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Hangers for the Storage of Historic Garments and Reproductions

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Hangers for the Storage of Historic Garments and Reproductions

Lucie Thivierge
Textile Conservator

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Collections, Curatorial and Conservation Branch
Heritage Conservation and Commemoration Directorate
Parks Canada
1800 Walkley Road
Ottawa, Ontario K1H 8K3

This report is intended for conservators, curators, collection specialists, students and volunteers.

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1.0 Introduction

The purpose of our research was to find a hanger that could be used to store historic garments in good condition and reproductions, through the examination of both commercially produced and custom made hangers. The hanger needed to meet the following criteria: neutral material, adequate shoulder length and width, shoulder slope, straight profile[1], a neck high enough to accommodate a variety of collars, material that could be cut if necessary and that could support a certain weight, and material that could be readily acquired at an affordable price.

Not all clothing can be stored on hangers. The garment needs to be in good condition, and the fabrication technique needs to be considered. For example, knitted or heavily decorated garments should be stored flat.

Section 2.0 defines the terms used when measuring a garment or a hanger.

Section 3.0 describes various commercially made clothes hangers, connectors and clips. The hangers can be used as is for reproductions but need to be padded for historic garments that are in good condition. Commercially made connectors and clips are used primarily for reproductions. Section 4.0 describes custom-made hangers for historic garments.

Adapting these products has helped broaden our knowledge. We hope that the information in this document will meet your requirements and provide some inspiration. We did not find the perfect hanger, but we did find a number of solutions to problems for storing garments.

[1] A slight curve forward at the shoulders (concave shoulders) was one of the original criteria. This criterion was eventually dropped after multiple tests. It was determined that the straight profile was more appropriate for most garments.

2.0 Terminology

Throughout this document, we use the terms length of garment at the shoulder, length of hanger, length of hanger at the shoulder and width of hanger at the shoulder.

Length of garment at the shoulder is the measurement taken from the base of the collar to the end of the shoulder (Figure 1).

Figure 1
Length of garment at the shoulder.

Length of hanger is the measurement taken from one end of the hanger bar to the other (Figure 2).

Length of hanger at the shoulder is the measurement taken on the right or left side of the hanger bar (Figure 2).

Width of hanger at the shoulder is the measurement which is perpendicular to the length of the hanger bar (Figure 2).

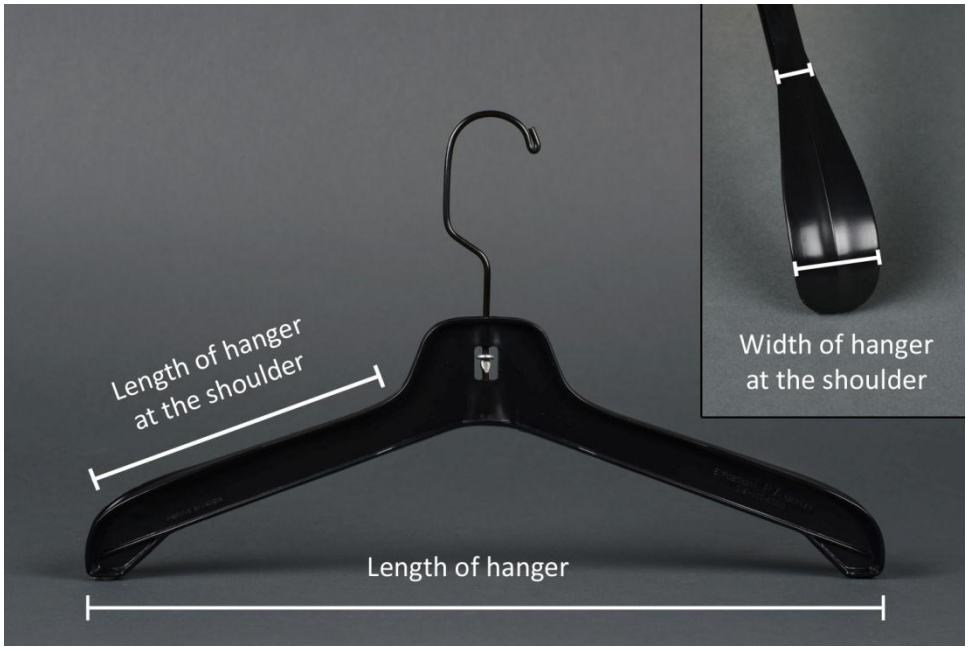

Figure 2
Length and width of hanger at the shoulder and length of hanger.

3.0 Commercially produced hangers, connectors and clips

The hangers, connectors and clips discussed in this section are produced commercially. They are used primarily for reproductions. The hangers, provided that they are padded, can also be used for historic garments in good condition.

3.1 Models 1625 and 1625 LH

Models 1625 and 1625 LH (Figures 3, 4 and 5) have the same characteristics, except that the neck of the hook is longer on the Model 1625 LH (LH stands for long hook).

Source
ERA Group

Dimensions
The total length of the hanger is 41.5 cm (16 3/8 in.).

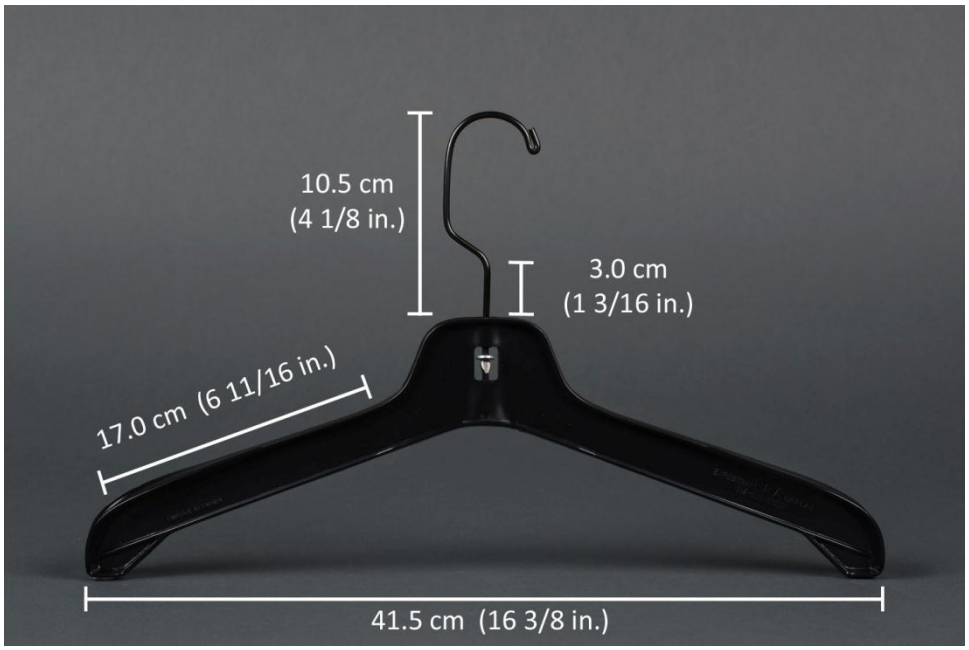

Figure 3
Model 1625 with black hook.

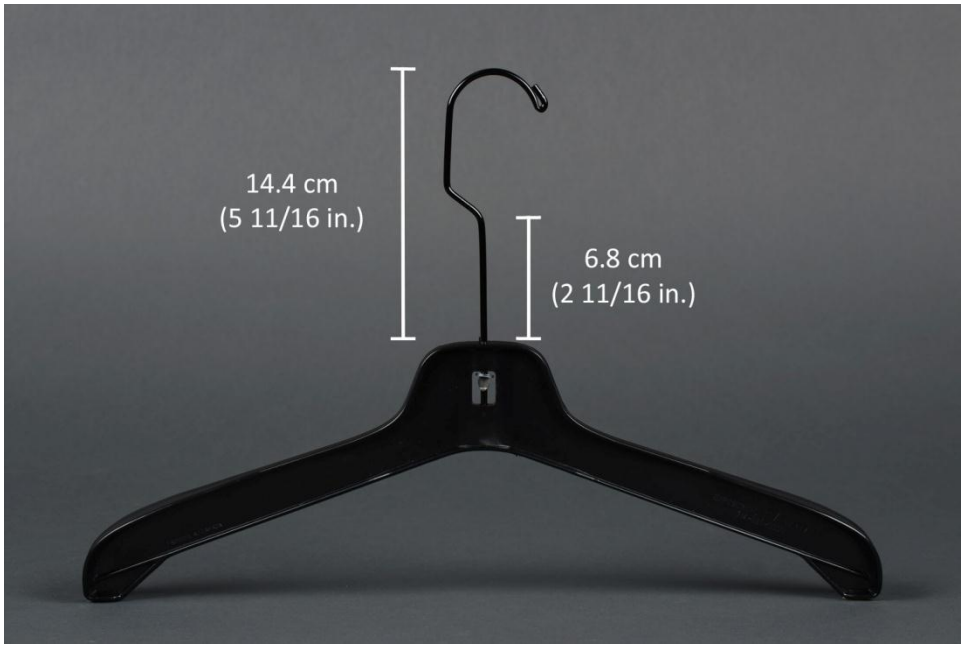

Figure 4
Model 1625 LH with black hook.

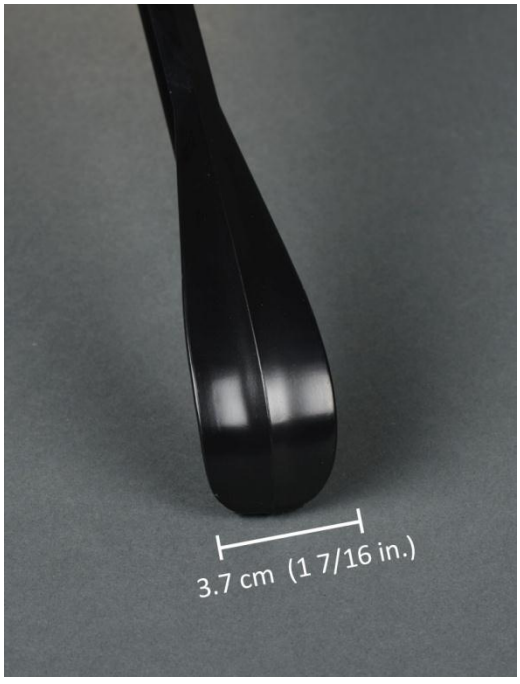

Figure 5
Maximum width at shoulder on Models 1625 and 1625 LH.

Application

These hangers can be used for blouses, shirts, dresses, waistcoats, jackets and coats for men, women and children. A connector (Section 3.3) and a PM Model hanger (Section 3.2) can be added to hang trousers and skirts, as well as a clip (Section 3.4) for accessories if necessary. Because the 1625 LH model has a longer neck, it is more suitable for garments with high collars.

Construction

The 1625 and 1625 LH models are made from acrylonitrile butadiene polystyrene (ABS), a stable plastic that can be used in conservation. They can also be special ordered in polypropylene. The 1625 and 1625 LH models have a straight profile and a metal hook that is available with either a chrome finish or black paint.

Comments

When we began our research, we tested a variety of commercially produced hangers with reproduction garments from the collection at Manoir-Papineau National Historic Site (NHS). We concluded that in most cases the 1625 and 1625 LH models are the most appropriate hangers to use because of their straight profile, shoulder slope, shoulder support, neck length, inert material, availability and low cost. These hangers have a straight profile and are therefore suitable for most garments. Hangers with concave shoulders are less effective because they deform the garments at the shoulders and neck. The width of hanger at the shoulder provides good support. These models can be used as-is for reproductions but should be padded for historic garments (Section 3.1.1). They can also be easily cut (Figure 6) with a hand saw to adjust the shoulder length as needed (e.g. for children's garments).

Figure 6
Model 1625 with ends cut off to accommodate small garments.

3.1.1 Preparation of 1625 and 1625 LH models

A padded hanger provides better support for garments. Below is a simple and inexpensive way to add padding to the 1625 and 1625 LH models.

1) The hook is covered with silicone tubing to prevent the garment from coming into contact with the metal (Figures 7 and 8). The bent back tip of the hook will hold the tubing in place.

Figure 7
Silicone tubing.

Figure 8
Model 1625 LH with silicone tubing.

2) The hanger is padded with Tundra® pipe insulation (Figure 9). Made of polyethylene, the insulation has an outside diameter of 3.8 cm (1 1/2 in.) and an inside diameter of 1.9 cm (3/4 in.). The insulation is cut along its entire length. An incision approximately 8.5 cm (3 5/16 in.) long is then made in the middle, as well as two short incisions measuring 1.5 cm (9/16 in.) perpendicular to the ends of the long incision for the hook and the top of the hanger. The insulation is put on the shoulders of the hanger and the ends cut parallel to the ends of the hanger (Figure 10). When the shoulder length of a garment is longer than the hanger, another piece of insulation of suitable length must be used (Figure 11).

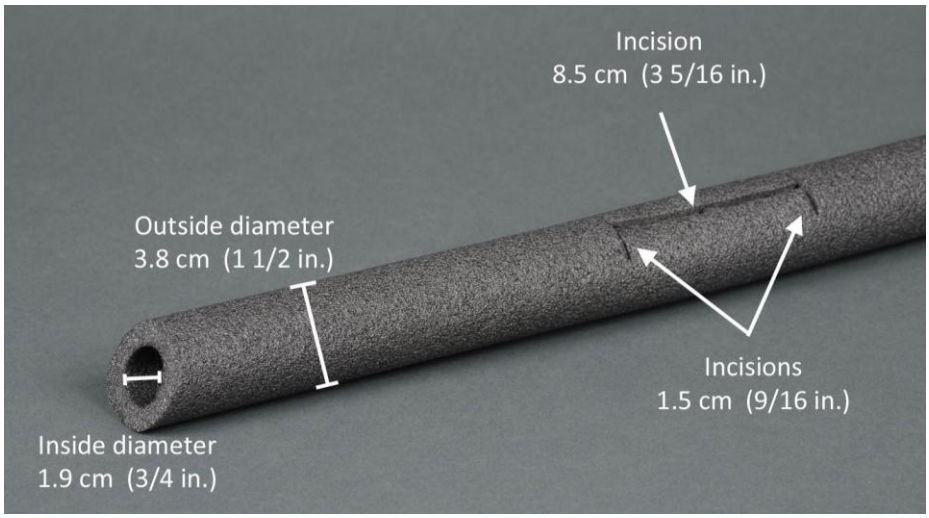

Figure 9
Pipe insulation with incisions in the middle.

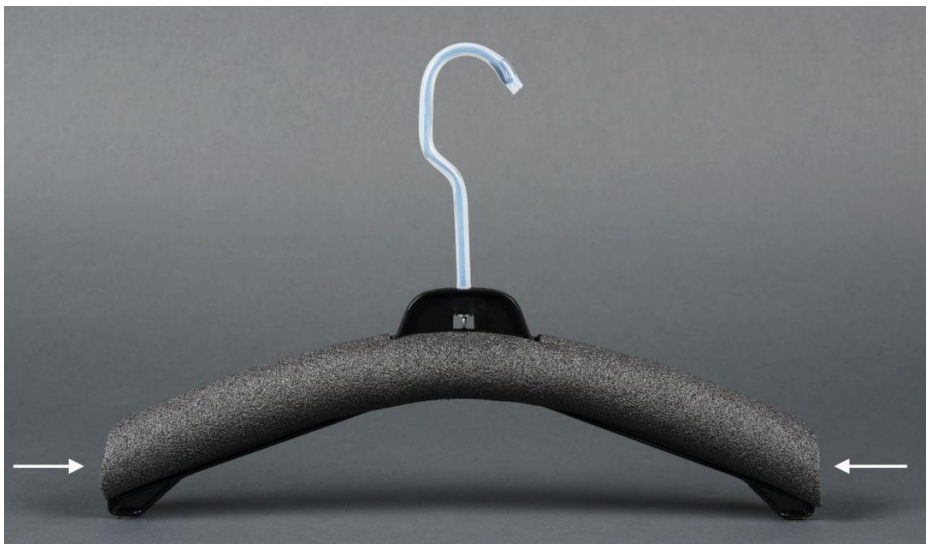

Figure 10
Model 1625 LH with pipe insulation cut parallel to the ends of the hanger.

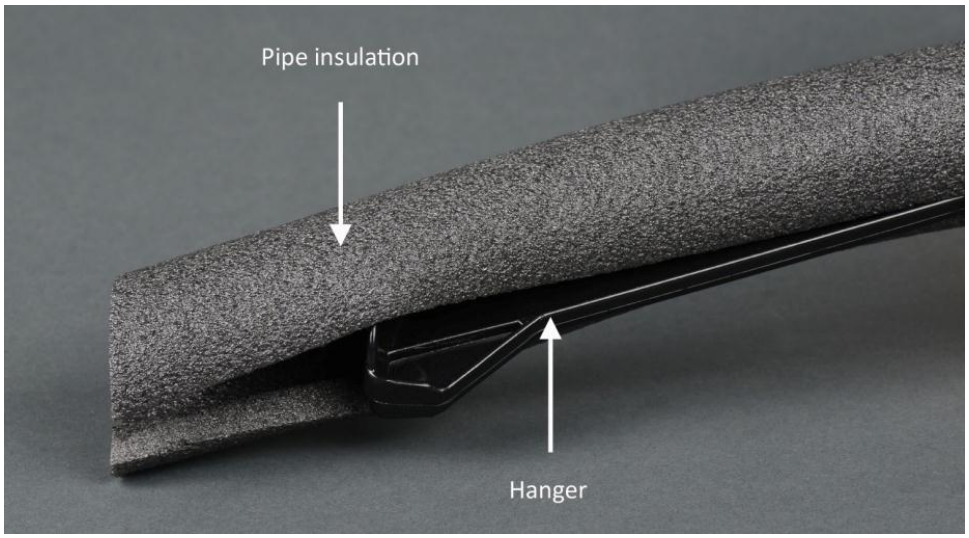

Figure 11
Model 1625 LH with pipe insulation longer than the length of the hanger.

3) The hanger is covered with a quilted unbleached cotton cover (Figure 12).

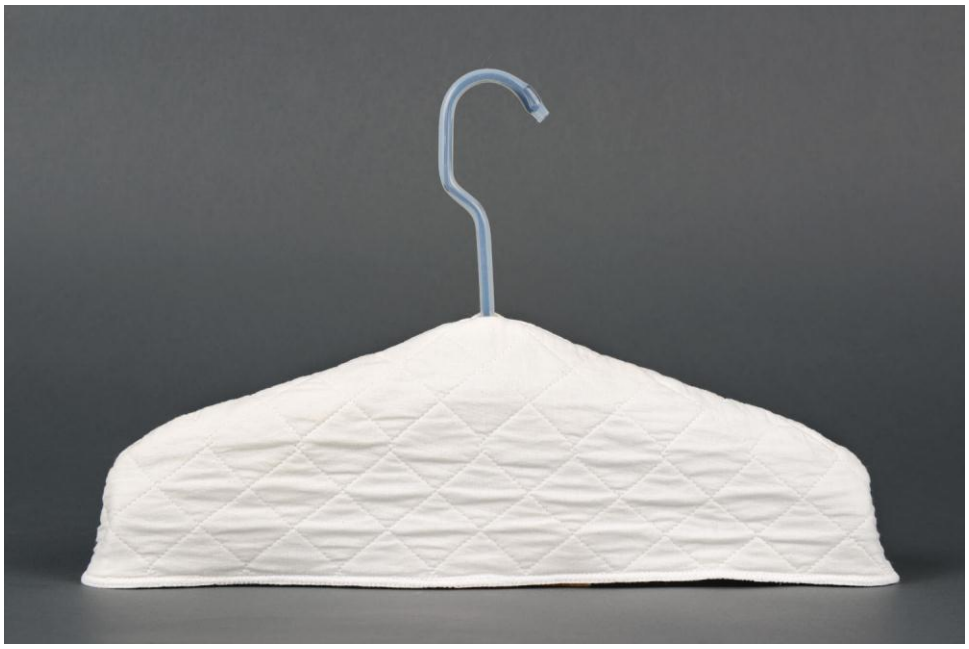

Figure 12
Model 1625 LH with pipe insulation and quilted unbleached cotton cover.

4) We made hangers in six different sizes (Figure 13). Before making a new hanger, we test a garment on these models and then reproduce the most appropriate model. When none of the sizes fit, we make a custom hanger (Section 4.0).

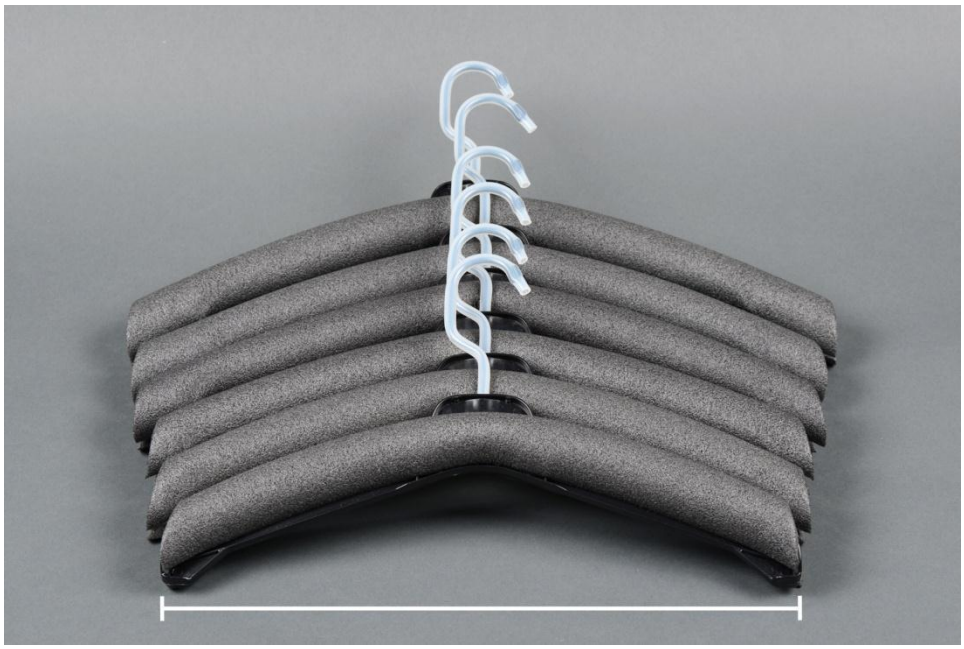

Figure 13
Model 1625 in six different sizes from 41.5 cm (16 3/8 in.) to 53.0 cm (20 7/8 in.).

3.2 PM Model

Source
ERA Group

Dimensions
The height of the hook is the same for all PM Models. This hanger is available in the following sizes:

PM25 = 25.0 cm (9 13/16 in.),
PM27 = 27.0 cm (10 5/8 in.),
PM32 = 32.0 cm (12 ½ in.) and
PM36 = 36.0 cm (14 3/16 in.)

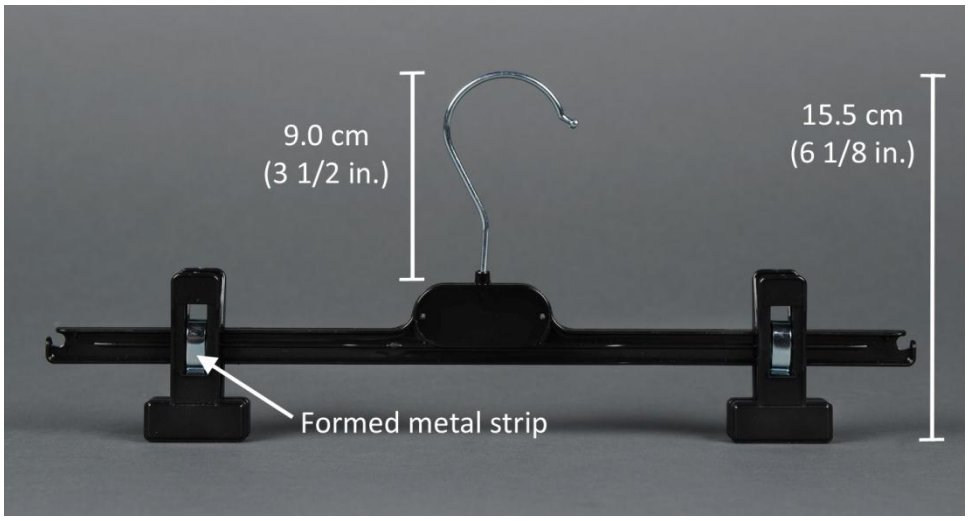

Figure 14
PM Model.

Application

This hanger is used for skirts and trousers and can be used alone or attached to the Model 1625 (or 1625 LH) with the PCL400 connector (Figures 18 and 19). The PM36 is appropriate for adult-sized garments. A 5.0 cm (2 in.) piece of 2-ply acid-free cardboard is placed on either side of the garment to reduce the impact of the clips (Figure 16). The length of the cardboard varies with the width of the garment.

Figure 15
Metal hook covered with silicone tubing extending to the base of the round plastic ring.

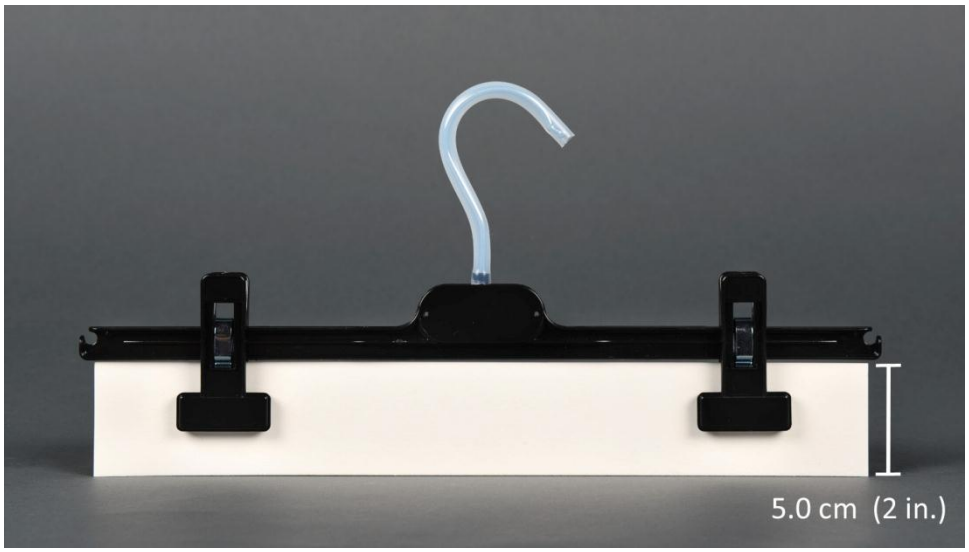

Figure 16
Piece of acid-free cardboard placed inside the clips on either side of the garment.

Construction

The PM hanger has a straight plastic bar, a chrome hook and two clips that slide easily along the bar. The bar and clips are made of acrylonitrile butadiene polystyrene (ABS) and the cushioning on the inside of the clips is made of butadiene polystyrene. Both are stable plastics that can be used in conservation. The clips are attached to the bar using formed metal strips (Figures 14 and 17).

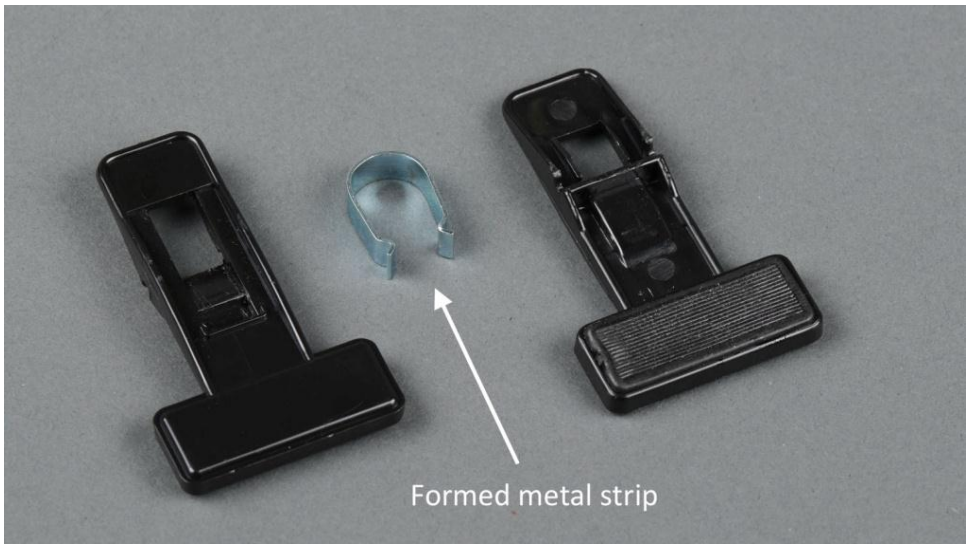

Figure 17
Disassembled clip.

Comments
- The metal hook is covered with silicone tubing extending to the base of the round plastic ring (Figure 15) to hold the tubing in place as the tip of the hook is not bent back.
- Sticky residue from the cushioning on the inside of the clips has left a brown stain on the acid-free cardboard. The cushioning was replaced with hot-melt adhesive (Thermogrip 6363).
- To prevent corrosion, we recommend applying two coats of Paraloid B-72 solution in ethanol (30%) on all surfaces of the metal strips.

3.3 Connectors

3.3.1 PCL400

Source
ERA Group

Dimensions
See Figure 18.

Application
The modified PCL400 connector is inserted through the hook of Model 1625 or 1625 LH and used to hang the PM hanger (Figures 19 and 20).

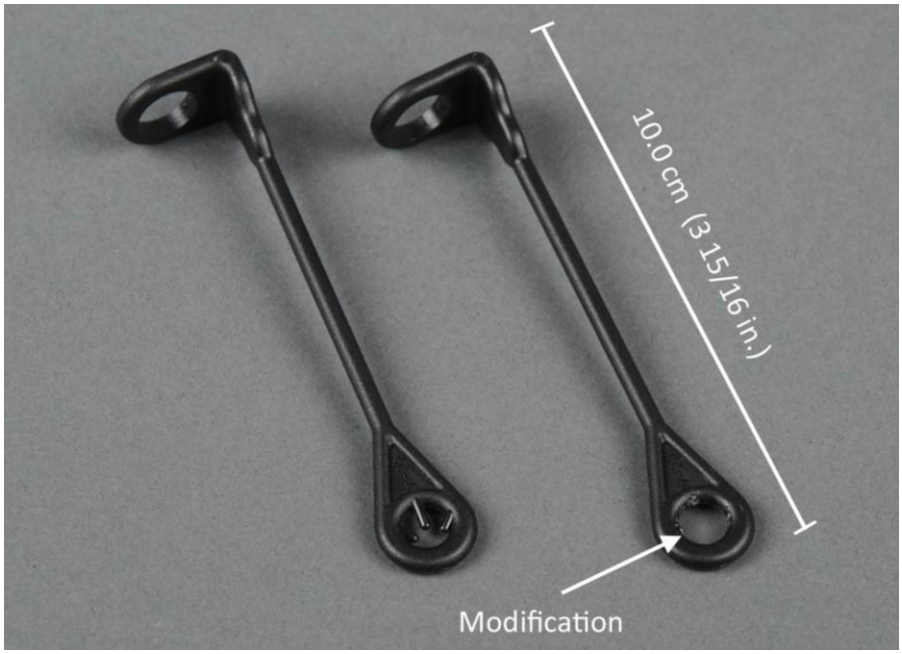

Figure 18
PCL400 connectors, one of which has been modified.

Figure 19
Model 1625 LH with modified PCL400 connector.

Figure 20
PM hanger hung on a 1625 LH hanger using the modified PCL400 connector located under the pipe insulation.

Construction
The PCL400 is made of isotactic polypropylene, a stable plastic used in conservation. The end of the connector needs to be hollowed out (Figure 18) with a utility knife to accommodate the hook of a PM hanger covered with silicone tubing.

Comments
N/A

3.3.2 PCL900

Source
ERA Group

Dimensions

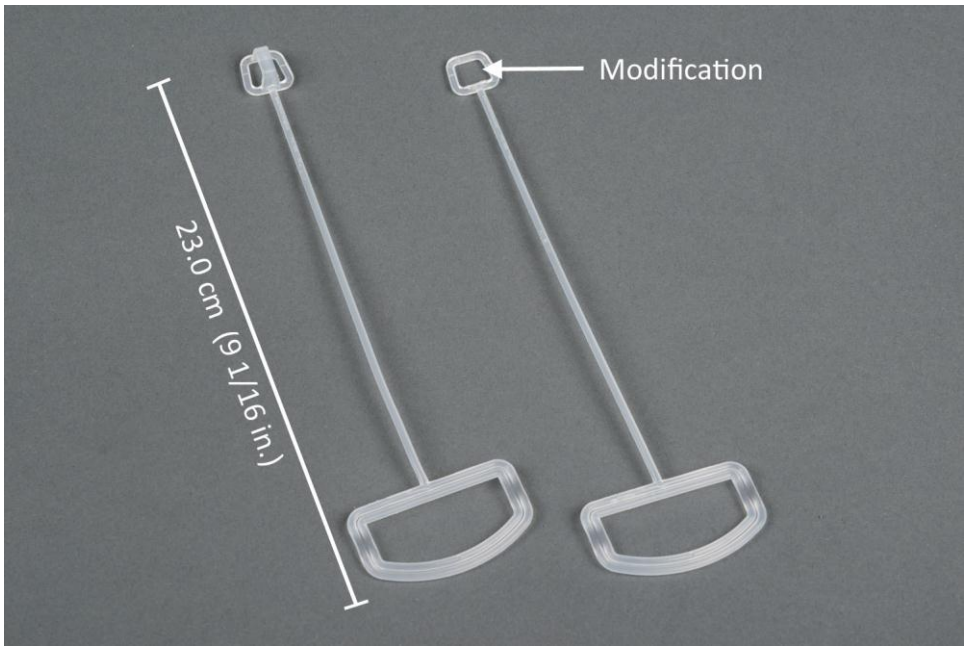

Figure 21
PCL900 connectors, one of which has been modified.

Application
The modified PCL900 connector (Figure 21) should never be used with historic garments. However, if the larger end is padded with an unbleached cotton quilted fabric (Figure 22), it can be used to hang reproductions (e.g. a necktie). The connector can then be inserted through the hook of a Model 1625, 1625 LH (Figures 23 and 24) or PM hanger (Figure 25).

Figure 22
Padded PCL900 connector.

Figure 23
Model 1625 LH with padded PCL900 connector.

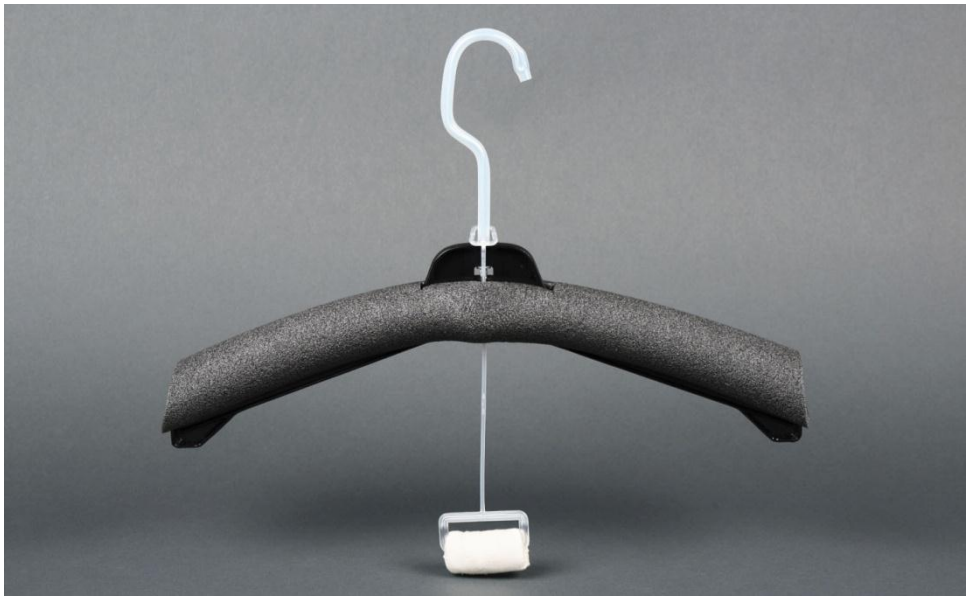

Figure 24
Model 1625 LH hanger covered with pipe insulation and featuring a padded PCL900 connector.

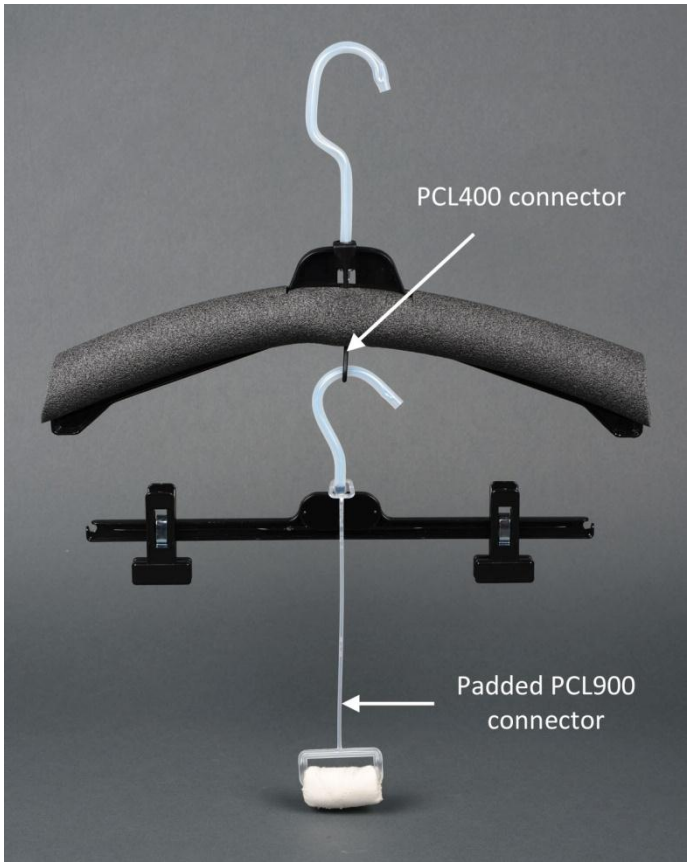

Figure 25
PM hanger hung on a Model 1625 LH hanger using a PCL400 connector.
PM hanger fitted with a padded PCL900 connector.

Construction
The PCL900 connector is made of isotactic polypropylene, a stable plastic used in conservation. The smaller end needs to be modified (Figure 21) with a utility knife to accommodate the hook of a 1625, 1625 LH or PM hanger covered with a silicone tubing.

Comments
N/A

3.4 Big Grabber and Starlette clips

Source
ERA Group

Dimensions

Figure 26
Big Grabber clip.

Figure 27
Starlette clip.

Application
These clips are never used with historic garments. They can be used to hang reproductions such as belts, scarves and caps. The clips can be inserted in a braided cord made from three pieces of unbleached cotton tape (Figure 28). The hook of a 1625, 1625 LH or PM hanger (Figure 29) is inserted between the tapes.

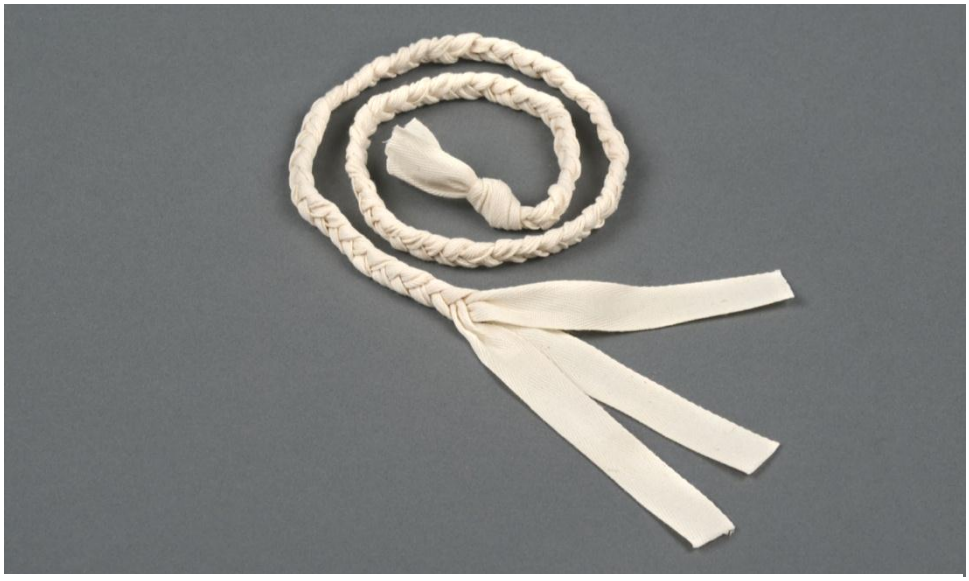

Figure 28
Braided cord made from three pieces of unbleached cotton tape.

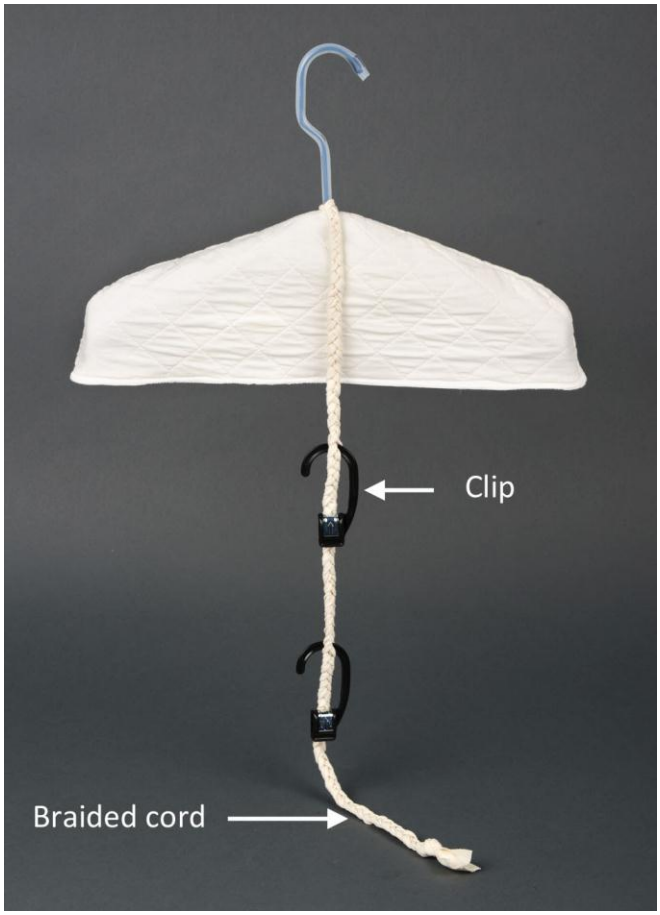

Figure 29
Braided cord suspended from a hanger hook. Clips, for hanging reproductions, inserted into the braid.

Construction

The Big Grabber and Starlette clips consist of a hook and a clip, both of which are made with isotactic polypropylene, a stable plastic that can be used in conservation. The clip also contains a formed metal strip.

Comments

To prevent corrosion, we recommend applying two coats of B-72 solution on all surfaces of the metal strips.

4.0 Custom-made hangers for historic garments

Historic garments are generally more fragile than reproductions and require greater care. Historic garments in good condition can be hung on padded commercial hangers such as the 1625 model described in Section 3.0. Garments requiring greater support are usually hung on a custom-made hanger, and fragile historic garments should be stored flat. Each garment should be assessed and stored in a manner appropriate for its condition and for how the garment was produced. Section 4.0 illustrates various models of custom-made hangers for historic garments.

The following materials were used to fabricate custom-made hangers: stainless steel wires and fender washers, round and flat nuts, aluminium flat bars, corrugated polyethylene/polypropylene sheets (Coroplast), polyethylene planks (Ethafoam), polyethylene foam rounds, unbleached cotton jersey fabric, tubular cotton jersey fabric (stockinette), unbleached cotton tapes, polyester batting, silicone tubing, hot-melt adhesive (Thermogrip 6363) and Paraloid B-72 solution in ethanol (30%).

4.1 Model 1

This hanger is made with stainless steel wire, Coroplast, Ethafoam, polyester batting, unbleached cotton jersey fabric, silicone tubing, and Thermogrip 6363.

Source
Custom-made by the Textile Laboratory at Parks Canada in Ottawa.

Dimensions
The hanger dimensions vary depending on the garment (Figures 30, 32 and 33).

Application
This hanger provides more support than the padded 1625 and 1625 LH hangers. It was designed for the collection of chasubles at Grosse Île and the Irish Memorial National Historic Site (NHS). This type of garment requires good shoulder support. The hanger is also suitable for rain slickers but should be covered with a Teflon-coated fabric to prevent it from sticking to these garments.

Construction
This hanger is made with a 4 mm (3/16 in.) piece of Coroplast cut to the desired shape, keeping the flutes vertical. The Coroplast reinforces the hanger. A stainless steel wire is fed through the centre flute of the Coroplast (Figure 31). The end of the wire has a pre-made hook (Figure 30), and the height of the neck varies depending on the garment. The wire at the base of the hanger is bent into a U-shape, then re-inserted into the Coroplast (Figures 32 and 33). Silicone tubing covers the hook to prevent the garment from coming into contact with the metal. The hanger is held in place by the wire bent at the base and the silicone tubing. A 2.5 cm (1 in.) thick piece of Ethafoam is cut and glued to each side of the Coroplast with Thermogrip 6363 hot-melt

adhesive. The hanger is covered with polyester batting and unbleached cotton jersey fabric (Figure 34). The hanger thickness can be varied as needed.

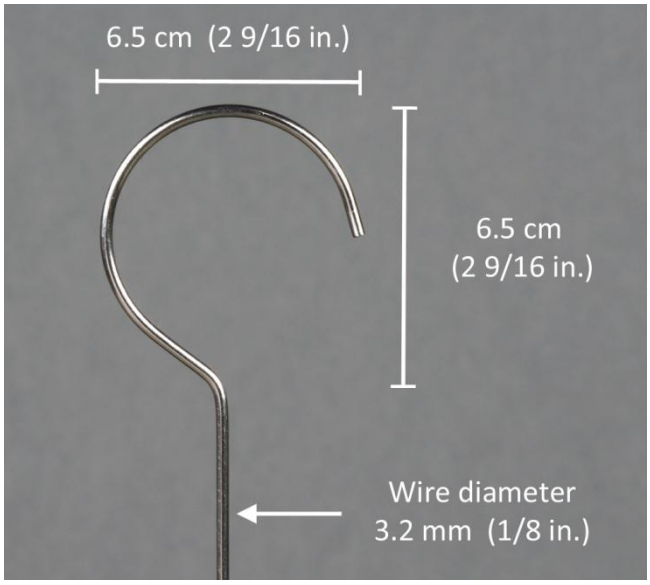

Figure 30
Hook made of stainless steel wire.

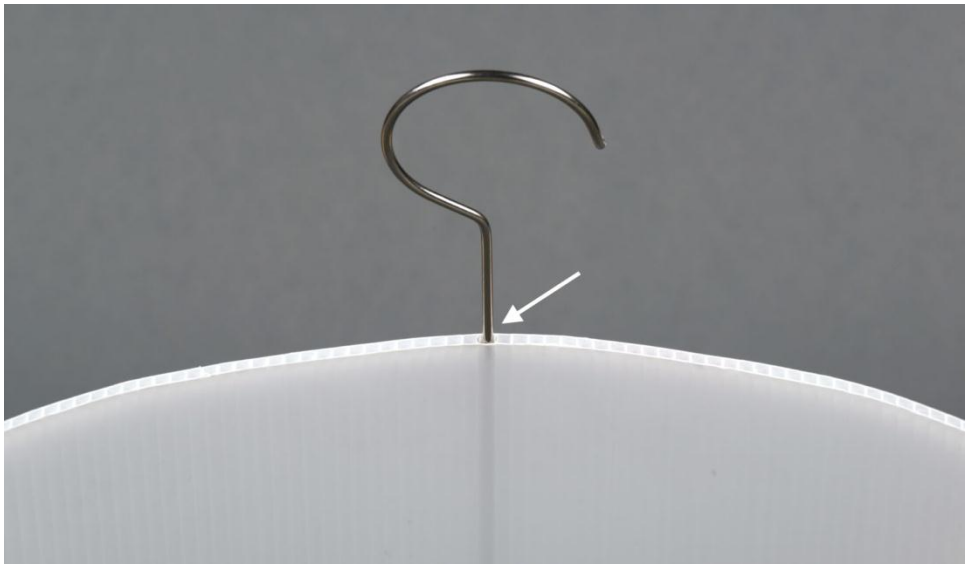

Figure 31
Wire inserted through the centre flute of the piece of Coroplast.

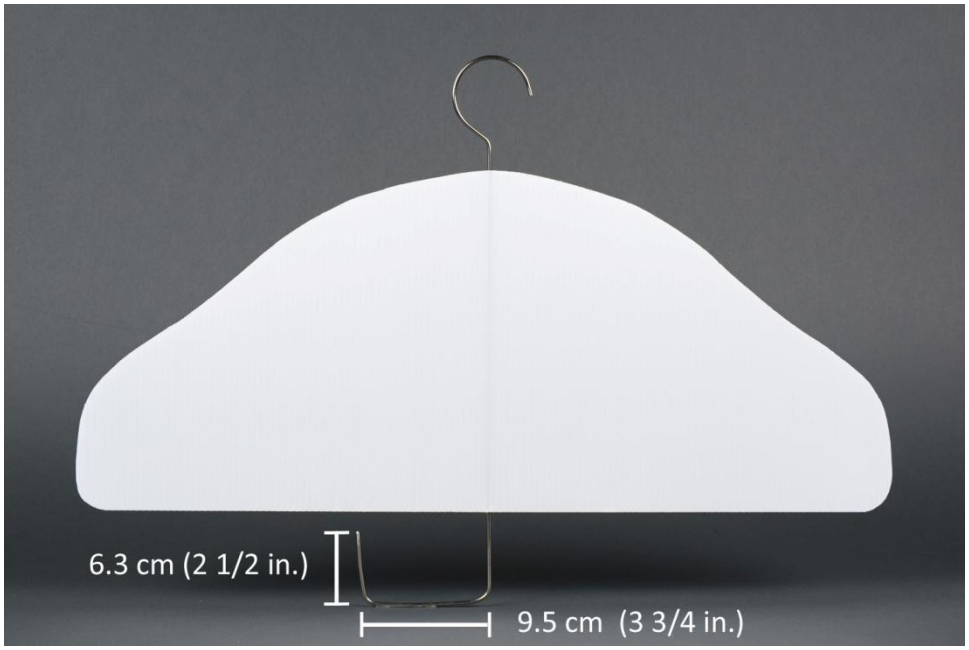

Figure 32
Wire bent into a U-shape at the base of the hanger.

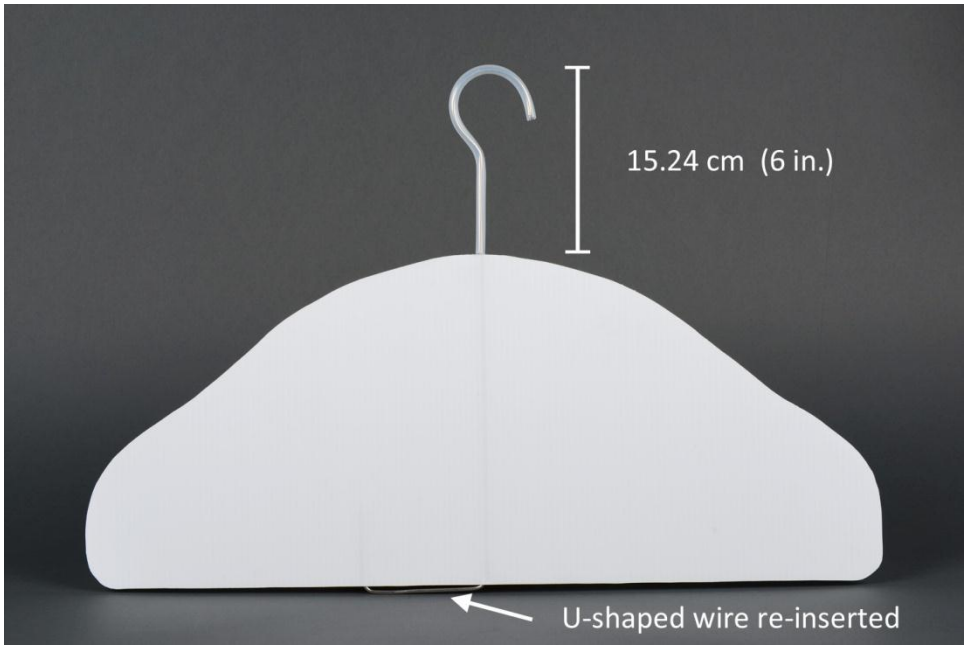

Figure 33
U-shaped wire re-inserted into the Coroplast and silicone tubing placed over the hook.

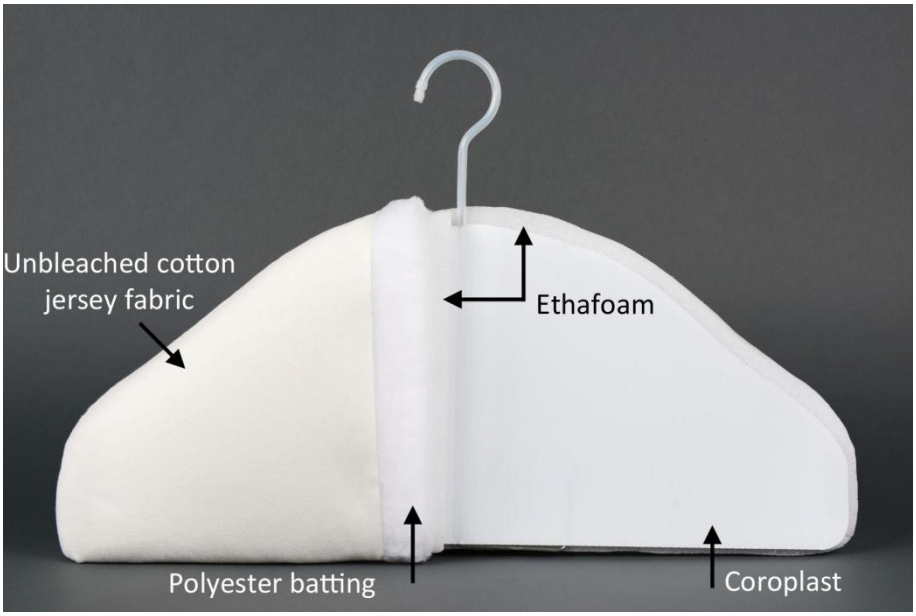

Figure 34
Pieces of Ethafoam cut and glued to each side of the Coroplast. The entire hanger is then covered with polyester batting and unbleached cotton jersey fabric.

Comments

- Because the tip of the hook used in our tests was not bent back, the silicone tubing covering the hook moved when it was handled. A ball of Thermogrip 6363 was applied to the tip of the hook, and once it cooled, the adhesive was covered with a small piece of silicone tubing; which was then covered by overlapping the silicone tubing covering the hook (Figures 35).

Figure 35
Hook covered with silicone tubing.

– Alternatively, the tip of the hook may be bent back (Figure 36) to prevent the silicone tubing from moving when the hanger is handled. The tubing is placed over the bent end (Figure 37). This requires special tools. Sometimes it is easier to use the previous technique, as shown in Figure 35.

Figure 36
Hook with bent tip.

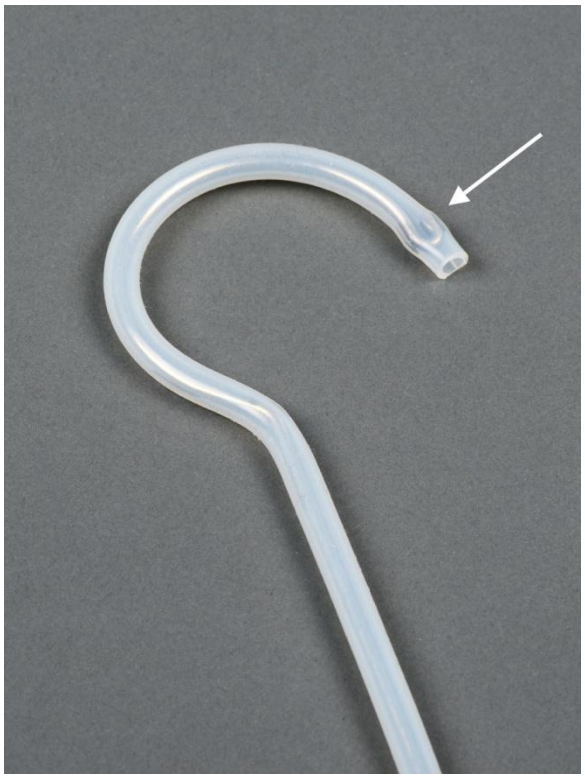

Figure 37
Silicone tubing covering the bent tip.

4.2 Model 2

This hanger is made from stainless steel wire, round and flat nut, Ethafoam, polyester batting, unbleached cotton jersey fabric or stockinette, unbleached cotton tapes, and silicone tubing.

Source
Custom-made by the Textile Laboratory at Parks Canada in Ottawa.

Dimensions
The hanger dimensions will vary depending on the garment.

Application
This hanger model can be adapted for different types of garments. The hanger in Figure 40 was made for trousers. The buttons inside the waistband, where the suspenders attach, are inserted into the buttonholes of the unbleached cotton straps sewn onto the hanger.

Construction

The hanger is made from a piece of Ethafoam 5.0 cm (2 in.) thick and cut to the desired shape (Figure 38). A hook made of stainless steel wire is inserted into the middle of the piece of Ethafoam. The height of the neck varies depending on the garment. The other end of the wire is threaded to accommodate a round and flat nut (Figure 39). Silicone tubing covers the hook to prevent the garment from coming into contact with the metal. The tip of the hook is bent back to prevent the silicone tubing from moving. The hanger may be covered with polyester batting or just unbleached cotton jersey fabric or stockinette. An incision is made at each end of the piece of Ethafoam using a knife, then the fabric ends are tucked inside the incisions using a spatula (Figures 38 and 40).

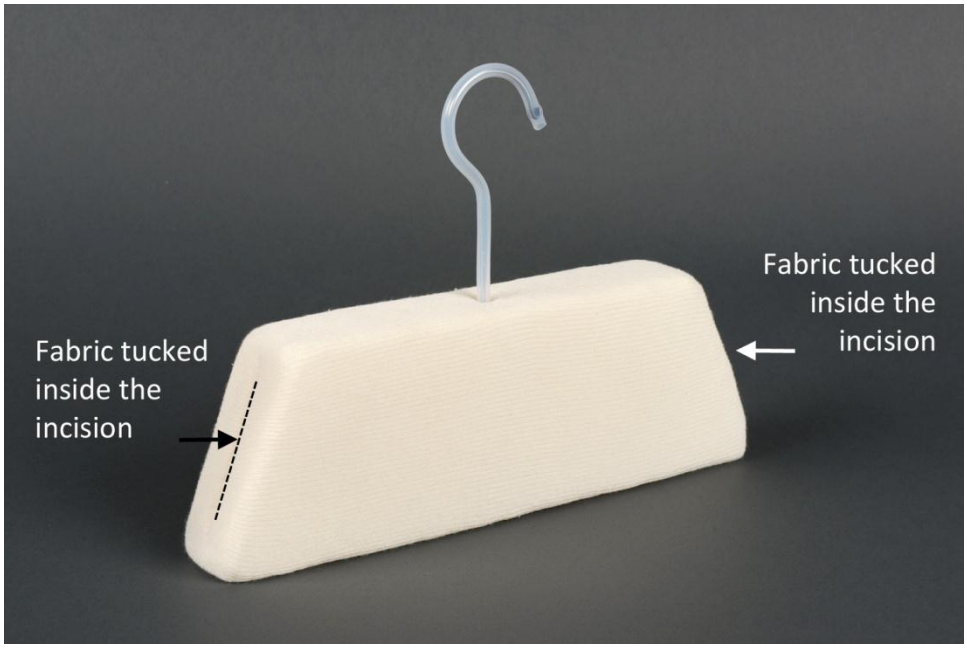

Figure 38
Hanger made with a hook covered with silicone tubing and a piece of Ethafoam covered with stockinette.

Figure 39
End of hook threaded with a round and flat nut.
Type of hook used in Figures 38 and 40.

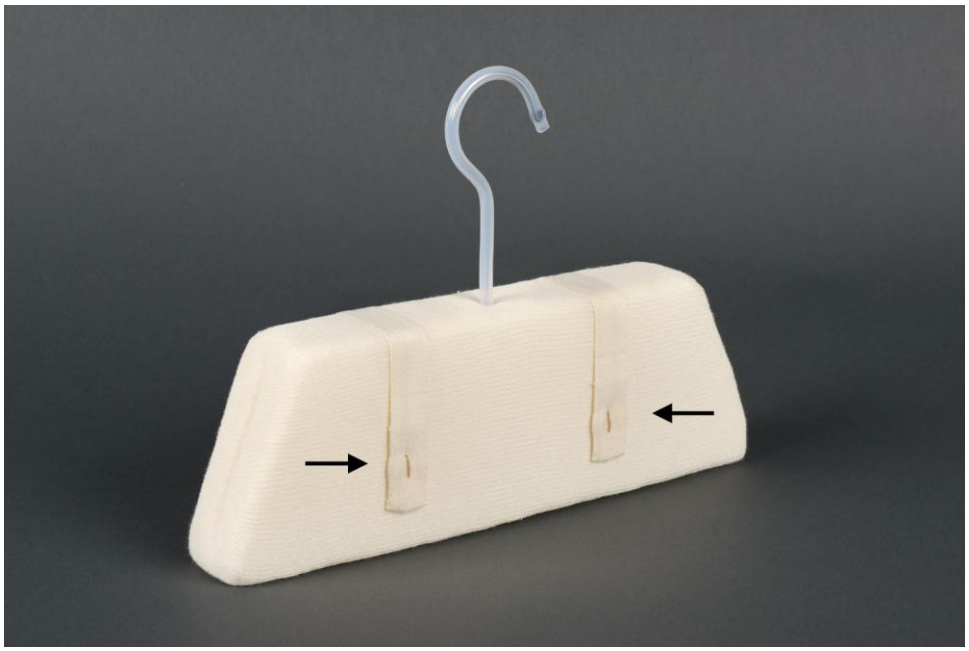

Figure 40
Hanger covered with stockinette; also has straps with buttonholes.

Comments
- The Ethafoam must be dense enough to support a certain weight and keep its shape.
- The Ethafoam thickness is dependent on the garment requirements.
- The silicone tubing keeps the hook in place.
- Because the Model 2 round nut tends to become unscrewed over time, we recommend using the hook from Model 3 (Figure 41) for its stability.

4.3 Model 3

This hanger is made from stainless steel wire and fender washer, polyethylene foam round, stockinette, and silicone tubing.

Source
Custom-made by the Textile Laboratory at Parks Canada in Ottawa based on the model constructed by Harpers Ferry Center as per "Instructions for Making Customized Ethafoam Hangers," National Parks Service, USA, 2004, 5 pages.
http://www.nps.gov/hfc/products/cons/con-faq5.htm

Dimensions
Hanger dimensions will vary depending on the garment.

Application
This type of hanger is suitable for a light garment such as a dress, blouse, shirt or jacket.

Construction
The hanger is made from a polyethylene foam round cut to the desired length. A hook made from stainless steel wire is inserted into the middle of the foam round and the tip of the hook bent. The height of the neck varies depending on the garment. The other end of the wire is bent into a U-shape (Figure 41). The shorter arm of the U-shape should measure approximately 3.0 cm (1 3/16 in.) to stabilize the hanger. A stainless steel fender washer is inserted onto the longer arm of the U-shape to keep the hook in place. The ends of the foam round are cut to the desired angle.

The hanger may be padded or simply covered with stockinette (Figure 42). A small incision is made in the middle of the piece of stockinette and the foam round and hook are inserted. A stitch is sewn around the incision. An incision is made in each end of the foam round with a knife and the fabric ends are tucked inside the incisions using a spatula. Silicone tubing covers the hook to prevent the garment from coming into contact with metal (Figure 42).

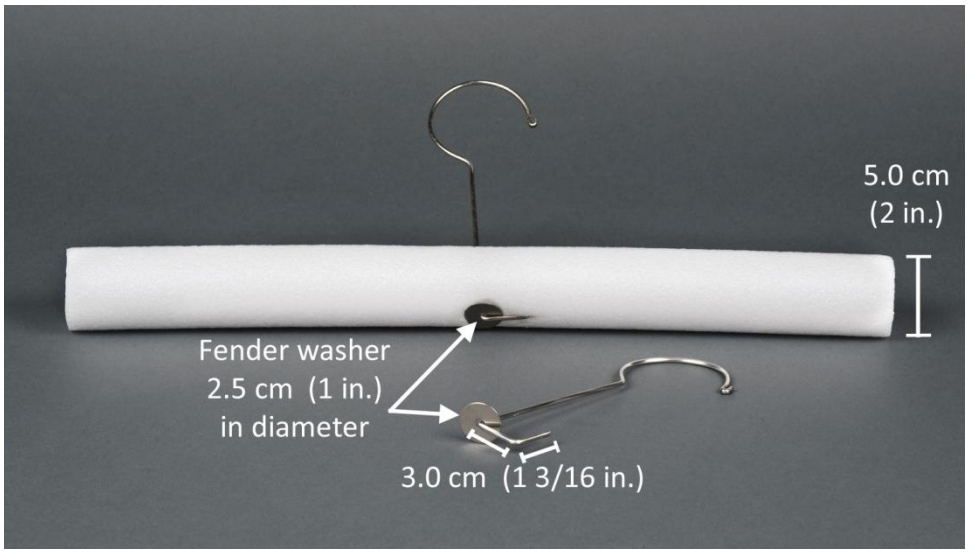

Figure 41
Hanger made with foam round and hook.

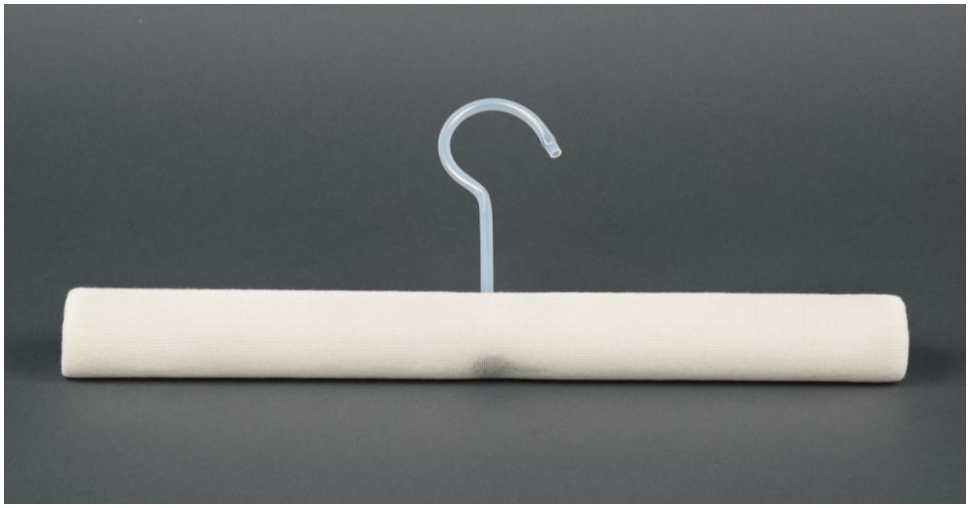

Figure 42
Hook covered with silicone tubing and foam round with stockinette.

Comments

- The silicone tubing keeps the hook in place.
- The foam round is available in 5.0 cm (2 in.) and 7.6 cm (3 in.) diameters.

4.4 Model 4

This hanger is made from stainless steel wire, aluminium bar, polyethylene foam round, stockinette, silicone tubing, and a solution of Paraloid B-72 in ethanol (30%).

Source
Custom-made by the Textile Laboratory at Parks Canada in Ottawa. The hanger design was based on Model 3 in section 4.3.

Dimensions
Hanger dimensions will vary depending on the garment.

Application
This hanger is much stronger than Model 3. It is suitable for a heavier garment. The same hanger can be adapted for a children's garment by adjusting the length of the bar.

Construction
A hook is made at one end of the stainless steel wire, and the other end bent into a U-shape (Figure 43). Two holes are drilled into the bar to accommodate the hook: one in the middle and the other 3.0 cm (1 3/16 in.) from the centre (Figures 43 and 44). The foam round is slit lengthwise and the bar inserted. The foam round is longer than the bar so that it can be cut to the desired length and angle. A hole is perforated in the centre of the foam round for the base of the hook. The base is inserted into the hole in the foam round so that it completely exits the slit. The U-shaped part of the hook is inserted into the holes in the bar and the resulting bar/hook assembly is slid into the slit in the foam round (Figures 45 and 46). The ends of the foam round are cut to the desired length and shape. The hanger is padded or covered with stockinette (Figure 47) as described in Section 4.3. An incision is made at each end of the foam round with a knife, the fabric ends are then tucked inside the incisions using a spatula. Silicone tubing covers the hook to prevent the garment from coming into contact with the metal. The tip of the hook is bent back to keep the silicone tubing in place. To make a slope in the hanger to accommodate the garment, hold one side of the foam round and bend it downward, then repeat for the other side of the foam round. This helps avoid weakening the aluminum bar in the middle.

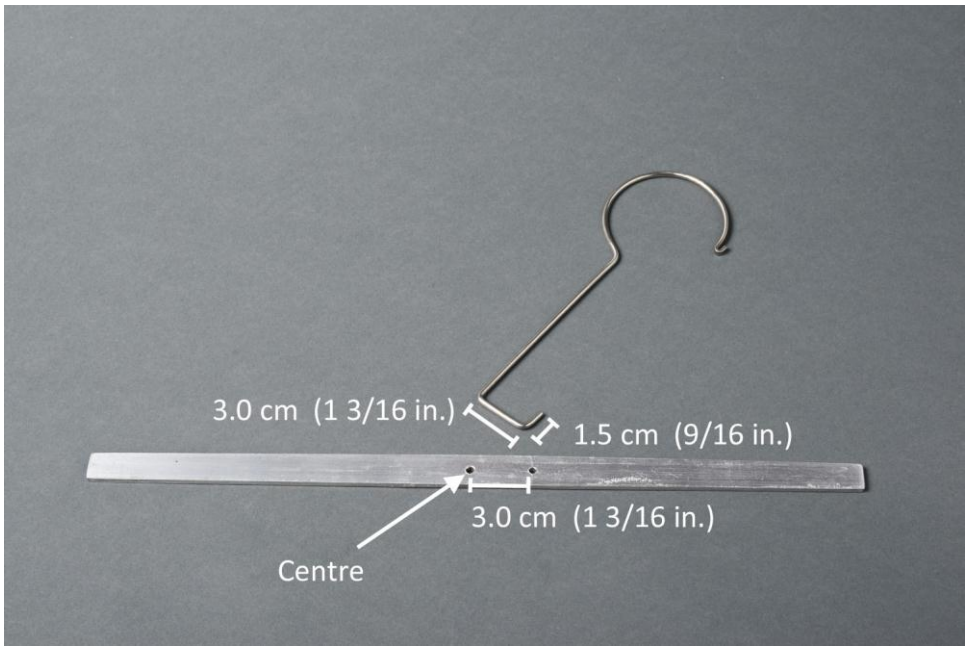

Figure 43
Hook and bar.

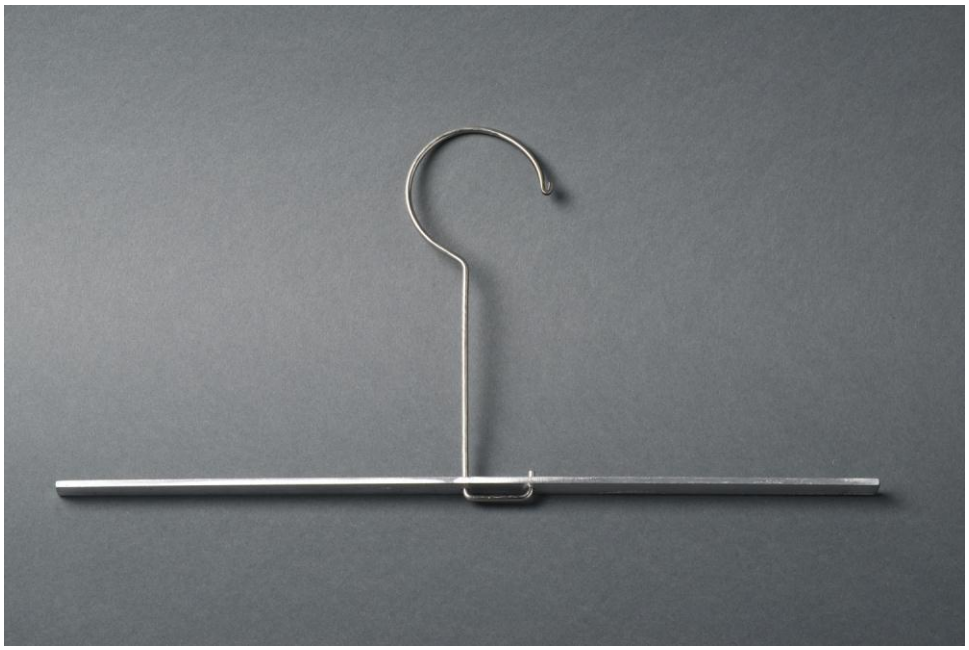

Figure 44
Assembled hook and bar.

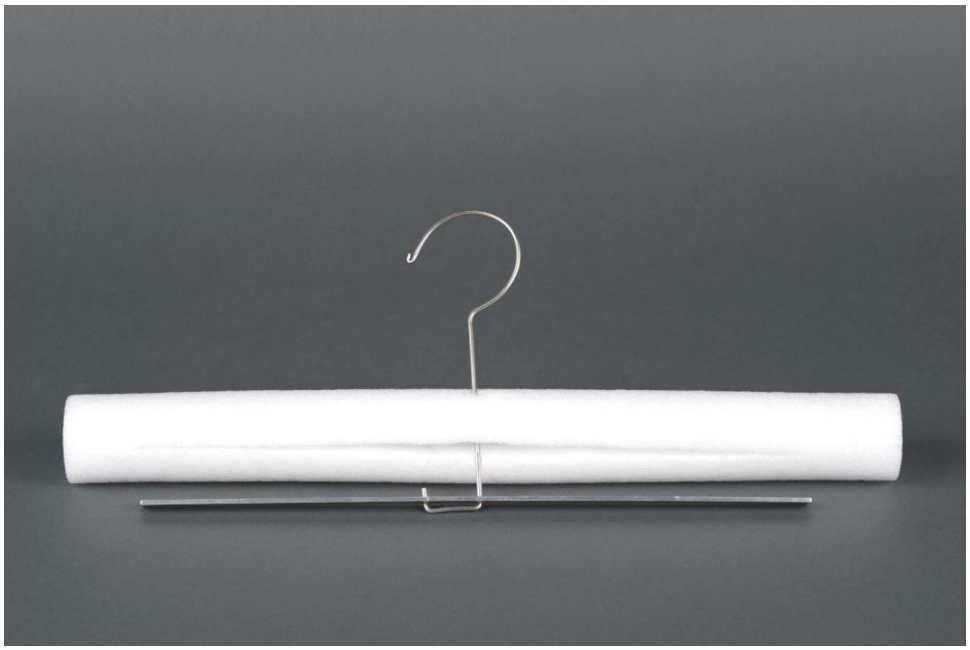

Figure 45
The hook and bar before inserting in the foam round.

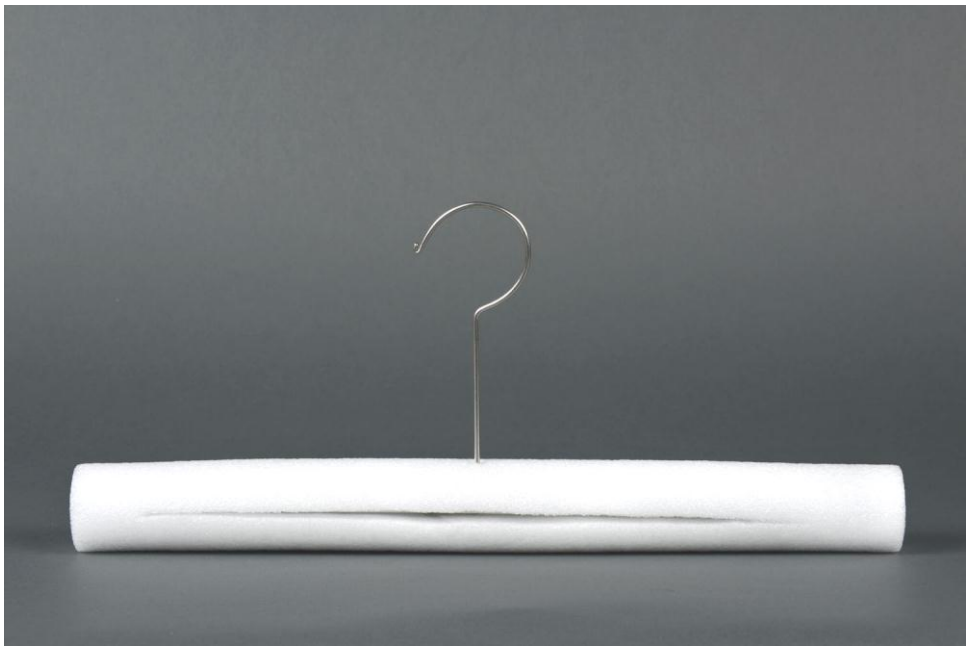

Figure 46
Inserted hook and bar.

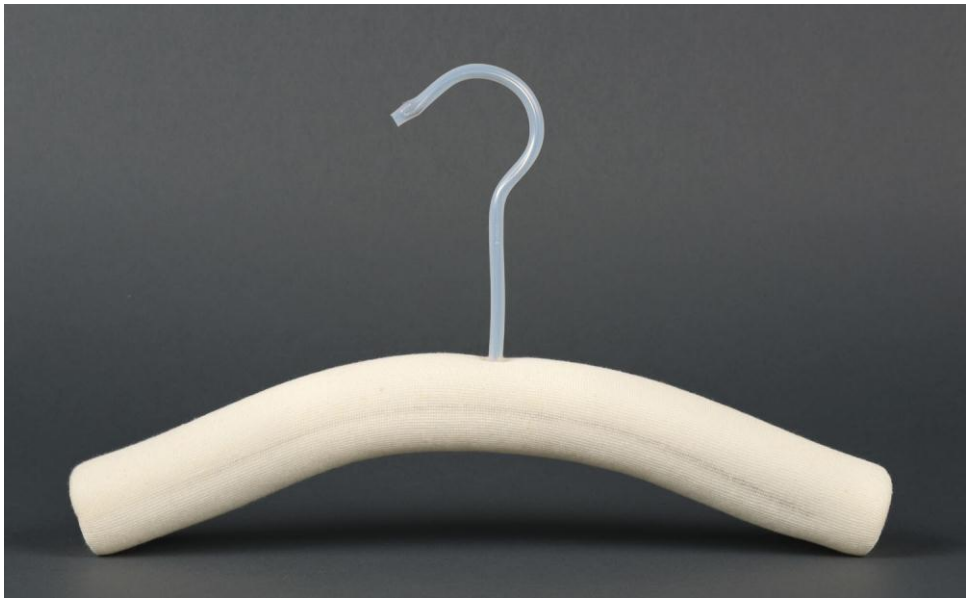

Figure 47
Hook covered with silicone tubing and polyethylene foam round with stockinette. Hanger bent into the desired shape.

Comments

- An easier way to insert the hook and bar into the foam round is to make an incision perpendicular to the lengthwise slit (Figure 48).

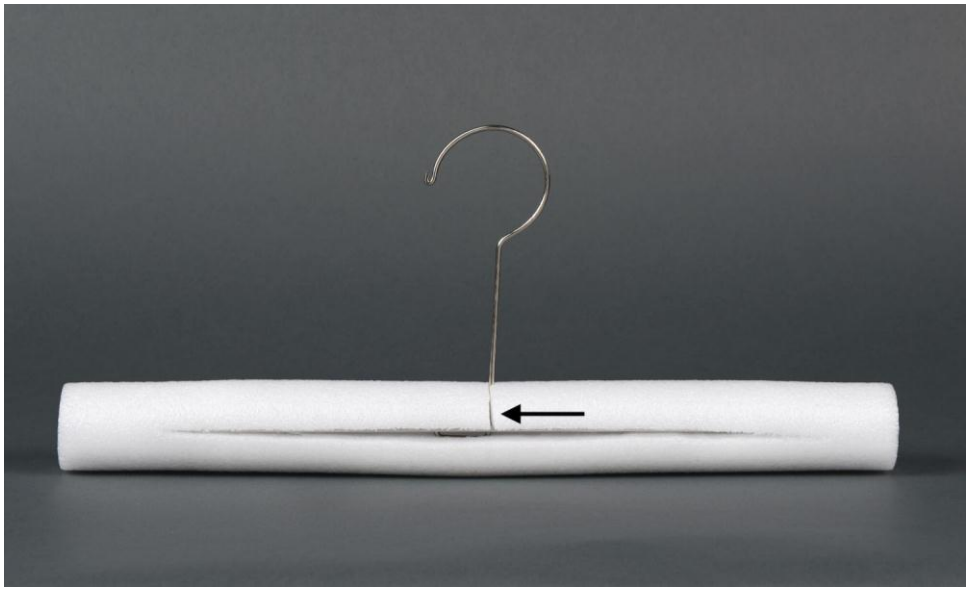

Figure 48
Incision perpendicular to the lengthwise slit.

- The short arm of the U-shape at the end of the hook is 1.5 cm (9/16 in.) long which is sufficient to stabilize the hook inside the bar.
- The silicone tubing keeps the hook in place.
- To prevent corrosion, we recommend applying two coats of B-72 solution to the aluminum bar.

5.0 Custom-made connector

This connector is made of stainless steel wire and silicone tubing.

Source
Custom-made by the Textile Laboratory at Parks Canada in Ottawa based on a hanger from ERA Group.

Dimensions
See Figures 49 and 50.

Application
This connector is used to hang a skirt or trousers on a hanger (Figure 52).

Construction
The connector is made of stainless steel wire. One end is bent so that it can be attached to the hook of a 1625 hanger (Figure 52). The other end is inserted into a hanger form made according to models outlined in Section 4.0.

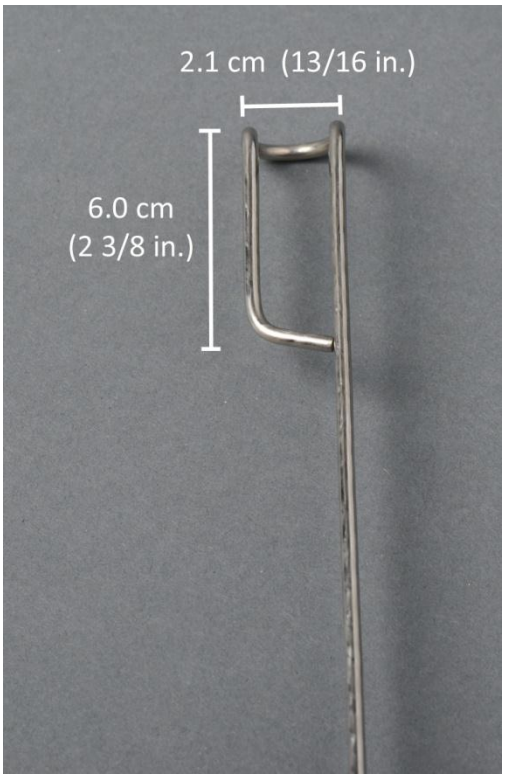

Figure 49
Connector, front view.

Figure 50
Connector, side view.

Figure 51
Connector inserted into a form.

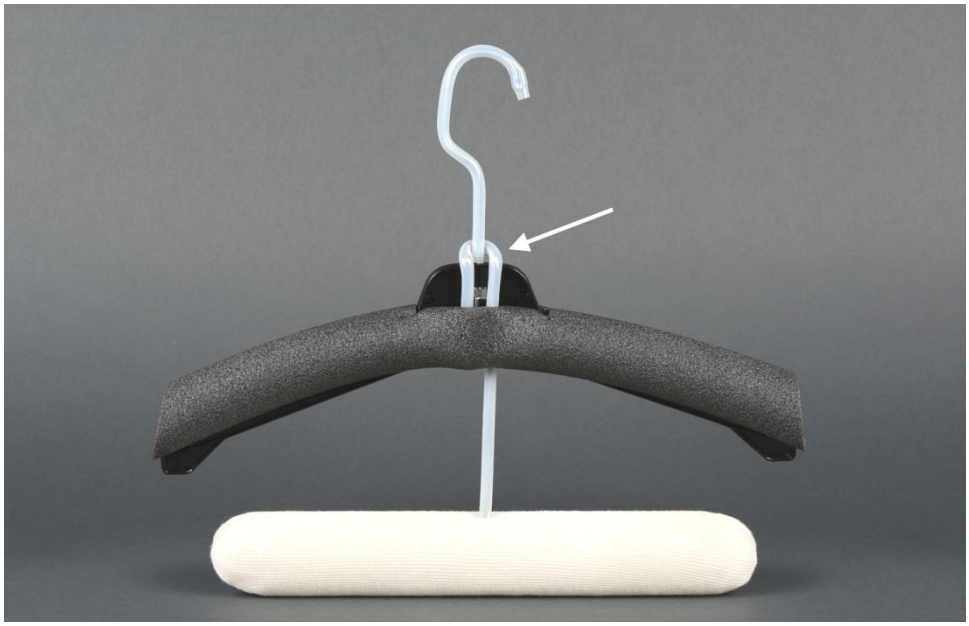

Figure 52
Form attached to a 1625 LH hanger.

Comments
N/A

6.0 Conclusion

When we first began this project, we stored clothing reproduction from Manoir-Papineau NHS on commercially produced clothes hangers as discussed in Section 3.0. Because storage space at Manoir-Papineau NHS is limited, all parts of a single garment (except for shoes) were put on the same hanger using commercially made connectors and clips. This project was a very valuable learning experience.

We are currently in the process of preparing the historic costume collection from the HMCS Haida National Historic Site (NHS) for permanent storage. The collection is in very good condition. We have used the 1625 model (Section 3.1) for men's coats, jackets and shirts, and the PM Model (Section 3.2) for trousers. Model 1625 was adapted for a variety of shoulder lengths as indicated in Section 3.1.1. When a garment required a shoulder length longer than 25.0 cm (9 13/16 in.), we used Model 4 as described in Section 4.4.

We adapted the various hanger models to suit our requirements while preparing the two collections. Other collections will undoubtedly lead to the development of other models.

Acknowledgments

During the 2005–2006 fiscal year, Simon Courcy, a curator with Parks Canada in Quebec City, asked the Textile Laboratory at Parks Canada in Ottawa whether they knew of a hanger that could be used for storing reproduction garments. This simple question led us to conduct research on hangers for reproductions and historic garments.

We would like to thank the conservators at the Royal Ontario Museum, the Canadian Conservation Institute, the Canadian Museum of History, the Centre de conservation du Québec and the McCord Museum, with whom we have discussed hangers used in conservation. In the course of our research, we also spoke with Jerry T. Shiner of Keepsafe Microclimate Systems (keepsafe.ca), who provided information on the 1625 and 1625 LH hangers.

We would also like to thank our colleagues at Parks Canada in Ottawa for their support: the Curatorial and Collections Management staff, with whom we discussed the hangers used in our collection; Flora Davidson, archeological conservator, who revised the report in English; Marni Wilson, photographic and imaging specialist, who produced the images for this document and finally Janice Brodie, textile conservator, for her special collaboration.

A special thank you to many colleagues who have since retired: Steve Duffield, furniture conservator and metalwork specialist, who selected suitable metals and made all the metal parts for the various hangers; Christopher Sergeant, conservation scientist, who analyzed all the materials; Guy Lavoie and Paul Cheatley of the translation department, who revised and edited the reports in French and English; Marthe Carrier, archeological conservator, who edited the digital images, revised the report in French several times and formatted the French and English versions; Ekaterina Nirtan Pasnack, a volunteer conservator, who found a simple way to firmly attach the pipe insulation to the 1625 and 1625 LH hangers and Brian Ford, a graduate of the Applied Museum Studies Program at Algonquin College of Applied Arts and Technology, who, during his summer job at Parks Canada, on his own initiative made hangers of different sizes to help determine shoulder length more quickly.

Lastly, John Stewart, formerly Head of the Analytical Section and now volunteer, who did the Oddy Test on selected materials.

Appendix A

Materials and Suppliers

Materials	**Suppliers**
Aluminum flat bar	Superior Metal Centre 2900 Old Sheffield Road, Unit 1 Ottawa, Ontario K1B 1A4 Tel.: 613-747-7511 Fax: 613-747-7148 superiormetal.ca
Commercial clothes hangers, clips and connectors	ERA Group 2500 Guénette Street Saint-Laurent, Quebec H4R 2H2 Tel.: 514-335-0550 Fax: 514-335-0571 Attention: Marie-Josée Reiher, ext. 247 eragroup.ca
Corrugated polyethylene/polypropylene sheets (Coroplast)	Sabic Polymershapes 1290 Old Innes Road, Unit 713 Ottawa, Ontario K1B 5M6 Tel.: 613-745-7043 Fax: 613-745-4291 sabic-ip.com Coroplast 900 Cowie Road Granby, Quebec J2J 1P2 Tel.: 450-378-3995 Fax: 450-378-0835 coroplast.com
Hot-melt adhesive, Thermogrip 6363	Lines'n Curves (formerly Archival Products) 169 Carrington Drive Richmond Hill, Ontario L4C 7Z8 Tel.: 905-737-1387 Fax: 905-737-0727 linesandcurves.com For products, visit universityproducts.com

Materials	**Suppliers**
Paraloid B-72 (ethyl-methacrylate copolymer)	Carr McLean Limited 461 Horner Avenue Toronto, Ontario M8W 4X2 Tel.: 416-252-3371 Fax: 416-252-9203 carrmclean.ca
Polyester batting	Lines'n Curves (formerly Archival Products) 169 Carrington Drive Richmond Hill, Ontario L4C 7Z8 Tel.: 905-737-1387 Fax: 905-737-0727 linesandcurves.com For products, visit universityproducts.com
Polyethylene foam rounds (PE Foam Rounds) See also the Trapezoidal Backer Rods made of polyethylene foam	Smith Induspac Ottawa Inc. 140 Iber Road Stittsville, Ontario K2S 1E9 Tel.: 613-742-6766 Fax: 613-831-2536 induspac.com University Products Inc. 517 Main Street Holyoke, MA 01040 Tel.: 1-800-628-1912 Fax: 1-800-532-9281 universityproducts.com

Materials	Suppliers
Polyethylene planks (Ethafoam)	Emballages Cre-O-Pack Int'L 8420 Darnley Road Mont-Royal, Quebec H4T 1M4 Tel.: 514-343-9666 Fax: 514-343-8385 creopack.com Attention: Eric Gagné ext. 241 Packing consultant egagne@creopack.com Distributor for Sealed Air sealedair.com Lovepac 140 Barr Street Saint-Laurent, Quebec H4T 1Y4 Tel.: 514-904-4300 Fax: 514-904-4301 lovepac.com Attention: Sophie Pépin, Sales Director sophie@lovepac.com Distributor for Sealed Air sealedair.com
Quilted unbleached cotton fabric	Testfabrics Inc. P.O. Box 3026 415 Delaware Avenue West Pittston, Pennsylvania 18643 USA Tel.: 570-603-0432 Fax: 570-603-0433 testfabrics.com
Silicone tubing (Catalogue No. 95802-09)	Cole Parmer 210-5101 Buchan Street Montreal, Quebec H4P 2R9 Tel.: 514-355-6100 Fax: 514-355-7119 coleparmer.ca
Stainless steel fender washers	Schooner Industrial Limited 87 Bentley Avenue Ottawa, Ontario K2E 6T7 Tel.: 613-224-5555 Fax: 613-224-0972 schoonerind.com

Materials	**Suppliers**
Stainless steel wire, OK Tigrod 308L, No. 161032R150	Linde Canada 1101 Parisien Street Ottawa, Ontario K1B 3R6 Tel.: 613-745-9455 Fax: 613-744-8786 lindecanada.com
Teflon-coated fabric, products 7025 and 7038	Silchem Inc. 200 Granton Drive Richmond Hill, Ontario L4B 1H7 Tel.: 905-709-5867 Fax: 905-709-5942 silcheminc.com
Tubular cotton jersey fabric (stockinette)	Local drugstores
Tundra® pipe insulation without adhesive	Canadian Tire canadiantire.ca
Unbleached cotton jersey fabric	Local fabric stores
Unbleached cotton tape	Cansew Inc. 111 Chanabel West, Suite 101 Montreal, Quebec H2N 1C9 Tel.: 514-382-2807 Fax: 514-385-5530 cansew.com

Appendix B

Identification of Materials Found in Hangers Used for the Storage of Historic Garments and Reproductions

by

Christopher Sergeant
Conservation Scientist

Identification of Materials Found in Hangers Used for the Storage of Historic Garments and Reproductions					
Sample No.	**Sample Catalogue No.**	**Sample Description**	**Information Required**	**Results**	
				Type of Plastic	**Can Be Used in Conservation**
1	PM27L	Hanger	Identification of plastic	Butadiene polystyrene	Yes
2	PM27L	Cushioning inside clip	Identification of cushioning	Butadiene polystyrene	Yes
3	726	Hanger	Identification of plastic	Isotactic polypropylene	Yes
4	726	Cushioning inside clip	Identification of cushioning	Polyvinyl chloride (PVC)	No
5	PM27	Hanger	Identification of plastic	Acrylonitrile butadiene polystyrene (ABS)	Yes
6	PM27	Cushioning inside clip	Identification of cushioning	Butadiene polystyrene	Yes
7	PCL900	Connector	Identification of material	Isotactic polypropylene	Yes
8	PCL400 (Sample A)	Connector	Identification of material	Isotactic polypropylene	Yes
9	69-5-090	Connector	Identification of material	Polyvinyl chloride (PVC)	No
10	----------	Starlette clip	Identification of plastic	Isotactic polypropylene	Yes
11	910	Big Grabber clip	Identification of plastic	Isotactic polypropylene	Yes
12	401L	Hanger	Identification of plastic covering	Polyvinyl chloride (PVC)	No
13	PCL400 (Sample B)	Connector	Identification of material	Isotactic polypropylene	Yes
14	PM36	Cushioning inside clip	Identification of cushioning	Butadiene polystyrene	Yes
15	1625 LH	Hanger	Identification of plastic	Acrylonitrile butadiene polystyrene (ABS)	Yes
The samples listed above were provided by the ERA Group, 2500 Guénette Street, Saint-Laurent, Quebec, H4R 2H2 Telephone: 514-335-0550 Fax: 514-335-0571, eragroup.ca.					

Appendix C

The Results of the Oddy Test on Materials for the Hangers Project

by

John Stewart
Conservation Scientist

INTRODUCTION:

The report "Hangers for the Storage of Historic Garments and Reproductions"[2] recommends several types of clothes hangers; the present work examines the constituent materials of these hangers to see if they are suitable for use for the storage of historic materials. This is done using an accelerated aging test commonly used in museums, the Oddy Test, first proposed by W.A Oddy of the British Museum in 1973[3,4,] . The test used here is a modified test proposed by the Smithsonian Institution and used at the Metropolitan Museum of Art, New York since 1994[5]

This test exposes the material being tested for a period of twenty-eight days to three different metals (silver, copper and lead) at 60°C and a relative humidity of 100%. This determines whether or not the material gives off gases or fumes that are corrosive to these metals; if corrosive gases are found to be present, it is reasonable to assume they are deleterious to other materials as well.

After twenty-eight days of testing the metal strips are visually examined and classified into three groups:

P Permanent. No visible corrosion. Suitable for permanent use.

T Temporary. Slight tarnish or film of corrosion; discolouration. Suitable for temporary use (less than six months).

U Unsuitable. Corrosion clearly visible. Unsuitable for display case or storage case use.

When Bamberger et al [5] studied replicate samples, the Oddy test was found to have a 90% degree of agreement. While this is not perfect and the test is qualitative rather than quantitative, the classifications resulting from the Oddy test "have given museum personnel useful and satisfactory guidance for many years regarding the suitability of materials." [5] .

PROCEDURE:

Test samples (2 to 3 cm pieces) of the different materials used in the coat hangers were cut off and subjected to the modified Oddy test.

The test used was in accordance with the test described by Bamberger et al [5], with the following exception.

The bottles used were not I-Chem flint glass jars but rather ProClean environmental containers, (120 mL clear short jars with 58mm Teflon lined caps[6]).

RESULTS

The results are shown in the following table.

[2] Thivierge, L, "Hangers for the Storage of Historic Garments and Reproductions", Report 2007-0123, (2015); Heritage Conservation and Commemoration Directorate, Parks Canada

[3] Oddy, W.A., "An unsuspected danger in display", Museums Journal 73 (1973) 27-28.

[4] Oddy, W.A., "The corrosion of metals on display", Conservation in Archaeology and the Applied Arts, IIC, London (1975) 235-237

[5] Bamberger J.A., Howe Ellen G., Wheeler George; "A Variant Oddy Test Procedure for Evaluating Materials Used in Storage and Display Cases", Studies in Conservation **44** (1999) 86-90

[6] While this should cause no problem to the test, they are awkward to use due to a convex inner bottom surface and it would be advisable to acquire the I-Chem flint jars.

Results of the modified Oddy test

#	Material	Metal	Permanent	Temporary	Unsuitable
1	Cushioning from the inside clip of a PM Model	Ag	X		
		Cu	X		
		Pb	X		
2	End pieces from the black plastic bar of a PM Model	Ag	X		
		Cu	X		
		Pb	X		
3	Hot-melt adhesive, Thermogrip 6263, before it was melted	Ag	X		
		Cu	X		
		Pb	X		
4	Black plastic clip from PM Model - probably same plastic as #2	Ag	X		
		Cu	X		
		Pb	X		
5	Black plastic pieces broken off at the shoulders of Model 1625 LH	Ag	X		
		Cu	X		
		Pb	X		
6	End of metal hook, coated with black paint, of Model 1625 LH	Ag	X		
		Cu	X		
		Pb	X		
7	PCL 400 connector	Ag	X		
		Cu	X		
		Pb	X		
8	PCL 900 connector	Ag	X		
		Cu	X		
		Pb	X		

Results of the modified Oddy test (Cont.)

#	Material	Metal	Permanent	Temporary	Unsuitable
9	Silicone tubing	Ag	X		
		Cu	X		
		Pb	X		
10	Plastic pieces from hook of Starlette clip	Ag	X		
		Cu	X		
		Pb	X		
11	Plastic pieces 2cm from the end of hook of Big Grabber clip	Ag	X		
		Cu	X		
		Pb	X		
12	Tundra pipe insulation	Ag	X		
		Cu	X		
		Pb	X		
13	Formed metal strip coated with B72 from the Big Grabber clip	Ag	X		
		Cu	X		
		Pb	X		
14	Formed metal strip from the Starlette clip	Ag	X		
		Cu	X		
		Pb	X		
15	White foam cover at shoulders of CMH hanger	Ag	X		
		Cu	X		
		Pb	X		
16	White plastic cap from end of shoulders of CMH hanger (#15)	Ag	X		
		Cu	X		
		Pb	X		

Results of the modified Oddy test (Cont.)

#	Material	Metal	Permanent	Temporary	Unsuitable
17	Polyethylene foam rounds	Ag	X		
		Cu	X		
		Pb	X		

Samples 1, 2, 4-8, 10, 11, 13 and 14 were provided by the ERA Group, 2500 Guénette Street, Saint-Laurent, Quebec, H4R 2H2 Telephone: 514-335-0550 Fax: 514-335-0571, eragroup.ca

Samples 15 and 16 were provided by the Textile Conservator at the Canadian Museum of History (CMH) in Gatineau, Quebec.