Caring for cast iron

Cast iron is a strong aesthetic feature of many of our 19th century buildings. It was often used as a decorative element in columns, balustrades and brackets framing verandahs as well as for fences and gates on street frontages.

These guidelines give information to help conserve original cast iron elements which are a significant part of many heritage buildings of the period.

Decorative exterior cast iron: Walker family at Thorne Street, Carina, Brisbane, Queensland circa 1900, State Library of Queensland

Cast iron is an alloy with a high carbon content, from around 2% and up to nearly 4% carbon, making it more resistant to corrosion than wrought iron or steel.

Key features

- can be poured into moulds when molten, making it possible to create an unlimited range of decorative and structural forms
- can withstand great compression loads but is relatively weak in tension
- individual castings can be bolted or screwed together
- brittle, cannot be forged and shatters if hammered
- heat resistant
- cheaper to produce than wrought iron but more expensive than aluminium

Maintenance

Good quality and well coated cast iron corrodes slowly if kept clean, dry and occasionally brushed.

Cast iron characteristics

- oxidises rapidly if uncoated and exposed to moisture and air corroding as the iron changes back to the original mineral ore
- requires regular coatings for long-term protection
- was preserved traditionally by dry brushing on a regular basis and then applying a thin fish oil-based coating
- is subject to galvanic corrosion when it is adjacent to metals such as lead or copper
- employ experienced and qualified tradespeople using protective equipment to clean and paint cast iron as the process is potentially dangerous

Surface preparation

- use a specialist in the field to identify the original colour scheme before removing the paint
- undertake thorough surface preparation to ensure new protective coatings adhere by removing all loose, flaking, and deteriorated paint
- thoroughly strip the existing paint only when the layers are so thick as to obscure the details

Abrasive cleaning and sandblasting

- sandblast carefully to remove paint and surface rust – low-pressure abrasive grit blasting, or sandblasting is one of the most effective method for removing excessive paint build-up or substantial corrosion
- avoid using heavy shot or grit blasting which can damage the decorative details
- test a small area to determine the correct air pressure (which should not exceed 60-70 psi) and grit size
- avoid using copper slag on cast iron because of the potential for electrolytic reactions

Lead paint

- use extreme care when removing old lead paint by minimising the generation of dust or fumes

Chemical strippers

- use specialist tradespeople to remove paint by dipping cast iron in acid pickling or by applying a chemical paint remover containing compounds, such as methylene chloride or potassium hydroxide
- make sure all traces of cleaning compounds are removed or neutralised to ensure new paintwork does not break down

Galvanising

- modern galvanising provides a thin, even protective coating without obscuring the details, unlike traditional dip galvanising which resulted in a thick and uneven coating
- galvanising before painting or powder-coating provides further protection especially in a coastal environment or where air pollutants, acid rain and salts are present

Primers

- apply a corrosion-inhibiting primer immediately after removing paint before new rust begins to form – time may vary from minutes to hours depending on environmental conditions

Coatings

- maintain a protective coating of paint on the metal to preserve cast iron

Use the traditional method by applying:

- a priming coat, followed by
- a carefully and evenly applied undercoat and
- two coats of oil-based enamel or where required, a micaceous type of paint

Alternatively:

- spray paint cast iron, or
- dip in a paint bath and brush off excess, or
- powder coat – available in a wide range of standard colours or can be custom made if required

Repairing

- common cast iron problems include badly rusted or missing elements, impact damage, broken joints, damage to connections and loss of anchorage
- research the nature and extent of any cast iron problems before proceeding with work
- retain and repair historic ironwork instead of replacing if there is only minor damage
- carefully handle and protect cast iron during construction as it is brittle and can fracture easily under impact or stress

Graphitization process

- graphitization occurs when cast iron is left unpainted for long periods, acidic rainwater or seawater is present, or where caulked joints have failed
- a porous graphite residue is impregnated with insoluble products as cast iron corrodes
- cast iron retains its appearance and shape when it corrodes so graphitization only becomes apparent when the surface is scraped to reveal any crumbling iron underneath
- often the only solution is to replace the damaged element

Graphitization repair

- it is usually less expensive to replace a badly deteriorated cast-iron section with a new casting rather than splicing or reinforcing
- cast iron can sometimes be unobtrusively repaired with iron bars and screws or bolts
- deteriorated cast iron structural elements, such as posts, should be replaced or reinforced with iron and steel
- experienced welders can repair major cracks or splice a new cast iron piece in place by brazing or special nickel-alloy welding

Duplicating and replacing

- replace cast-iron components when features are missing, severely corroded, or damaged beyond repair
- use early photos and physical evidence, such as marks on verandah posts, to identify the original design and materials to be reinstated
- search the site for remnants of intact original sections to use as a casting pattern
- engage an experienced pattern maker to replicate the original pattern – new patterns of wood or plastic should be slightly larger than the original to compensate for about 1% iron shrinkage on cooling
- select a suitable pattern from identical or similar buildings if no evidence is available
- search old foundries and/or secondhand shops for old patterns to use for reproduction castings
- search iron foundry catalogues for matching pattern designs that can be copied

Fixings

- use zinc-plated or galvanised steel screws to fix cast iron or cast aluminium decorations
- avoid using either brass screws with cast iron or stainless steel screws with aluminium as contact between the metals will cause corrosion due to electrolytic action
- ensure cast iron does not come into contact with copper and lead-coated copper because of galvanic corrosion problems

Casting process

Architectural elements were traditionally cast from a pattern made of wood, plaster or metal in sand moulds packed into a flask.

Foundries use their own formulas, sometimes adding clay to the sand to make the moulds more cohesive.

Foundry worker with spoke-making machine: Atlas Foundry, corner Russell and Merivale Streets, South Brisbane, circa 1915, State Library of Queensland

City foundry: Harvey & Son Foundry 112 Margaret Street, Brisbane, circa 1905, State Library of Queensland

A mould with a top and bottom is used for making a casting with relief on both sides, or ‘double face casting’ while an ‘open-top’ mould produces a ‘single-face casting’ with a relief on one side and a flat surface on the other.

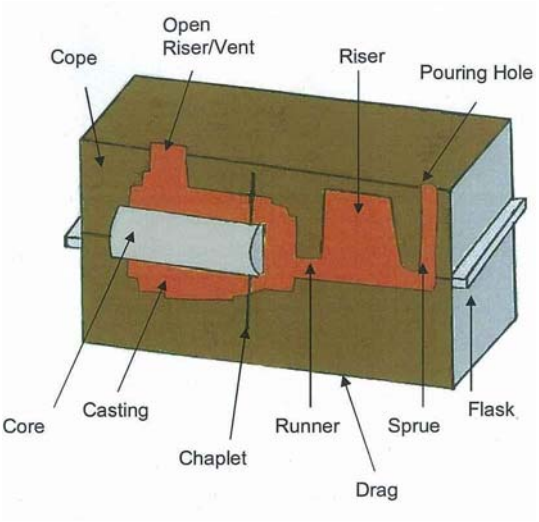
The moulding sand is compacted into forms around the pattern which is then removed to leave an imprint in the mould. Molten iron, heated to approximately 1482° C, is poured into the mould and allowed to cool.

The moulds are then stripped from the casting, the tunnels to the sprues and risers that allow release of air are cut off and ragged edges, called ‘burrs’ on the casting, are ground smooth.

Sand mould section – closed

Terms
Chaplet: metal spike holding core which becomes part of the casting
Cope: top half of mould
Core: solid piece creating a hollow casting
Drag: bottom half of mould
Flask: metal or timber sides holding moulding sand
Open Riser: riser with opening vent to release excess gas
Riser: reservoir of molten metal compensating for shrinkage
Runner: channel to control the flow rate of molten metal
Sprue: molten metal entry channel

Note: risers and sprue are cut after casting



The castings are shop-primed to prevent rust, laid out and preassembled at the foundry to ensure proper alignment and fit. Precision is needed when making the pattern to match an existing panel as cast iron shrinks when cold.

Single-faced castings were more common in Queensland than other states.

A core mould was used to produce castings hollowed on one side. These casting were installed with the hollow side facing inwards. In this way less metal was used which minimised weight and costs.

Unlike other cast metals little more can be done to finish cast iron, other than coat it.

Cast aluminium

- less expensive than cast iron and available from more supplies
- looks similar to cast iron when coated though aluminium panels cast directly from iron originals will be much smaller than the originals
- ensure the coating is maintained to avoid white-oxide corrosion which spreads through the metal turning it to powder

Further Reading

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For more information contact Council's Heritage Unit.