseyside



Summary

This document describes the treatment undertaken to the surfaces of the bronze statues and plaques on the Grade-II listed [Bootle War Memorial](#). Over time, the bronze surfaces had developed a green patina due to the failure of the original protective wax coatings, an issue that is fairly common on outdoor bronzes. A specification was made for treatment that was both ethical and achievable, and which respected the object's history whilst ensuring the that the bronze elements were placed into an excellent structural and visual condition, which could thereafter be regularly and economically maintained.

This guidance is intended for those designing, specifying and undertaking conservation and repair work to free standing war memorials, such as architects, building surveyors, structural engineers, project managers, contractors, craftspeople, and conservators. It will also be of interest to those responsible for making decisions, such as local authority conservation officers, custodians or volunteer groups. It also indicates where to get further help and advice.

This guidance forms part of a series of resources produced by Historic England, to coincide with the centenary of the First World War. This series covers the overall approach to caring for these memorials, as well as some of the more poorly understood technical aspects. It includes:

- guidance on how to record, repair, conserve, maintain, and protect these unique monuments for future generations: [The Conservation, Repair and Management of War Memorials](#) and [Conservation and Management of War Memorial Landscapes](#)
- short technical advice notes covering inscriptions, structural problems and repairs, and maintenance
- case studies on conservation options for specific war memorial issues
- films on technical aspects of war memorial conservation

This guidance has been prepared by Rupert Harris Conservation and edited by Clara Willett (Historic England).

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Front cover:

General view of the memorial after conservation work.

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1 Description and Condition

Description

The Grade-II listed **Bootle War Memorial** (unveiled in 1922) is constructed from Forest of Dean sandstone and comprises a twelve-sided base on two circular steps, with bronze panels bearing the names of the First World War fallen. Above this base is a triangular, concave-sided obelisk that supports a bronze figure of a mother and child. Flanking the obelisk on three sides are over life-size bronze figures of an infantry soldier, a seaman and an airman. On the stonework separating the figures are three bronze wreaths; there is also a plaque on the west side commemorating the Liverpool Escort Force who were active in the Second World War. On the wide stone balustrade either side of the steps leading to the memorial are set two bronze memorial plates carrying the names of those who died in the 1939–1945 conflict, with additional names in lead lettering surrounding the bronze plates (as shown on the front cover image).



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1 The Bootle War Memorial, before conservation.

Condition

When the bronzes of the Bootle war memorial were made, an 'artificial' patina would have been applied to them before they left the foundry. Under the direction of the sculptor, traditional techniques and chemicals (usually weak solutions of potassium sulphide and/or ferric nitrate), would have been used by the foundry to turn the cast bronzes from their raw yellow-pink colour to a deep brown colour. This surface would then be visually enhanced and protected from corrosion by the application of several coats of protective clear wax, which also gives the bronze a subtle sheen that highlights the modelling of the sculpture. Protective coatings are necessary for long-term preservation because the porous structure of the patina on copper alloys can act as a moisture reservoir and pollutants, which might initiate corrosion, tend to cling onto porous surfaces.

In cases where a bronze has not been maintained through the application of a protective coating, such as wax, the bronze will react with the atmosphere and water, initiating the corrosion process. All naturally formed patinas are the result of corrosion and generally form very slowly and evenly over the surface; as the patina grows in thickness and homogeneity, the rate of corrosion decreases.

Naturally formed patinas on bronzes have complex morphologies, and the composition of any given patina will be a reflection of the specific bronze composition and the environment in which it is situated. The make up of any patina will reflect the gases and pollutants found in the atmosphere. In environments where the average pH levels are between 5.5 and 7, and pollutant levels are low, the slowly formed patinas can be called 'stable'.

The most common products found in patinas are the copper oxides (cuprous or copper (I) oxide (Cu_2O) and cupric or copper (II) oxide (CuO)) and the alkaline salts of copper sulphates, carbonates and, in some cases, chlorides. The stability of naturally formed, heterogeneous patinas depends on their chemical composition, thickness, porosity and crystalline structure. The colour of the patina will be reflected in its overall chemical composition.

Where environmental conditions are unfavourable to the formation of a stable natural patina, the corrosion rate of the bronze surface can increase, often associated with the dissolution of copper salts onto surrounding surfaces. This can result in the loss of surface detail across the bronze or, more commonly, the aggressive corrosion of areas where pollutants and moisture are not easily removed by washing by rainfall. In these circumstances the corrosion is referred to as 'active'; this is often manifested as areas of bright green spots resulting in pitting corrosion. The most prevalent pollutants that promote corrosion are chlorides and acid base compounds.

The Bootle war memorial bronzes had not been regularly maintained and so, over time, green patina had accumulated over parts of the surface of the bronze figures, wreaths and plaques. At some point in the past, the bronzes had been painted with a black, semi-gloss paint to cover the green surface. Weathering had degraded this paint significantly, and in some areas had been lost completely, revealing the naturally formed green patina beneath. However, areas of minor 'active' corrosion were found in recessed areas of these bronzes, which needed to be addressed.



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- 2 Active corrosion spots on the bronze surface.
 - 3 The bronze surface showing remains of black paint over naturally formed patina.



In addition to the deteriorated surface of the bronzes, the overall quality of the casting was poor. Firstly, many parts of the casting were affected by gas porosity (Figure 4): this appears as small pin-holes, or larger, irregularly shaped holes in the surface, caused by trapped air or gas from the metal or mould. Secondly, some areas had been short poured: this occurs when insufficient bronze has been poured into the mould, resulting in a hole or fissure (Figure 5). Such areas are repaired before the sculpture leaves the foundry. This is usually achieved by the insertion of bronze patches, as in this case, although a large hole in the top of the Infantryman's helmet had been filled with cement. Casting faults, and failed or poorly executed foundry repairs, often trap pollutants and moisture and consequently can initiate corrosion. These need to be carefully identified by the conservator, and made good.

Despite their flaws, the general structural condition of the Bootle war memorial bronzes was sound and no strengthening works were required.

Once conservation had begun, steam cleaning further revealed that the surface of the bronzes had also been stripped of their original dark brown patina in the past, by abrasive blast-cleaning. Overly aggressive abrasive blast-cleaning, stripping of original patina and painting of bronzes are all misguided treatments that would normally not be permitted today, as they are unethical on several grounds.



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- 4 Gas porosity in the surface of bronze.
 - 5 An example of 'short pour'; its foundry repair has now failed and is lost.

2 Remedial Options

The poor surface condition had implications for the future survival of the memorial and could encourage further vandalism.. The options for addressing the condition were, broadly three-fold.

Do nothing

This was not an acceptable option. To leave the bronze surface untreated would mean that it would suffer steady deterioration. Active corrosion would eat into the bronze surface and it would eventually lose sculptural detail. The black paint would eventually wear off altogether and the bronze would appear dry and green throughout, and would continue to deteriorate. This condition would not respect the original appearance of the memorial and would imply neglect by those responsible for its upkeep. Experience has shown that neglected monuments are likely to invite disrespect, abuse and vandalism.

Full restoration

To fully restore the memorial to its original appearance, the removal of the natural green patination could be achieved by abrasive blast-cleaning the bronze elements back to raw metal using aggressive abrasives (such as garnet, copper slag or olivine), and applying chemical patination to achieve a replication of its original mid- to dark brown colour (finished by layers of clear, microcrystalline protective wax). But removal of either original patina or naturally formed patina obliterates the historical condition of the object, which is unacceptable on ethical grounds, as it contravenes the central guiding principle of conservation – that of minimal intervention. Such drastic action is unnecessary.

Conservation

A minimum-intervention conservation treatment was achievable and ethical.

In cases such as this, which are common, it is unnecessary to remove the naturally formed, stable green patina. If carried out by experienced conservators it is possible to greatly improve the appearance of the now naturally patinated bronzes, returning them to a far more unified colour while at the same time retaining the character of patination acquired by the surface over time. In the case of Bootle, this treatment could be combined with the replacement of the original patination that had been unethically removed in the past.

3 Solution

The chosen minimum-intervention conservation treatment was made up of the following steps.

Cleaning

Removal of the black paint coating was achieved by steam cleaning, with the addition of a proprietary water-based paint remover where required.

Selective, localised glass-bead abrasion or chemical cleaning would be permitted where there was active corrosion, as this must be completely removed to prevent further loss of original material. However, such techniques were not required, as the active corrosion was successfully removed by the steam cleaning.

Re-patination

Before patination of the bronzes, a small test area of patination was prepared and then waxed, so that the custodian could approve the intended final appearance of the surface of the bronzes. The existing naturally patinated surface of the bronzes and the unpatinated, raw metal surfaces were then both corrected overall, by the application of a traditional chemical patina over the existing green patina and over the areas of bright metal that had been stripped of their original patina in past treatments. This returned the colour of the bronzes to a mid- to dark brown, while still retaining traces of dark green: the surface was thus visually unified but exhibited a subtle variation of colour reflecting the memorial's age.

Application of protective coating

The application of protective coatings of clear, microcrystalline wax has resulted in a cared-for appearance while still respecting its original appearance and condition history. Furthermore, this treatment has placed the bronze into a stable, maintainable condition, which ensures that it can retain its good condition at optimal cost effectiveness to the custodian responsible for its care.

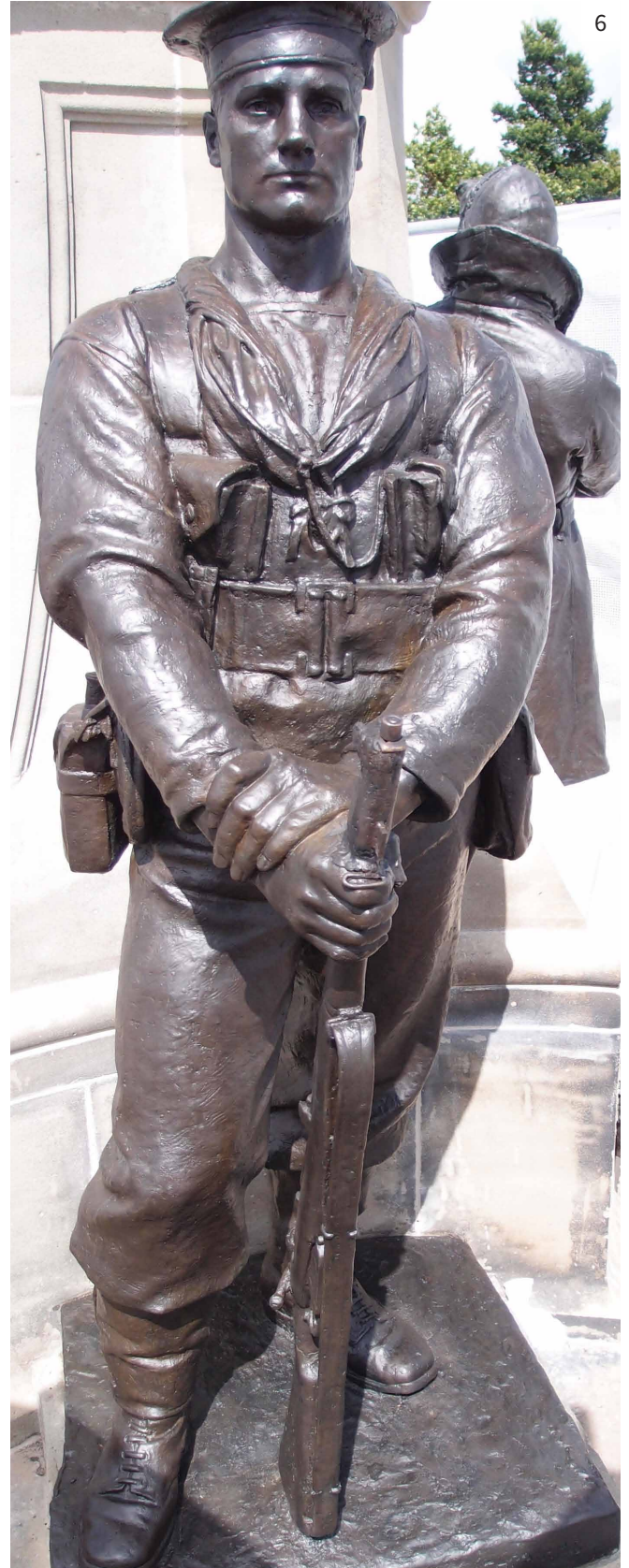
Note: The application of chemical patinas is a process that only trained and experienced conservators should undertake. It requires the craftsperson to fully understand the process and adapt the procedure as required during the patination process. The colouring chemical used, although very dilute, will react differently depending on the particular nature of the bronze surface. As this composition will vary, the patination technique will need to be adjusted as the work proceeds, so great care is required to achieve the necessary subtlety of finish and colour.

4 Lessons Learnt

Post-project reflections are useful for learning what could be done differently in the future. The nature of conservation often means that unforeseen dilemmas and situations arise and even the best planned projects require flexibility and adaptation to resolve them to produce appropriate outcomes.

Many memorials have received incorrect 'restoration' or makeshift maintenance treatments in the past. It is important to try to establish an object's treatment history: if no records exist this must be ascertained by careful visual inspection by an experienced specialist conservator. Ethical, justifiable decisions must then be made as to what must be corrected and what must be respected.

War memorials often comprise a combination of stone and metal elements and so the project to conserve them will either require the conservation company to have specialist staff with the necessary range of expertise, or will involve teams from separate specialist companies. It is crucial to plan the sequence of each element of the project carefully to avoid one process damaging works that have already been completed. For example, avoid scheduling stone works after the completion of bronze works, as stone dust may cling to the newly waxed bronzes, necessitating that they be re-cleaned and waxed.



6 The surface of the bronze after patination treatment and waxing.

5 Acknowledgements

Project Team

Client: Sefton Council

Architect: Ian Bright Architects

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Metals Conservator: Rupert Harris Conservation Ltd

Images

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