

**Clothworkers Fellowship Report
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**ALTERNATIVE METHODS OF WET
CLEANING CARPETS IN
COLLECTIONS**

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AIMS

- To survey and evaluate current conservation practices employed in museums and collections to clean **knotted** carpets, with particular focus on washing.
- To investigate methods used by commercial rug cleaners and restorers.
- To explore alternatives to complete immersion in water, including looking at equipment used to clean domestic carpets.

INTRODUCTION

In recent years, washing carpets has become more challenging. The process demands time and space, both commodities have come under pressure as museums' scheduling of gallery refurbishments and exhibitions have increased in ambition.

The scale and weight of carpets can be daunting, characteristics which add to the inherent risks of wet cleaning, including: slow drying, colour run, dimensional change, mould growth and bad odour. If a treatment becomes a rare event, so confidence dwindles. By investigating and taking a broader approach to the process, the intention is to explain and increase the options available to the textile conservator.

Information has been gathered and assimilated from many sources including:

- UK and international textile conservators.
- A literature search (which proved of limited relevance).
- Visits made to explore processes employed by commercial washing businesses, including trade rug cleaners and aerosol facilities.
- Witnessing methods of in-situ wet cleaning.
- Wet cleaning trials carried out on V&A carpets.
- Discussions with chemists at the Open University, leading to research into detergent residues (initial results have proved inconclusive).
- Working with a National Trust colleague to develop a simple technique to remove surface soiling from piled textiles, including carpets.

This report summarises the collected findings and is presented as a practical guide for textile conservators with carpets in their care. It is hoped it will encourage the advancement of techniques and treatments, and the sharing of our future collective progress within the profession.

CARPET STUDY GROUP

The investigations were informed by the examination of a core group of 124 carpets from the Victoria and Albert Museum's collection of approximately 1,700. This group had been on semi-open display for over 50 years in the Textile Galleries which showcased different materials and techniques. They were housed on hanging racks and were accessible to the general public to handle and examine. The majority are Middle Eastern but there were also examples from Central Asia, China and Europe, forming a good representative cross-section of the V&A's collection as a whole.

The programme of examination took place one day a week over a 26 week period. Five to six carpets were unrolled for the author and curator of the V&A's Iranian collection to study, although both had worked with carpets, neither considered themselves carpet specialists. The information gathered served to enhance their knowledge and was also used to update and correct the Museum's cataloguing system where necessary. The carpets were left out to be photographed the following day as part of a larger programme of digitisation.

The carpets in the group were all made from natural fibres: wool, cotton and silk, with one example having a coarse hair weft. Wool had commonly been used for warp, weft and pile. Cotton was generally used for the warp and/or weft, with a few examples where it had also been included in the pile, to give a pure white. Only one of the carpets examined was all silk, and two others had a silk warp and weft with wool pile.

In 2010 this group of carpets had been removed from display to facilitate the refurbishment of the galleries. Although they were treated for insect eradication before storage, they had not been cleaned, even though the majority were soiled and would require cleaning before future display.



(Image: Moya Carey)

Examining a batch of carpets from the Study Group in the V&A Stores.

LOCATION OF SOILING

Of the 124 carpets from the Study Group, 104 were closely inspected. In examining the carpets, it was noted that the location of the soiling formed three distinct group:

- surface only - 38%
- ingrained, in the knots and foundation weave - 46%
- dry particulate or very light soiling – 10%

The remaining 6% would not be considered for future display either because they are too pieced or worn.

Surface soiling – this was on the crowns of the pile only. It was very typical of ‘display’ soiling found on textiles at the V&A that have been on open display. This type of soiling is characteristically black and slightly sticky. Whilst vacuuming and other dry methods do not remove it, wet cleaning processes have proved to be successful on other categories of textile.

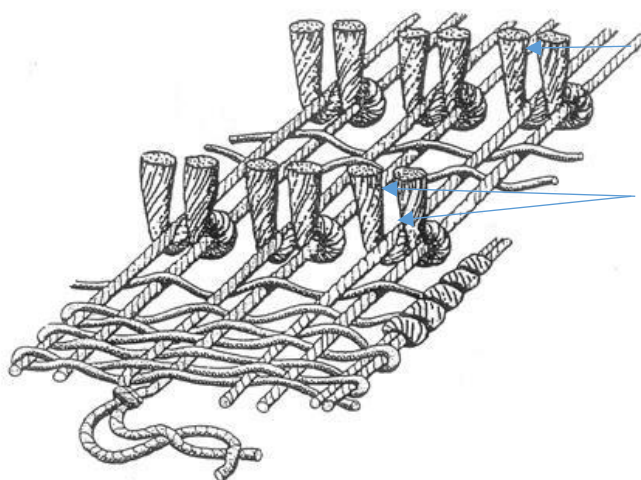
Ingrained soiling – this was usually a mix of the display soiling and other dirt with a muddier appearance. Both types of soiling are considered to be water soluble.

Dry particulate – most of this type of soiling can be removed by tamping (beating) and vacuuming. Carpets with only this category of soiling would not necessarily benefit from wet cleaning.

The location of the soiling directed the investigations into the most efficient methods of removal.

Analysis of soiling composition was not undertaken as part of this research, as this is not a routine procedure in most conservation studios. Textile conservators are practised in judging if water, or water and detergent are going to be the most effective solvents required to remove soiling. The focus of this Fellowship has been to investigate the various methods of delivery and removal of the water and detergent.

(Image sourced from www.nejad.com/consumer/anatomy-of-a-rug)



Surface soiling sitting on the tips of the knots

Ingrained soiling, in the knots and foundation

CARPET CHARACTERISTICS – and their influence on wet cleaning

Fibres, Structure and Knots

FIBRES

The fibres used in the construction of a carpet will have a direct correlation to the way the carpet responds to water. It will also influence the drying process and can affect the appearance of the carpet when dry. The descriptions below, are in the order of the fibres most commonly found in hand knotted carpets.

Wool – commonly used for warp, weft and pile. This is the most stable and hardwearing of the fibres employed in carpet weaving. It responds well to washing and is quicker to dry than cotton and other natural fibres.

Cotton – commonly used for warp and weft, less frequently for pile. Carpets with a cotton content will become very heavy when wet, as cellulose is extremely hydroscopic. Cotton dries much more slowly than wool, increasing the risk of colour run, mould growth and a residual bad odour. Slow drying causes degraded cellulose to collect in the warp ends or fringes and on the tips of cotton pile, giving an unsightly brown appearance unless preventive measures are taken.

Silk – used for warp, weft and pile. Carpets with a 100% silk construction tend to curl in across the weft when wet, and will even do so in high humidity. They are also tightly woven and can become alarmingly brittle on aging. Silk weakens when saturated and excess handling when wet should be avoided. Silk pile is easily disturbed and must be encouraged to remain laying in the pile direction, both when wet and on drying, it is highly reflective and if the pile is not laying correctly the carpet will appear visually patchy.

Linen and hemp – it is not uncommon in European carpets of the 18th and early 19th century to find one of these fibres used for the warp or weft. They are often degraded and weak, therefore before any wet treatment is undertaken tests should be carried out to ascertain the strength of the linen or hemp when wet.

Jute – was commonly used in machine woven European carpets of the late 19th and 20th centuries. Its aging properties are poor and there is a real risk of disintegration when aged jute is introduced to water.

Synthetic and semi synthetic fibres – many modern carpets are woven using man-made fibres such as viscose. The choice can be economic as it is considerably cheaper than silk, or it can be an aesthetic choice because of its extreme softness and the special surface effects that can be produced. Carpets with man-made pile were not investigated during the Fellowship, however it is understood that these can have a problematic relationship with water, posing their own unique set of wet cleaning challenges and should be approached with caution.

STRUCTURE

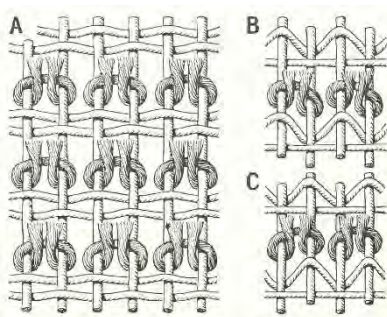
Carpets like any other woven textile have a base structure of warps and wefts. The warps can lie flat on the same plane or form two layers: this is produced by pulling one or more shoots of weft tight and is referred to as a 'depressed' warp.

Knots

Knots are not a structural element, they are simply wrapped around the warps creating a patterned surface. Their loss does not compromise a carpet's structure, only its appearance.

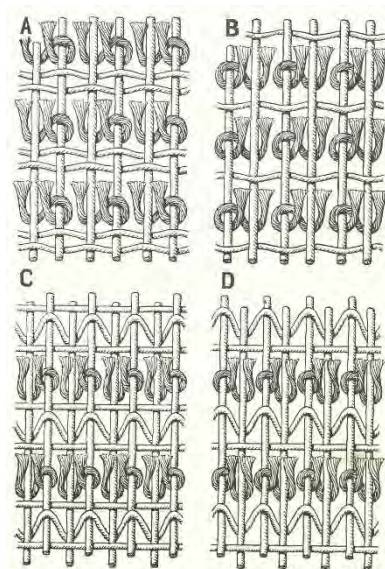
Symmetric (Turkish, Ghiordes) – as the name suggests, this knot is symmetrical in appearance, wrapped around two warps, with the ends brought up between the warps. Every row is worked over the same two warps. This can be less easy to recognise on a depressed warp as the symmetry is skewed.

Asymmetric (Persian) – worked over two warps, the yarn is run under one warp and around the adjacent warp. This allows for tighter packing and a more intricate design. Again, every row is worked over the same pairs of warps.



Above: **symmetric** knots on A) parallel warps and B) and C) depressed warps.

Right: **asymmetric** knots A) and B) on parallel warps, C) and D) on depressed warps



(Images from "Notes on Carpet Knotting and Weaving"
Published by the ©Victoria and Albert Museum, 1969)

Single warp (Spanish) – this knot is far less common, except on Spanish carpets. It is wrapped around a single warp and the knots are worked over every other warp with the following row worked across alternate warps etc. This gives vertical design lines a serrated appearance.

SUMMARY

When considering the information in this section, two simple examples can be given to illustrate how the characteristics of a carpet may be used to predict its reaction to wet cleaning:

- A carpet with a cotton foundation, depressed warp and asymmetric or single warp knot will be very dense – this will slow the penetration of water, hinder the release of soiling and drastically impede drying.
- Conversely, a wool carpet with a flat foundation will offer less resistance – allowing water to penetrate more readily which in turn speeds the release of soiling. The drying process will also be less protracted than that of a carpet with other fibres in its composition.

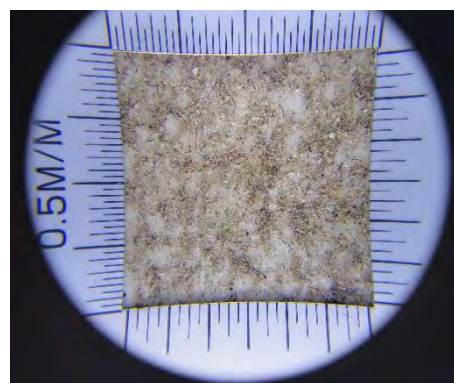
DRY SOIL REMOVAL

Tamping or Beating, Airdusting, Vacuuming

As with all textiles, removing any dry or particulate soiling before washing should maximise the efficiency of a wash.

TAMPING OR BEATING

Traditionally carpets are hung over a line or balcony and beaten with a light weight cane paddle. This is a very effective way to release particulate soiling caught in the base structure and knots but hanging historical carpets to beat them is neither sensible nor safe. Tamping is the modern equivalent and can be performed with the carpet remaining flat on the floor, even in-situ in a display room. It should be noted that beating a carpet releases both soiling and loose fibre. The amount of loose fibre may be an indication of a carpet's condition. By assessing the residue from tamping it can be judged when to stop the process, as the ratio of particulate matter to fibre decreases.



Residue from tamping with particulates and fibre

Image: F. Hartog

MANUAL TAMPING

Traditionally tamping batts were made of cane, rattan, wicker or metal and most were rigid.

Rubber Bats - The National Trust (UK) tamp carpets on the floor, often in the rooms where they are displayed. They found the use of rigid bats was both exhausting for the operator and not as effective as a flexible beater. Consequently, they use bats made to their specification, consisting of a white, food grade rubber (6mm thick), clamped in a wooden handle – these are simple and effective.



National Trust tamping bat

Image: F. Hartog

Method In-situ

- The carpet is rolled up to clear the floor area.
- Polythene is laid out over the floor (laying Tyvek or a light coloured fabric under the polythene makes it easier to examine the released soiling).
- The carpet is unrolled face down on the polythene.
- A second sheet of polythene is laid over the back of the carpet, to prevent dust escaping into the room during tamping.
- The first section of carpet is tamped.
- This is repeated until a satisfactory level of particulate soiling has been removed.
- The polythene under the carpet is cleaned between each tamping.
- The upper layer of polythene is then folded back allowing the reverse of the carpet to be vacuumed.
- This section is then gradually rolled as the front surface is slowly and methodically vacuumed, before the next section is tamped.
- The process is repeated, section by section, until the whole carpet has been treated.



A test carpet being tamped



Residue from tamping

Images: F. Hartog

Cons - hand tamping can be quite demanding, and it is difficult to ensure a completely even application, especially for large carpets where more than one operator is required.

Pros – It is low tech, does not require expensive equipment and can be carried out in-situ by non-conservators with appropriate training and guidance.

MECHANICAL TAMPING WITH AN UPRIGHT VACUUM CLEANER

The brushes of upright vacuum cleaners are mounted on ‘beater bars’, and higher quality models offer height adjustment and separate ‘brush motors’. Domestic models are not weighty enough, therefore heavier, industrial vacuum cleaners are required for a satisfactory result. Even though these are too aggressive for vacuuming historic carpets, they can be used for effective tamping in conjunction with an interim layer. An off-cut of new, clean carpet with a tight, medium length pile has been found to work well when placed face-up over the reverse of the historic carpet. The brush or beater bar of the vacuum cleaner ‘slaps’ the off-cut at high speed. This causes vibration which travels down through the off-cut and into the carpet, dislodging the particulate soiling. The off-cut not only shields the carpet but also maximises the vibration effect.

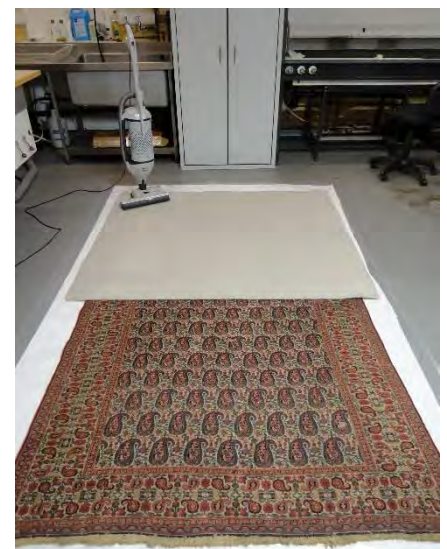


Beater bar on a Sebo upright vacuum cleaner

Image: F. Hartog

Method

- The carpet is unrolled face down on polythene.
- The off-cut carpet is placed over the top, pile uppermost - carpet and off-cut lay back to back (*see image right*).
- The upright vacuum cleaner is then slowly and systematically run over the face of off-cut.
- The off-cut is moved along the carpet as the treatment proceeds.
- The carpet can either be treated in two halves or rolled.
- If treating in two halves, the off-cut is removed and the tamped half of the carpet is folded over a roller allowing the front to be slowly and methodically vacuumed.
- The plastic under the first half is then cleaned, the carpet laid back down and the reverse is vacuumed.
- The second half is cleaned in the same manner.
- The process is repeated until a satisfactory level of soil removal has been achieved.
- If rolling, the carpet can simply be treated in sections and the reverse and front vacuumed as the carpet is rolled.



Off-cut placed over carpet before beating

Image: F. Hartog

Cons – The weight and power of a professional upright vacuum cleaner is required to deliver beneficial results and unfortunately these are relatively expensive. The beating may not be as hard as hand tamping, requiring more passes with the vacuum cleaner.

Pros – The uniform vibration results in effective and even soil release. On larger carpets, this method is far less exhausting for the operator than the manual method.

COMMERCIAL BEATERS

RugBadger: this is one of the most universal of the mechanical beaters. However, this machine is extremely heavy, much too heavy for use on heritage carpets. Lighter versions are available, so it is worth describing the relatively simple mechanism: there is a motorised bar into which are set 25 vibro-straps made from hard plastic. As the bar rotates so the straps beat the carpet. There is a double action of beating and vibration which together are extremely effective at removing gritty soiling from the structure of carpets.



Image: © Lisa Wagner

Underside of a RugBadger showing beater straps.

Mechanical beaters of this type are highly efficient and should not be dismissed out of hand. If the lighter versions weigh considerably less than the RugBadger they could be considered for use. Or a machine with a similar rotating bar to which straps could be attached, might offer an alternative. This category of beater would also require an interim layer of off-cut carpet, as described above.

AIRDUSTERS

These offer another method for dry soil removal, they can be used alone, or after beating and before vacuuming. Most airdusters are powered by large compressors, powerful enough to deliver pressurised air (set at around 100 psi) down a long pipe to a wide metal head, the air exits via a narrow slot across the width of the head (*see image below*).



An airduster in action

Commonly, the treatment is undertaken outside as it creates clouds of fine dust. The rug is laid face up on a gridded mat and the operator walks along the rug systematically waving the wand from side to side over the knotted surface. The soiling can be seen as a dust cloud puffing up as the wand passes over the rug. The soiling is not 'captured' but is allowed to float away on the breeze. Personal Protective Equipment (PPE), comprising of dust masks and ear defenders, is essential. The air expelled from the wand appears quite violent but when a hand is placed in front of the air-slot, the air stream feels 'soft' and slightly warm. Airdusters can also be driven by a high volume electric fan, fitted with a hose and hand tool that allows for a more responsive directional air flow. The strength of the air flow is controlled by the distance the head is held away from the carpet.

Cons – the amount of dust produced can be considerable and even if used outside it could be a menace to neighbours. At present, there does not appear to be a machine that combines blowing

with dust collection (however, a trade operator in the UK is currently seeking a solution). Because residues are not collected, fibre loss cannot be monitored. The compressors tend to be large, diesel fuelled and noisy. Even the fan powered units, though smaller, are similarly noisy.

Pros - air dusting is extremely efficient at removing dust, comprising of particulate soiling, from the pile. Many consider it to be more effective than vacuum cleaning.

VACUUMING

Apart from sucking up particulate soiling, vacuuming offers an opportunity for the conservator to closely examine a carpet both front and back. This can be invaluable in spotting well disguised repairs that could cause problems during wet cleaning.

A comprehensive vacuum treatment is necessarily slow and methodical.

Some carpets have been brought into museum collections new and unused. These tend to have little particulate soiling and may not require tamping. However they can have an accumulation of loose fibre which it may be desirable to remove, if the carpet requires wet cleaning due to soiling from past display.

Strength of vacuum - This cannot be prescribed as the condition of the carpet will dictate the strength and amount of vacuuming it can tolerate. However, for carpets in good condition with a medium pile it is not unusual to run a vacuum at 100 millibars (mb). For the structure of a carpet to be effectively vacuumed from the front, the suction needs to reach down to the base of the knots. The suction can normally be reduced for the flat surface of the reverse.



Vacuum gauge

Vacuum tools – The condition of the carpet will dictate the size of vacuum head employed. Most carpets can be considered as large scale and although a crevice tool is effective it may not be practical. The majority of vacuum cleaners come with an assortment of heads and a small flat head with a smooth base may be a more suitable option. It is worth investigating specialist retailers who will carry a range of heads that can be fitted on several different makes and models of vacuum cleaner.



Assortment of small flat vacuum heads

Estimating vacuuming time

- Mark off an area of carpet: 0.5 x 0.5 m.
- Choose the level of mb you wish to run the vacuum.
- Insert a clean piece of white muslin between the vacuum head and hose.
- Turn on the vacuum, and slowly and methodically vacuum the square timing how long it takes.
- By changing the muslin, it will become clear when the vacuum cleaner has removed all it can.

The time it will take to vacuum the whole carpet can then be calculated: divide the carpet's square meterage by the chosen size of the test square and multiply the answer by the time taken.

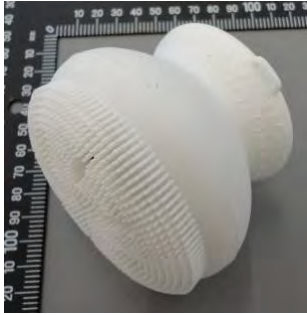
Example: carpet dims 8m x 3.5m = 28 sq m, 28 ÷ 0.5 = 56 half square meter sections.

Time taken to vacuum each 0.5m² section = 15 minutes x 56 = 840 mins ÷ 60 = 14 hrs

Additional equipment – Hair, lint and carpet underlay fibres are often left behind on a surface after tamping and vacuuming. They can be removed with latex ‘smoke’ sponges, however these tend to leave crumbs which are difficult to extricate, and latex sponges have a natural grip which easily

removes fragile pile. An alternative is to lightly brush the surface with a silicone or rubber brush. The silicone cleansing brushes (*see image left*) are most suited to carpets with a finer, more delicate pile and are sold as a ‘beauty’ products (warning: there is an expensive ‘sonic’ version which is not required). Rubber pet brushes and brooms are very effective on large scale carpets and those with a more robust pile (*see images below*).

Image: F. Hartog



A silicone cleansing bath brush.

Image: Glyn Charnock



Hand held rubber pet brush.



Rubber broom in use on a carpet at Felbrigg Hall, Norfolk

©National Trust

WET CLEANING

Conservation Immersion Washing, Trade Washing, In-Situ Wet Cleaning, Aerosol Washing, Wet Surface Cleaning

Introduction

This section describes the different wet cleaning methods used by conservators and commercial businesses. The information gathered under the title '*Conservation Immersion Washing*', came from the regrettably small number of colleagues in institutions around the world who are washing carpets in their collections. Visits were made to businesses in the rug washing trade, mostly in the UK, and their practices and equipment are explained under the heading '*Trade Washing*'. '*In-situ Wet Cleaning*' is illustrated with a case study of the work the National Trust and Glyn Charnock have carried out at Saltram House in Devon. The three European aerosol facilities have also been visited and the system is explained in '*Aerosol Washing*'. The advances in washing knotted carpets made by De Wit are described in more detail. Finally, instructions are given for the new method of '*Wet Surface Cleaning*' with microfiber cloth, developed in tandem with the National Trust's upholstery conservator.

Colour Testing

Variations on colour testing were performed by all operators; both conservators and commercial facilities. Most commonly blotting and swabbing were used, rather than the more comprehensive destructive testing which also emulates the length of time a textile will remain damp. Some carried out blotting tests in warm water to increase the likelihood of a conclusive result. In the US commercial cleaners routinely do a 24 hour dye test; dampening a cloth in solution and leaving it weighted down on the rug for 24 hours. All tests should be carried out in the intended wash solution at the correct concentration.

Everyone agreed, it is impossible to guarantee the testing is definitive as there are often generations of repairs, including added or enhanced colours using paint, felt pens etc. They can be subtle and difficult to detect, and it should be assumed that colour movement remains a risk.

Many commercial cleaners routinely give an acid rinse to prevent colour run, this ranges between 3.5 – 5.5 pH depending on the product used. Conservators need to be clear if they wish this stage to be omitted.

CONSERVATION IMMERSION WASHING

The few studios that are undertaking carpet washing are using the same wash tables and wash floors they use for other large textiles. The only 'specialist equipment' described by one studio were modular stainless steel screens (approximately 1.2 x 1.5m with 1 cm holes) that are used in the base of the bath during washing. The same studio has a bridge on wheels that extends over the width of their wash table. Other conservation practices use plastic washroom floor tiles that clip together to line the base of the wash bath. The advantage of these is size flexibility and ease of storage. Raising a carpet off the base of the bath during washing aids soil release and removal. Large carpets are difficult to roll when wet, if a dedicated gantry is not available a temporary bridge can be constructed to gain access over the whole of a carpet's surface during the washing phase.

Water

Soft and de-ionised are habitually used. Often the majority of the washing and rinsing is carried out in soft water with de-ionised only used during the final rinse. The benefit of soft water delivered via a hot and cold tap, is that warm water can be used in the bath, increasing the efficiency of the wash and initial rinsing.

pH - soft water usually has a higher pH than de-ionised. The advantage of a higher pH (7+) is that soil removal is more effective, and it enhances the action of anionic detergents and chelating agents - if used. The advantage of a lower pH (4.5 – 5.5) is that protein dyes are less likely to bleed.

Typical values - soft water: 6.5 to 7.5 pH
de-ionised water at the point of use: 4.5 to 5.5 pH

Detergents

It is not helpful to be dogmatic about which detergent should be used, as different detergents are available in different countries and different conservation studios will have favoured detergents with which they are familiar.

Surfactants used in textile conservation fall into two groups - non-ionic and anionic. These groups have common characteristics:

Non-ionic surfactants

- Are suitable for use on any fibre.
- Do not 'ionise' in solution therefore do not affect pH.
- Are tolerant of slightly acidic conditions, therefore good in de-ionised water.
- Their cloud point tends to be low but they are very efficient close to their cloud point.
- They usually have a lower critical micelle concentration (CMC) than anionic detergents – i.e. smaller amounts are required in the wash solution.
- They generally take longer to rinse out.

Anionic – because these are understood to permanently bind to protein fibres, they are not normally used to wash wool or silk textiles at the V&A.

None the less they are:

- Effective at degreasing (which may not be desirable for new wool).
- High foaming, which assists with soil suspension and removal. Some suspend soiling sufficiently well that a builder may not be required (example Hostapon HTPC).
- Particularly efficient in warm water.
- Easier to rinse out from cellulose fibres than non-ionic detergent.

Plus

- Their CMC decreases as the pH rises, allowing for lower concentrations.
- HOWEVER they also raise the pH and although this increases the efficiency of a wash, it can also cause acid fixed dyes to run.

Additives

The most commonly used are builders, chelating agents, and more rarely buffers:

- **Builder** - Sodium carboxyl methyl cellulose (SCMC) is a soil suspension agent or builder with a normal working strength concentration of 0.05g/l. Its inclusion should be judged against the amount of soiling to be removed. For light to medium soiling it may not be deemed

necessary. SCMC attaches to cellulose fibres which could be seen as a disadvantage, though some think this may increase the fibre's long-term strength.

- **Chelating agents** (examples: tri-sodium or tri-ammonium citrate) can greatly assist the release of carbon soiling; the reasons for this are complex and not yet fully understood. They also generally increase the efficiency of a wash bath and lower the CMC of anionic detergents.

Warning - the action of chelating can attack the metallic salts of mordents thus destabilising dyes and causing them to bleed, as can the raised pH conferred by some chelating agents.

- **Buffers** (example: citric acid used in conjunction with sodium hydroxide) this is a solution that holds the pH of a wash bath stable. They are most successfully used for extremely acidic textiles that without a buffer cause the pH of a wash bath to crash, drastically reducing the efficiency of the detergent.

USEFUL EQUIPMENT

Rubber or Plastic Matting – can be bought as mats (approx. 1 x 1.5 m) or in smaller squares that clip-together. They can be used to line a wash bath, separating the released soiling from the carpet, and as an aid during drying allowing air to flow underneath the carpet.

Brushes and Sponges – in an immersion bath, knotted carpets respond well to a combination of brushes and sponges.

- **Brushes** – Equestrian and pet suppliers have a good range of soft to medium brushes. These can be used to gently agitate the pile, disturbing the soiling and giving maximum access to the foundation, allowing the wash solution to penetrate.
- **Sponges** - Ramer sponges made from PVA foam (O-M grade), are favoured by many UK textile conservators. They are dense and can hold up to x12 their dry weight in water. They quickly regain shape after compression, allowing optimum wash solution exchange through the textile. Cellulose sponges, though a little less effective, are a satisfactory alternative.

Wet & Dry Vacuum Cleaners or Wet Vacs – are very useful both during the wash to increase soil and detergent removal, and at the end of the process to remove excess water, thus reducing the drying time. They come in many sizes and strengths, domestic wet vacs being powerful enough to remove a considerable amount of water. The most important part of the machine is the vacuum head - a small flat head is practical, effective and easy to use (*see model pictured right*). When employed in combination with an immersion bath, wet vacs are used for extraction only and not for the delivery of water.



Vax Upholstery Tool – 32mm (Type 1)

Note: Wet Vacs should not be used directly on a wet carpet, a rigid screen ought always to be placed over the carpet to protect it from the suction.

Screens – modular screens made of a rigid frame with mesh tightly stretched over and firmly attached are useful for drying; raising the carpet up onto screens allows air to circulate. They can also be placed over the carpet, during a wash, to protect it if a wet vac is used to extract water, soiling and detergent.



Wet vac in use, through a 'silk' screen, during the wash of a 17th century carpet fragment

At the V&A silk screens, normally produced for printing, were ordered. They have a lightweight aluminium frame and can be made to size (*see image above*). The Textile Conservation Studio has five that when put together fill the wash table. Even the coarsest gauge silk screen is very fine but this gives maximum protection to the carpet during extraction. (The screens are versatile and are also used to support extremely fragile textiles during wet cleaning.)

Washing Procedures

The wash procedures described by the studios that have undertaken carpet washing in recent years followed those commonly used for other textiles. The length of time was tailored to the needs of the carpet: shortening the wash in cases where dyes were unstable or lengthening the process for heavy soiling. It should be noted that exposed wool warps can lose their tight twist during a prolonged wash, particularly in combination with frequent agitation. At St John the Divine, New York, in the case of large, particularly dirty carpets, the carpet is humidified and then given a pre-soak in detergent and a running rinse the day before the wash. It is then gently blotted and left overnight before the full wash the following day. This pre-treatment was found to loosen heavy soiling and speed the washing process the following day. Wet Vacs used during the washing process, as described above, both reduce the time of a treatment and increase its efficiency.

Rinsing – generally, a mix of soaks and running water. When a textile has been immersed in a bath containing wash solution for a length of time, soaking in a depth of water performs an essential role in the removal of the detergent. Part of the process involves the quantity of detergent in the textile and rinse water reaching equilibrium, this requires time. It is unlikely that a rinse conducted with only running water would be as profound.

Drying – some studios use a wet vacuum cleaner, through screens, before blotting. All conservation studios blotted and rolled the carpets several times before laying them out to dry. Elevating the carpet on screens or plastic clip-together tiles were common practice, allowing air to circulate. Fans were used routinely and de-humidifiers, if available.

As stated, slow drying encourages degraded (brown) cellulose to collect in fringes and on the tips of cotton pile. To reduce this effect, slightly damp muslin or other absorbent material was laid over the fringes. The discoloured cellulose is attracted through capillary action to the fastest, drying area and as the carpet dries it is drawn up into the overlay. Using a damp layer of absorbent fabric can also be used to alleviate the risk of lateral colour run but should not be considered infallible.

St John the Divine use a drying cloth over the face of the carpet, made from a layer of muslin covered with cotton sheeting. The carpet is left damp enough that the muslin layer conforms to its surface. The carpet, covered with both layers of fabric, is left to air dry with the assistance of fans. The drying cloth draws up the degraded cellulose with any remaining loose dye and dissolved soils. It is not removed until the carpet is completely dry which could be a matter of several days.

Cons – the treatment may require a sizable space, a large volume of water and a considerable amount of time because of slow drying. Lack of specialist equipment may reduce efficiency and in the case of drying increases the risk of colour run, odour and dimensional change, particularly in cold damp climates. The weight of wet carpets requires extra personnel to roll and turn them. Handling a sodden carpet increases the risk of damage both to the object and personnel. For all these reasons, large carpets with a cellulose foundation can be particularly challenging.

Pros – the method can offer the most comprehensive wash. The conservator is in complete control of the process (though not necessarily a carpet’s reaction to it). No outside costs are incurred for fees, transportation and insurance.

TRADE WASHING

The worlds of trade and conservation carpet washing can seem far removed from each other. Industry or trade ‘rug’ cleaners are paid to clean and improve the visual appearance of a carpet because that is the priority for most domestic customers, and not necessarily the carpet’s longevity. In the heritage world it is usually the exact opposite situation; the preservation needs of the object out-weigh the level of cleaning.

If the heritage and trade sectors are to work together, they must be flexible, open minded and able to fully discuss methods. A relationship of mutual understanding and trust needs to be developed between the individuals involved. Many cleaners in the industry may not be interested in, or experienced enough to work with the heritage sector. Finding those that are can be difficult.

In the UK a useful link has been made between Glyn Charnock of Chameleon Cleaning (Director of the National Carpet Cleaners Association) and the National Trust. Glyn Charnock would term himself a ‘cleaning geek’, having a deep interest in, and fascination for, the intricacies of rug cleaning. In the US, Lisa Wagner of K. Blatchford’s, San Diego, is of a similar mind set. Both are very experienced and provide training for other trade operators. They are prepared to suggest others in the industry who may be interested in collaborating with the conservation/heritage sectors and their contact details are given at the end of this report.

Most conservators would not consider trade methods suitable for early or fragile objects. But for more robust 19th and 20th century carpets that are structurally sound but soiled, they are worth consideration.

Water

In the UK most trade businesses use tap water which may or may not be naturally soft. Though it is unlikely they would change their water systems without a guarantee of adequate business, bringing in de-ionised water for the initial wash and final rinsing phase should not prove problematic.

Detergent

Commercial businesses will have their preferred ‘product’. In the UK these are often Woolsafe ‘approved’ but this does not mean they are suitable for conservation use. They are made up of many constituent parts, including chelating agents and strong organic solvents. Typically the surfactant is an anionic.

However, there is no reason why the conservator’s preferred detergent cannot be used, if the conservator supplies it.

Equipment

Pressure hose – these dispense pressurised water and are ubiquitous in the industry. If inexpertly used they can be too forceful, this is entirely in the hands of the operator. Their power is easily reduced by increasing the distance between the hose head and the carpet surface.

Brushes – are used to agitate the fibres and work the wash solution into the carpet.

The machine driven rotary brush is a universal piece of equipment, although it looks heavy and fearsome, with thick stiff bristles, when in use it appears to glide over the carpet's surface. Having closely examined the wool pile of rugs after treatment, no sign of pile disturbance was noted. Though the bristles are stiff, they are bent in the direction of spin, therefore it is the sides of the bristles that rotate over the carpet's surface. More advanced models have a central plastic pad which raises the brush head slightly, imparting a gentler action.

Note: these machines start with a jolt and should never be switched-on when sitting directly on the carpet being treated. It is better practice to start the machine on an off-cut, once running at full speed it can be smoothly transferred to the carpet.



Rotary brush in use during a domestic rug wash.

Hand brushes with soft to medium bristles are an alternative, or brushes mounted onto long broom handles. In the US Lisa Wagner uses soft bristled window washing brushes. Another option could be long handled paint rollers. However, trying to apply an even gentle pressure when using a brush or roller on the end of a long handle can be awkward and they need to be used skillfully.

Wipers and rollers – are used to remove excess water during rinsing and at the end of a treatment, there are many variations.

Wipers are more commonplace and can be made of rubber, wood or metal. The metal version uses a right-angle section on a long handle (*see image right*). As it is pushed over the surface of the carpet, the upper angled part prevents the water running over the wiper and redepositing. The corners of wipers can be hard and if not adeptly applied, damage could occur.



Metal, angled wiper in use

Long handled rollers are also employed, usually plastic and free spinning (*see image right*). They run smoothly and effortlessly over the surface. They are very safe, if slightly less effective.



Roller used at Art of Clean, Cambridge

Wash Surface - this is usually a sloping floor or platform. Some facilities use plastic grid matting under the rugs to separate the released soiling from the object. The whole wash is carried out in running water and during a fast trade wash, though a rug may appear sodden, the water may hardly penetrate the internal structure of those with a tight weave.

Processes

Wash process for a Domestic Rug (see below for Wash Process for V&A Carpet)

Treatment undertaken at Art of Clean, Cambridge, UK

- The rug was laid face down and wetted out using a pressure hose.

- Wash solution (a Woolsafe approved carpet shampoo) was sprayed over the surface using a hand held pump spray.
- A machine rotary brush was run over the rug to work the wash solution in.
- The rug was folded in readiness to be turned and the platform was sprayed down.
- The rug was then unfolded face up.
- The front was wetted out using an ordinary hose which delivers more water than the pressure hose.
- Wash solution was sprayed over the surface with the pump spray.
- The machine rotary brush was run over the rug to work the wash solution in.
- Rinsing was carried out with the pressure hose, no extraction was performed, prior to the drying process.

Note: Fringes will often undergo localised cleaning and the products used for the process may not be considered suitable by conservators for heritage carpets. Though fringes frequently require extra attention, any treatment should be discussed and agreed prior to washing.

Drying

Blotting is generally not carried out in the trade. At the end of a wash some businesses will use a wet vacuum cleaner to remove most of the excess water, even if the carpet is to be put into a centrifuge.

Centrifuge – these are considered essential by many commercial businesses, particularly in northern climates. They are highly efficient at removing large amounts of water in a very short time. The carpet is rolled on itself, pile in, in the warp direction, before being placed in the centrifuge. The centrifuge is turned on and left to spin for the required number of minutes. When it is stopped and opened, the carpet will have unfurled. There are known instances of carpets being badly damaged in centrifuges due to inexperienced rolling and loading, once again the experience of the operator is crucial.



Centrifuge at Art of Clean, Cambridge, UK

Image: F. Hartog



Press wringer or mangle in use

Image: ©Lisa Wagner

Press Wringer (or mangle) - In the US a number of specialist rug cleaning facilities prefer to use press wringers (*see image left*) because the carpet is fed through flat, avoiding the need to roll those with weak structures. The wringers have adjustable rubber rollers allowing the pressure to be altered according to the needs of the carpet.

Drying room – It is usual to find several hanging mechanisms in a drying room, as it is customary to wash numerous domestic rugs in a day. Hanging is not ideal for most heritage carpets, the alternative of

laying the carpet out flat for the final drying phase is usually perfectly acceptable to the trade operator. The drying surface the carpet is laid on will also need to be agreed between the conservator and operator prior to treatment, this may require the purchase of appropriate matting.

Drying rooms are equipped with dehumidifiers and large fans. Commercial businesses are very aware of the advantages of speedy drying to reduce risk to the object.

Conclusion

Trade businesses have the space and specialist tools. They employ many highly experienced operators who wash rugs regularly. A good operator has a deep understanding of the characteristics of many rug types and is very aware of the possible hazards.

On carpets with a tightly woven structure, this method may not permeate as deeply as an immersion wash but with all the inherent risks of washing carpets with compact foundations, this treatment could be considered a more expedient and acceptable alternative.

A satisfactory outcome is entirely reliant on the relationship between the client and operator. The skill of the operator and the care taken with the equipment used must be of a high standard. It is recommended that the conservator not only discuss methods to be used but also attends the wash.

Other considerations

- Transportation
- Security of the building
- Insurance cover (this may not satisfy the requirements of some institutions)
- Cost: a wash for the heritage sector will take longer and cost more than for a domestic rug.

Note: Commercial washing using immersion tanks was witnessed by the author but only to wash modern rugs. It was not considered by the trade businesses consulted as being suitable for the heritage sector.

Wash Process for V&A Carpet (Museum N: 837-1877)

Treatment undertaken by Art of Clean, Cambridge, UK

Carpet: 19th Century, Mashhad, Iran.

Dimensions: 2.66 x 1.55 m

Structure: warp: cotton (depressed), weft: cotton, pile: wool

The tightly woven carpet was from the Study Group and had been on semi-open display for over 50 years. It had suffered pile loss due to insect attack but was otherwise sound. The top fringe was slightly weaker than the bottom fringe and noticeably more soiled. The reverse was covered in grey/black soiling whilst the front was cleaner with only the upper half appearing soiled.



Image: F. Hartog

Heavier soiling on reverse.

The carpet had no signs of wear and was new when gifted to the Museum in 1877 by the Shah of Iran. It was tamped once and thoroughly vacuumed before transportation to Art of Clean.



Carpet, Mashhad mid-19th century

Image: ©Victoria and Albert Museum, London

Colour tests – though destructive tests had been performed at the V&A, the facility re-tested by dampening towelling with wash solution and leaving it weighted down on the carpet’s surface for 15mins. Both test results were negative.

NOTE: Raw ends and side cords must be secured before a wash is undertaken.

Wash procedure

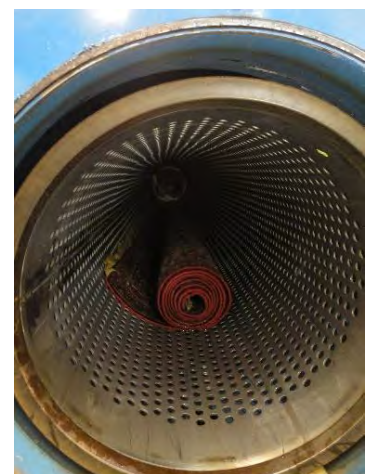
- The carpet was laid out face down.
- The reverse was wetted out with de-ionised water using a pressure hose, held high above the surface.
- 3 litres of working strength wash solution (non-ionic Dehypon LS54 @ 1.2g/L) was sprayed over the reverse from a hand-held pump spray.
- The rotary brush worked the solution into the carpet’s surface and fringes (*the rotary brush was started on a carpet off-cut. The off-cut was placed overlapping the carpet allowing the brush to transfer smoothly from off-cut to carpet.*)
- The rotary brush was passed over the reverse for 7 to 8 minutes.
- The fringes were sponged.
- An initial rinse was performed with the pressure hose using de-ionised water.
- The carpet was rolled (on a PVC roller) and turned face up.
- At this stage, patches on the front had remained dry.
- The front was wetted out using the pressure hose.
- Wash solution was applied from the pump spray.
- The wash solution was worked in with the rotary brush.
- The fringes were sponged again.
- A tap water rinse was performed with the pressure hose.
- An ordinary hose, running with tap water, was placed under the carpet to maintain the reverse rinse, whilst rinsing the front continued.
- A small roller was continuously run over the carpet’s surface to remove excess water and wash solution.
- The carpet was turned, and rinsing continued on the reverse using tap water delivered via both the pressure and ordinary hose.
- The carpet was rolled on itself, face in, and loaded into the centrifuge. The centrifuge was run for approximately 5 minutes.
- The front and then the reverse were rinsed in de-ionised water.
- The carpet was loaded back into the centrifuge for 3 minutes.
- Further rinses on the front and the reverse were performed in de-ionised water.
- The small roller was continuously used to remove excess water and wash solution during rinsing.
- At the end of the rinse phase, residues of wash solution were substantially reduced though a faint trace remained.
- The carpet was placed for a final time in the centrifuge which was run for 6 minutes.

Total wash time: 2 hrs



Rotary brush in use on V&A carpet

Image: F. Hartog



Carpet in centrifuge

Image: F. Hartog

Drying method

A special platform had been made from plywood. It was covered in Tyvek and holes had been drilled through its surface. The carpet was laid face up on the platform. A powerful fan with horizontal airflow was switched on. It blew air under the platform which escaped up



Carpet 'hovering' on the drying platform

through the holes causing the carpet to hover fractionally above the platform's surface, allowing air to move across the reverse. The carpet was turned once (reverse up) to ensure comprehensive drying and was dry within 36 hours.



Tyvek covered drying platform

Images: F. Hartog



Images: F. Hartog



Before washing left and after washing right – the grey soiling was removed from the reverse and the colours on the front became more vibrant.

Conclusion: due to the structure of this carpet, washing and attempting to dry it in-house would have been immensely time consuming and disruptive. The drying alone would have taken several days even if carried out at the height of summer. The result of this co-operative conservation and trade wash was very satisfactory. Two small observations for the future are made: the addition of Ramer (or similarly efficient) sponges would be advantageous for the extra work that fringes require, and it should be ensured that the wash solution is made up at least a day in advance to allow the water and detergent to fully coalesce.

IN-SITU WET CLEANING

This method borrows a machine usually employed in the carpet cleaning industry, to deliver and remove wash solution, and to rinse the carpet. In the past, less sophisticated wet vacuum cleaners have been used in similar cleaning processes but generally not for in-situ treatments where strict parameters must be observed. Some large carpets are too fragile or logistically unwieldy to be moved – often both. The National Trust has been collaborating with Glyn Charnock on a protocol for wet cleaning carpets whilst in their display rooms. A good example of their team work is the Saltram Carpet, Saltram House, Devon, which was successfully cleaned in 2016.

Specialist equipment

Industrial rinse extraction machine - this piece of equipment is more commonly used to wet clean fitted carpets. It is powerful enough to pump the water down a very long hose, allowing the machine to remain outside the building, avoiding the risk of leaks and spills. It can recover 90% of the water delivered. In this case the large rinse water tank was filled with de-ionised water sourced from a local supplier. The model used had a heater with thermostat, allowing the water to be set at the



Sapphire Pro Upholstery Hand Tool

desired temperature. A specialist head was employed to deliver and remove the rinse water, called a Sapphire Upholstery Pro Hand Tool. This is, as its names suggests, more commonly used to clean upholstery and to 'spot' clean fitted carpets. The use of this head was recommended by Glyn Charnock because of the superior control it offers with both water delivery and removal, far greater than any domestic wet vacuum cleaner and enough to prevent the carpet ever becoming saturated.

Dri-Pod Fans – These highly efficient fans were chosen because they deliver a flow of horizontal air through 360°, over a 3m circular area.

Moisture meter – used to measure the carpet’s moisture levels before the treatment, and again on drying. Care was taken not to over dry the carpet.



Dri-Pod fan

CASE STUDY - SALTRAM CARPET

Carpet: 18th century, English Axminster

Dimensions: 6.2 x 13.35 m

Structure: warp: wool, weft: linen, pile: wool

The carpet almost fills the room where it is displayed and for which it was originally designed.

Method summary:

- The carpet was gridded out into 0.5m squares.
- Each square was slowly and methodically vacuumed for 15 minutes at 90 mb, using an adjustable suction vacuum cleaner, fitted with a soft brush head attachment.
(Total vacuuming time approximately 80 hours).
- Grid lines were re-laid across the width only, at 0.5m intervals.
- The width sections were roughly subdivided into four.
- The first section was initially sprayed with de-ionised water. It had been found that if wash solution was applied immediately, it was instantly absorbed impeding the cleaning process.
- The same section was then sprayed with working strength wash solution containing non-ionic detergent, warmed to 20 - 25°C.
- The wash solution was brushed into the pile using soft hand brushes.
- The next section was sprayed and brushed.
- The first section was re brushed after 5 mins and then rinsed.
- Rinsing was carried out in warmed (25 – 30° C) de-ionised water, using an industrial rinse extraction machine which both delivers and extracts the rinse water.



Saltram carpet with grid, awaiting vacuuming.

- The rinsed section was dried off with cotton toweling, wiping in the pile direction. The toweling came away lightly soiled.
- The process was repeated in areas of heavy soiling.
- For the final drying phase Dri-Pod fans were used, placed directly on the carpet and regularly repositioned (their feet sitting in plastic cups and to avoid pile compression).

Total wet cleaning time: 8 working days

The image on the right shows the startling results from an initial test using this method on the Cabinet Room Carpet at Felbrigg Hall, Norfolk. The carpet is English, mid-19th century, woven and shaped to fit the room. It has a wool warp and linen weft with a long wool pile, much longer than that of the Saltram carpet. This latter characteristic necessitated slight alterations to the protocol to better suit the longer, denser pile (the full surface wet clean was completed in December 2017).



Results from the test clean on the Felbrigg Hall Carpet

Image supplied by ©Glyn Charnock

Other considerations

Before cleaning in-situ, account has to be taken of:

- Environmental parameters, particularly the effect of wet cleaning on the relative humidity, and the possible impact this may have on both the fabric of the room and its furnishings.
- Equipment for monitoring RH and de-humidifiers should be on hand.
- Protection of other furnishings.
- Noise levels.
- Numbers of personnel required.

Note: the concentration of detergent when using this method may only need to be at or slightly above its critical micelle concentration, due to the short duration of use and comparatively small quantities of wash solution employed. A lower concentration also assists with rinsing.

Conclusion

This is a deep surface wet clean rather than a wash, the aim of which is to avoid saturating the carpet, keeping the foundation as dry as possible. The method continues to be honed and its success is utterly reliant on the knowledge and expertise of those involved. It is a blend of the conservator's understanding of the environment, the object and its long term preservation needs, together with the trade expert's familiarity with a broad range of equipment and its capabilities. This, combined with their joint experience, allows a treatment path to be developed. Every project will differ, requiring adjustments and modifications.

AEROSOL WASHING

There are now three aerosol cleaning facilities in Europe: De Wit in Mechelen, Belgium which was developed over 25 years ago; Hilde Neugebauer at Schönbrunn Palace, Vienna, Austria set up in 2007 and Opera Laboratori Fiorentini, Florence, Italy, only commissioned in 2016 (the author has visited all facilities). They were originally designed to wash tapestries. Knotted carpets with their layer of pile and base structure have more complex requirements.

The system

The basic system common to all the facilities consists of a chamber, the base of which is a large vacuum suction platform (approx. 8 to 8.75m x 6 to 5m). The walls are made from transparent sliding panels and the aerosol is delivered from a series of nozzles positioned around or across the ceiling.

Aerosol should not be confused with water spray. An aerosol is a very fine mist consisting of pressurised air containing tiny water droplets, to which detergent can be added. The type of water used depends on the facility and more than one might be employed during different stages of a wash. The water can also be warmed and additives included.

The textile is laid out on a substrate (commonly foam) on the vacuum platform. The area not covered by the object is masked off with polythene and the vacuum is switched on. The chamber fills with aerosol mist which can be seen settling gently on the surface of the textile before being pulled through to a collecting chamber below. When detergent is added and the tiny bubbles are pulled through the textile they expand dramatically forming a mass of foam under the platform. This huge increase in surface area of the bubbles maximises the potential efficiency of the detergent, requiring only small quantities to be used.

The vacuum suction is left on during the rinsing and drying phases, reducing the risk of lateral dye run from unstable dyes and preventing dimensional change. The whole operation, including drying, is carried out in one day.

Overview of the De Wit carpet washing processes

De Wit is the original and most experienced facility. The system uses both soft and de-ionised water, and their preferred surfactant is non-ionic and suitable for aerosol delivery. They are also the most practised in washing carpets. Recently, they have radically reappraised their carpet washing methodology, producing customised equipment that maximises the cleaning capability, whilst the aerosol system minimises risk.

Images: F. Hartog



De Wit aerosol chamber – preparing for tests.
Image reproduced by kind permission of De Wit



Chamber filled with aerosol mist.
Image reproduced with kind permission of De Wit

In the summer of 2107, they undertook the washing of a consignment of 54 carpets for a major European museum. The carpets could be collectively termed as 'Middle Eastern', most were knotted and varied widely in size, condition and structure. In anticipation of this project, over a matter of months De Wit had carried out an exhaustive programme of trials on test carpets. Their present protocol has been informed by these experiments and the exact choice of method is guided by the condition of the carpet and stability of the colours.

Image: F. Hartog



Washing flat with aerosol guns
Image reproduced by kind permission of De Wit

The more fragile carpets, and those with unstable colours (often from in-painting), are washed flat on the vacuum platform. They are laid out on an open-celled foam substrate. It should be noted that a poor choice of substrate can result in lateral colour run. Soft brushes and specially designed aerosol guns are used during the wash. As the wash solution is delivered, the aerosol from the gun massages and manipulates the pile. The soft brushes are used to raise the pile. Constantly working against the direction of the pile gives access to the carpet's foundation, maximising the effectiveness of the process. The manually operated guns allow for

adjustment where the condition of the carpet is not uniform. The vacuum continuously sucks away the used wash solution and soiling. Rinsing is carried out with the vacuum running continuously, using a combination of the aerosol mist and water delivered from sprinklers. Tapestries and flat woven carpets only require the aerosol but the structure of knotted carpets demands more intensive rinsing. The pile is gently brushed in the right direction before drying.

Silk carpets require a slightly different approach so as not to disturb the pile. Pile disturbance causes uneven reflectance on drying, effecting the visual appearance. Though the pile can be gently manipulated with the aerosol gun, it is constantly encouraged back into its natural direction using soft brushes.

The stronger examples were washed on a roller frame designed for the purpose. The cleaning roller has a wide diameter, naturally opening the pile over the curve and allowing the operators to stand, working at a comfortable height whilst washing the carpet using the aerosol guns and soft brushes. The carpet is rolled as the treatment progresses. There is an initial rinse built into the rolling process and the carpet is interleaved to avoid the risk of colour transfer from loose dyes or in painting. Final rinsing is carried out flat on the vacuum platform as described above.

Drying follows the same protocol as used for tapestries: an initial blotting phase followed by warm, filtered air drawn through the object, with the vacuum suction running throughout. For carpets, because of their habitual slow drying, the addition of fans has been introduced. To avoid compressing the pile, these are not placed on the carpet but are suspended above it on aluminium beams. The whole process, including drying, is still completed within a day – but a long day. The following day the carpets are given a final light brush and vacuum.

Conclusion

Having witnessed this system and inspected several of the carpets treated over the summer project (including a silk carpet), the techniques employed appear to give a thoroughly efficient wash combined with the lowest risk when compared to other washing methods.

WET SURFACE CLEANING

This method was developed for carpets with surface soiling only, held on the tips of the pile and not lower down in the knot yarns. This is commonly the result of open display. In London, display soiling tends to be sticky and appears as a grey/black coating, this is clearly illustrated in the photograph (*below left*). The carpet's wool pile has the characteristic grey/black surface soiling but below the surface the wool knot yarn is clean, as was the carpet's heavy cotton foundation. Vacuuming removes little of this sticky dirt and latex 'smoke' sponges remove more fibre than soiling.

Images: F. Hartog



English carpet circa 1936, wool pile.
Left before wet surface cleaning.
Right after wet surface cleaning.

Experience with other textiles in the V&A collection has proved that washing readily removes display soiling. However, to perform a full wash on a carpet with only surface soiling seems unwarranted and could, in the example above with its thick cotton warps and jute wefts, be foolhardy.

Tests

Initial trials were carried out in conjunction with Heather Porter, upholstery conservator (National Trust). Two salvaged 19th century chair covers were chosen for the tests because both had typical heavy soiling associated with open display. They were made from piled fabrics; one with cotton pile and the other wool. The assortment of cloths chosen for the initial cleaning trials included cotton and variations of microfibre. All cloths were first tried dry with poor results, the cleaning outcomes greatly improved when the cloths were used damp. The best performing cloths were then tried with and without detergent. The microfibre cloth described below outperformed all the others tested and was particularly effective at soil removal when dampened with water alone.

Equipment

Microfibre cloth – these are woven from synthetic fibres, superior microfiber has a diameter of only a few micrometres, considerably finer than silk. There are many versions of microfiber but the group of interest are a mix of polyester and polyamide. The fibres are extruded in a specific form consisting of a star shaped polyamide core, into which wedge shaped polyester filaments fit. This explains their ability to hold up to x25 their weight in water by capillary action and their proficiency at picking up and holding onto soiling. Additionally, polyester is able to remove grease without the need of detergent. This group of cloths are easy to recognise, as they are inclined to cling to bare skin, perhaps due to their static qualities or the crimped finish of their fine fibres.



Image of polyester/polyamide microfibre

Image sourced from www.textilecleaner.blogspot.co.uk

The tests had proved the most efficient cloths for this damp process were those with the following characteristics:

- Made from mixed fibres: polyester and polyamide
- With a ratio of polyester : polyamide of either 80:20 or 70:30 (the latter is slightly softer).
- Cloth with a pile, not a smooth surface
- Weight of cloth 250gsm or 300gsm (lighter weights felt too harsh and heavier weights proved too soft).

(A wide range is available in the UK from: Paragon Microfibre Ltd www.paragonmicrofibre.com)

Sponges – A piece of damp sponge (approx. 60 x 60mm) is used wrapped inside the damp microfibre cloth. This helps to keep the cloth consistently moist and gives the resulting cleaning pad the right consistency. Ramer PVA bath sponges are an excellent choice for this damp phase because of their spongy texture and ability to hold moisture without releasing it too readily. A dense cellulose sponge would be a satisfactory alternative.

For the dry pad, a piece of dry sponge is wrapped inside dry microfibre cloth. The importance of the sponge in this instance is the consistency it lends the cleaning pad, and both latex ‘smoke’ sponges and soft (polyurethane) cosmetic sponges work well.

Warm water – soft or de-ionised water can be used. Heating the water and applying it warm both in the spray and on the cloth considerably speeds the release of soiling.

Fine spray – a hand held pump spray is very effective (*see image right*). A fine spray is easier to apply evenly and importantly, because it is very light, it remains on the pile’s surface.



Image: F. Hartog

Hand held pump spray



Image: F. Hartog

Surface Wet Clean of V&A Carpet

(Museum No: Circ.481-1974)

Carpet: 1936, designed by Marion Dorn, English, Wilton Royal Carpet Factory

Dimensions: 1.09 x 2.13 m,

Structure: warp: thick cotton, weft: jute, pile: wool

Method

It is easier to work on table-tops, at a comfortable height but for large carpets this may not be practical.

- A guide line was run down the carpet to mark the first section.
- Polythene was laid over the carpet’s surface to mask off the portion of the section to be treated (a strip of 15-20cm wide by about 125 cm long works well).
- The area was sprayed with warm de-ionised water.
- Left for 2 minutes.
- Then worked over with the damp pad (damp sponge wrapped inside a damp cloth), working quickly and lightly in a circular motion.

©Marion Dorn/Victoria and Albert Museum, London

- As the cloth became soiled, the area covering the pad was moved and a clean part of the cloth used (*see image right*).
- When the soiling had reduced, the area was gone over with the dry pad (dry sponge wrapped in dry cloth), in the same circular motion but ending in the pile direction, this removes damp soiling and dries the fibres.
- The last three steps were repeated as necessary.
- The next section was then cleaned.
- At the end of the treatment, when the carpet was completely dry, it was lightly brushed in the pile direction with a soft brush and vacuumed.

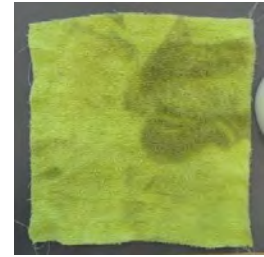


Image: F. Hartog

Soiling on damp cloth



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Working with damp and dry microfiber pads on first portion of the first section gives a very satisfactory result.

The method described above was also successfully used to clean a companion piece which had significantly more wear. This second piece (*see image right*) had a rough texture before cleaning but after the soiling was removed, it felt soft to the touch. Two conservators worked together on both carpets. This not only accelerated the process but also allowed the levels of dampness to be kept constant, increasing efficiency. The timing worked out at 1.75 – 2.0hrs per sq m for two people. Another carpet cleaned in this manner was machine woven, (English, circa 1956) with a short wool pile and jute weft. Due to the condition of the disintegrating jute the levels of moisture had to be kept under careful control. The process has to be adapted to the needs of each carpet. It is recommended that a test be performed in a discreet area before launching into a full treatment.



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First section cleaned on the second Marion Dorn carpet, Museum No: T.243-1978

Levels of dampness – the general rule is: the damper the cloth the more soil is released, but higher levels of moisture are not always desirable. Repeated applications with a less damp cloth may be required. The level of dampness must be judged by the conservator and is entirely controllable. The use of warm water noticeably increased the rate of soil release.

Detergent – this was included in both the initial tests on the piled fabrics and later, on two test carpets. The first carpet had a cotton foundation with wool pile and was heavily soiled, the second had an all wool construction and was less soiled. At the beginning of the treatment, the first section was sprayed with detergent solution which was left for four to five minutes before being worked over with damp microfibre cloth followed by a dry microfibre cloth, as described above. Though the soiling released more quickly than when using plain water, the visual difference between the areas cleaned with water only and that cleaned with detergent was barely perceptible on the more soiled of the two carpets, and there was no visual difference on the second less soiled carpet. There may be cases where the inclusion of detergent is desirable; this would be the conservator's choice.

Machine – trials were also carried out on the first test carpet using an industrial carpet spotting machine, fitted with the Sapphire Upholstery Pro Hand Tool, but this was found to deliver too much moisture. Only a light touch is required to remove soiling from the pile tips of a carpet. Manual application allows for subtle alterations to the levels of moisture, and the amount of mechanical action can be easily adapted, increasing or decreasing it, to suit the variable state of a carpet's surface, often the result of wear.

CONCLUSION

The guidelines for the Fellowship stipulated that the successful candidate should “develop their knowledge for the benefit of the wider profession”. The word ‘develop’ is particularly apposite as there is no single solution to washing carpets. This report is a distillation of the investigations undertaken. It brings together and describes methods already in practice, and the equipment currently in use by both textile conservators and commercial businesses. These varying approaches are offered for consideration and it is hoped they will broaden the options open to the textile conservator.

Each method discussed presents different intensities of cleaning, with full immersion washing probably providing the most penetrating but not necessarily the safest option for the object. The aerosol system offered by De Wit with their new equipment and methodologies, provides very efficient cleaning at the lowest risk. If the right contacts are made, trade facilities should be considered as a practical alternative to in-house treatments for more robust carpets with characteristics that make washing a logistical challenge, such as their scale or dense weave. In-situ wet cleaning has delivered beneficial results for carpets that cannot be moved from their location and would otherwise remain untreated. The new method of wet surface cleaning is an effective minimal intervention that removes display soiling from the tips of pile. The choice of treatment method must be guided by the conservator’s judgement of both the object’s condition and the degree of soiling, and should be informed by their knowledge of conservation considerations.

Techniques and tools will continue to evolve and by distributing this report as widely as possible it is hoped to encourage more communication on the subject. Our collective progress needs to be shared if it is to benefit the carpets held in collections worldwide.

Conservation Studios contacted:

Austria: Museum of Applied Arts, Vienna

Germany: Museum of Islamic Art, Berlin

Hungary: Museum of Applied Arts, Budapest

Netherlands: Rijksmuseum, Amsterdam

Spain: Royal Tapestry Factory, Madrid

USA: Museum of Fine Arts, Boston

Los Angeles County Museum of Arts, Los Angeles

Metropolitan Museum, New York

St John the Divine, New York

Philadelphia Museum of Art, Philadelphia

De Young, San Francisco

Talisman Textile Conservation, Santa Fe

Textile Museum - The George Washington University Museum, Washington

UK: Historic Royal Palaces

National Trust

Visits made:

Trade businesses: Art of Clean, Cambridge, UK

Classic Rug Care, Stapleford Abbots, UK

K. Blatchfords, San Diego, USA

Cryo Genesis, Littlehampton, UK

Tetley Workshop, Tisbury, UK

Thames Carpets, Oxford, UK

WoolSafe Organisation, Otley, UK

Aerosol facilities: De Wit, Mechelen Belgium

Opera Laboratori Fiorentini, Florence, Italy

Schönbrunn Palace, Vienna, Austria (January 2011)

Heritage collections: Historic Royal Palaces, Hampton Court, UK

Knole House, Kent, UK

Saltram House, Devon, UK

Tehran Carpet Museum, Iran

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