Development of a prototype: A rolling mechanism to aid the installation of oversize works on paper

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ABSTRACT

This paper outlines the use of a mechanism to aid the installation of oversize works on paper. It describes the design development, its use and modifications.

The mechanism consists of a vertical roll, mounted onto a turntable that is attached to a hydraulic adjustable lift table. A ball bearing system located above the roll allows it to rotate so that the artwork can be slowly delivered onto the gallery wall.

KEYWORDS

oversize photograph, installation, display, pinned works on paper, unrolling

INTRODUCTION

The Queensland Art Gallery | Gallery of Modern Art (QAG | GoMA) has an ever growing number of oversize works on paper in its contemporary collection. The ratio of oversize works compared to the rest of the works on paper within the collection is 250/7699, currently about 3%. These works are varied in media; ranging from inks, acrylics and collages to photographic and digital prints.

Although many oversize works are acquired into the collection mounted and ready for display, more often they are acquired with no hanging system attached. Some of these latter works due to both their size and construction require thoughtful consideration in order to devise a suitable system for display.

The work titled *Night revels of Lao Li*, by Wang Qingsong, a large chromogenic print measuring 127cm high and 972cm long, was required for display in early 2009.

Prior to March 2009 Wang Qingsong *Night revels of Lao Li* had been installed on two previous occasions, at QAG in 2002 and at GoMA in 2007. On both occasions it had been installed by unrolling the work supported against the wall, with staggered pinning along the upper edge. Once the work was completely unrolled with the work flat against the wall the entire top edge was pinned.

These installations were labour intensive, requiring 15 installation staff. The dual operation of both rotating and supporting the load of the roll was governed by 3 staff who dictated the pace of the installation, which was over 3 hours. These roles were taxing. Due to the length of time required it was necessary to exchange staff as they became fatigued. Another 2 staff controlled the tension of the work around the roll and synchronised their applied pressure with the team unrolling.

The remaining members of staff were employed to monitor the alignment and support the pinned length until the work was completely unrolled onto the wall. The precision required to retain the work at the exact height meant progress was slow and tiring. We wanted to devise a method which reduced fatigue for the staff involved and created a controlled delivery as the work was unrolled onto the wall. Therefore plans were jointly undertaken between QAG | GoMA workshop and the conservation department to develop a mechanism which would aid the installation of this work.

Our key objectives in developing the mechanism were to simplify installation by:

- Reducing the amount of direct handling for the sakes of both the artwork and installation staff,
- Increasing the degree of control in transferring a rolled work to the wall,
- Providing support to the roll at the correct height throughout the installation process.

This mechanism has subsequently been adapted and utilised for the installation of another oversize work, *King of the beasts* by George Gittoes and Nunelucio Alvardao, an acrylic on heavyweight paper measuring 200cm high and 568cm long.

INITIAL IDEAS

In developing the mechanism, existing commercially-made roll dispensers were investigated (see Figure 1). However they had limited application since they were only designed for specific roll widths and had narrow diameters. These dispensers could not be adapted to a range of different heights without compromising the integrity of the square steel tube framework.

Figure 1: Commercial vertical roll dispenser available from Blick Art Supplies online catalogue, <http://www.dickblick.com/products/vertical-paper-roll-racks/#photos> (please refer to Equipment list for further details).

Therefore, it was decided to create a custom-made device. In consultation with workshop staff, the particular requirements were identified and their knowledge of existing engineering devices was utilised to produce the mechanism.

The use of ball bearing turntables were considered as these are used in swivelling displays and industrial assemblies, where the ball bearings are housed in a circular race providing smooth stable motion, (see Figure 2). However, there was concern regarding the weight of the roll compromising the turning ability of the turntable and the difficulty in maintaining a true vertical axis.

Figure 2: Example of a ball bearing turntable ('Servocity online catalogue' 2008)

To overcome this concern an alternative ball bearing system was used for the mechanism. This ball bearing system operated within a housing above the roll. This achieved fluid rotation around a fixed central vertical axis with the weight distributed into a welded holster at the base, (see Figure 4).

STRUCTURE OF THE MECHANISM

The entire structure was secured to a hydraulic adjustable lift table with 2 clamps along the base platform, (see Figure 3). The hydraulic function of the table was hand operated which allowed for subtle adjustments in height and ensured that height adjustments were slow, smooth and controlled. The lift table enabled the work to be supported at the correct display height throughout the installation. The hydraulic system provided the required flexibility to make minor height adjustments in order to compensate for irregularities of the floor surface.

The base platform was constructed from plywood, cut into a triangular shape. A metal plate was attached to the base platform by screws. The longest side of the platform glided along the wall with the aid of inline skate wheels which were secured at either end (see Figure 3).

At each corner of the triangular base platform 2-3 upright supporting rods were bolted, depending on the height of the roll used (refer to installation section for full explanation). These supporting rods created a rigid framework for the mechanism and were also bolted to the top platform. The triangular configuration of the framework allowed for ready access to either side of the roll during installation.

Figure 3: Photograph of the mechanism

There are a number of elements to the mechanism that can be clearly understood with the aid of the schematic diagram (see Figure 4). The sequence of these elements, as listed below, correspond to the order of assemblage.

The metal plate attached to the base platform had a hollow tube welded at the centre which created a holster for the solid central rod to fit into. The central rod easily rotated within this holster as the internal diameter of the tube was 23mm compared to the 20mm diameter of the solid rod (see Figure 4).

The central rod was fitted with a hilt; a metal disc welded 110mm from the end of the rod. Attached to the hilt was a circular plywood disc which created a ledge at the base of the roll and was secured with screws from the underside of the hilt. Together both discs supported the entire weight of the roll above. On assembly a second set of screws (through the underside of the hilt) extend into the barrel of the roll, securing the roll to the central rod, (see Figure 4).

The roll was a polyvinyl chloride (PVC) pipe with 2 plywood discs inserted into either end. These discs were held in place with 4 countersunk screws that were equally spaced around the perimeter. Each plywood disc had a central hole allowing the central rod to extend thru the entire length the roll. The entire roll was covered with Mylar.

Figure 4: Schematic diagram of key features for the mechanism (created by S.Shellard with 3D modelling by D.Azzarello).

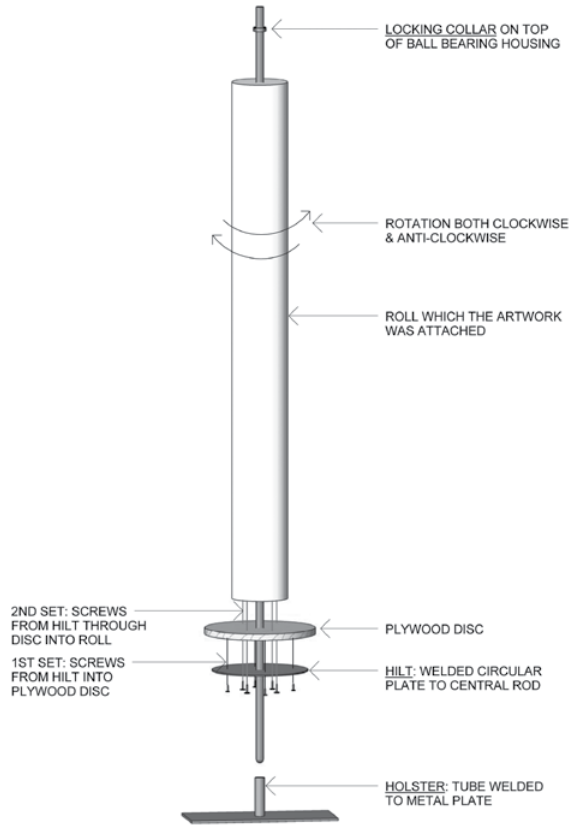

FIGURE 4: SCHEMATIC DIAGRAM OF KEY FEATURES FOR MECHANISM

The top platform, was also constructed from plywood and cut into the same triangular shape as the base platform. Located on the top and in the centre of this platform was the ball bearing housing. On assembly, the holes within the top platform were located over the supporting rods and central rod and gently lowered onto the bolts of the supporting rods. The locking collar of the ball bearing housing was secured around the central rod with grub screws. This engaged the internal ring of the ball bearing to enable the central rod to rotate in a clockwise and anticlockwise direction (see Figure 5 and Figure 6).

Figure 5: Cross section illustration of a ball bearing (New technology network 2008).

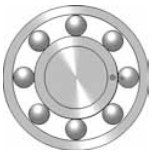

Figure 6: Circular movement of the ball bearing around a fixed point (PlusMinus 2008).

INSTALLATION OF *NIGHT REVELS OF LAO LI*

Treatment and preparation

As with all pinned works the previous pinning had resulted in enlargement of the pinholes, with minor tears to some. During the previous installation in 2007 a minor tear on the lower edge had also occurred.

Prior to installation with the mechanism, minor treatment was carried out and the work was also prepared in order to temporarily attach it to the roll of the mechanism for the installation process.

All pinholes were mechanically closed up. They were then re-enforced on the verso of the work. This was done using small 10mm diameter circles of Tyvek® (75gsm, smooth finish on both sides) using Lascaux 498HV/368HV ® (2:1) adhesive as a heat set film. After each Tyvek®/Lascaux® re-enforcement patch was placed in position it was bonded with a heated spatula set at 70°C. The tear was also repaired with a Tyvek®/Lascaux® patch in the same manner.

Placing work onto the mechanism

To prepare the work for attachment to the roll of the mechanism, small patches of the Tyvek®/Lascaux® adhesive were attached down the left side of the work. Tabs of Mylar® (75 microns) 50mm long x 20mm wide were fixed to these Tyvek® patches using Tyvek® self adhesive tape. The purpose of these tabs was to secure the work to the roll of the mechanism to ensure it did not slip during installation and also to retain tension on the work so it did not become uncoiled.

The work was rolled onto the mechanism roll the day prior to installation. This was done as close as possible to the installation time to avoid any unnecessary increase in curvature to the work due to the size difference between the 150mm diameter roll of the mechanism and the 420mm diameter roll the work is stored on.

The work was completely unrolled from its storage roll onto a length of adjacent tables secured together with clamps. The work was first test-rolled onto the Mylar® covered mechanism roll to ensure it was tracking straight. It was then unrolled and the Mylar® tabs extending past the end of the work were secured to the covered roll using Filmoplast® P90 tape. A strip of Light Impressions® paper was placed over the Mylar® tabs to isolate them from the work when rolled. The work was rolled face in, ensuring that it was aligned squarely on the roll.

When the work was completely rolled double strips of Light Impressions® paper (80mm wide), were wrapped around the work and secured with Filmoplast® P90 tape. These paper strips were placed at intervals approximately 200mm apart along the length of roll to ensure the work stayed secure and tensioned on the roll.

The central rod was then placed through the centre of the roll. Screws were used to secure the hilt and plywood disk to the roll.

A 50mm wide strip of Cell-air was wrapped around the lower edge of work and secured with cotton tape below the artwork to ensure there was no slip of the work.

All of the above preparation work was carried out in the conservation lab. The rolled artwork and the mechanism were then taken separately to the gallery space and assembled there. When ready for installation the rod/roll element was inserted into the holster. The top platform was threaded through the ends of the central and 2 supporting rods and secured. The grub screws of the locking collar on the ball bearing housing were tightened. Only two upright supporting rods were used in this installation, one at the front left corner and one at the rear corner. The third was not necessary for stability and having no upright rod where the work comes off the roll meant easier access to the work.

Installation

The roles of the installation team were as follows:

- One person directing the installation team, pinning the work and checking against the sightline as installation progressed.
- One person controlling/driving the table.
- One person controlling the unrolling of the work keeping pressure on it to retain the rolled tension and prevent slippage or uncontrolled unrolling of the work.
- An additional four people to hold the work in position on the wall as it was unrolled and until it was fully pinned.

The work was installed from right to left so as to pull the mechanism along the wall rather than push it. This meant that the mechanism was not travelling past the already installed artwork.

An upper edge sightline and corner locations had been marked on the wall to assist with the installation. The mechanism was lined up so as to run along the wall. The height of the hydraulic table was adjusted so the top edge of the work aligned with the sightline on the wall. We found it beneficial to have the work a few millimetres too high to allow for gravity while installing the work.

When the work was aligned correctly both against the wall and at the correct height, the mechanism was moved along the wall to sit approximately one metre from the corner edge markings on the wall. The paper strips securing the roll were then removed while one person held the work to keep the roll tensioned and prevent any unnecessary unrolling. Using two people, one at the upper and one at the lower corner of the work, approximately 1m of the work was initially unrolled with the mechanism stationary. The unrolled section of work was set against the markings on the wall.

It is important to note that the person controlling the speed of unrolling the work was required to maintain continuous pressure against the rolled work to ensure that the rolled tension was maintained and that there was no slippage of the work down the roll during the installation process.

The unrolled section of the work was held against the wall with nitrile gloved hands by two people, using the broad surface area of their palms rather than their fingertips, creating flat hand pressure. Once the work was aligned correctly along the sightline, we checked that the work was sitting smoothly against the wall. When correctly aligned a pin was placed in the end corner. Clear headed push pins were used. The next pin was placed two pinholes along. After double-checking that it sat smoothly a pin was placed in the pinhole between the two previously pinned holes (see Figure 7). This pinning sequence was used for the remainder of the work.

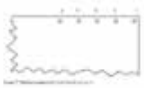

Figure 7: Sequence of pinning

After the first unrolled section was pinned, the work was unrolled further by moving the mechanism approximately 80cm at a time, exposing two pinholes with every section. To do this the person controlling the roll communicated with the mechanism driver, which ensured the work was unrolled in a slow and smooth manner. As the mechanism moved along the wall, additional staff came in to hold the work against the wall (see Figure 8). The work continued to be unrolled and pinned to the wall in this manner

until the end of the work became visible on the roll. At this point the adhesive tapes securing the tabs to the roll were sliced with a scalpel blade while the end of the work was held. The end was then held out from the roll and the mechanism was driven further along the wall out of the way. Before being laid against the wall the Mylar® tabs were folded back against the work so they were out of sight. The tabs were retained on the work so it could be re-secured to the roll when it was deinstalled. The final pins were put in position following alignment.

The process was simply reversed for de-installation.

Figure 8: Installation of *Night revels of Lao Li*

Observations made during the installation process

We found from the time of alignment to the work being fully pinned to the wall took close to 1 hour using 7 people. This was a significant advancement when compared to the previous installations, each taking 3 hours with 15 staff.

Overall after the first use of the mechanism we were very happy with the relative ease with which the work was installed, particularly in terms of the work's safety and the health and safety of the staff involved.

The following points were noted for future use of the mechanism.

- During the installation process we had to emphasise to installation staff that they needed to apply flat hand pressure against the work directly onto the wall rather than push with the heel of their palms. The latter movement has a slight upward motion which increases the likelihood of creating slight buckling and minor distortions along the top edge of the installed work.
- During the installation it was only necessary to have 3 people supporting the work on the wall as the remainder of the work was supported on the roll, thereby reducing the number of people required to 6 people for installation of this work.
- Once installation commences it is preferable to continue travelling in one direction, rather than attempt to reverse the direction mid installation. This limitation is due to the design of the wheels on the hydraulic lift table we used. This table has two front wheels in a fixed orientation and two back wheels that are multi-directional. Once aligned the table tracks smoothly in one direction, however if you decide to then go in the opposite direction the multi-directional wheels splay out to the side which results in the table becoming misaligned from the wall. This misalignment occurs whenever the direction, i.e. forward or backward motion, is changed.
- Before adjusting the height of table it is necessary to ensure that the skate wheels (guides) are not against the wall, otherwise they can mar the surface.

INSTALLATION OF *KING OF THE BEASTS*

In June 2009 the mechanism was modified for installation of George Gittoes and Nunelucio Alvarado's collaborative work *King of the beasts*. This is an acrylic on heavyweight paper measuring 200cm high and 568cm long. There are some stable impasto areas of media and this was taken into consideration when modifying and using the installation mechanism.

Preparation

Again the work was prepared prior to installation. The work had been previously displayed on only one occasion, at the Canberra Contemporary Art Space where it was executed in 1993. It came into the QAG collection in 1994 and this was the first time it was being displayed. When previously installed the work had been pinned around the perimeter with what appeared to be thumbtacks from the indentations evident in the support. All 153 pinholes were enlarged to varying degrees. Consultation and discussions with curatorial staff regarding the proposed and future displays confirmed that it is always intended to be pinned to the wall for display. For this reason all pinholes were re-enforced on the verso with RK-20 Japanese tissue impregnated with 3 applications of 2% w/v Klucel G I (hydroxypropylcellulose) in acetone. It was found in testing various reinforcement papers that impregnating the paper with the Klucel G® served to strengthen it against tearing and hole enlargement. These patches were attached to the verso of each pinhole with 2% w/v methyl cellulose (high substitution) in deionised water following mechanical closure of each pinhole.

To allow the work to be fixed to the roll of the installation mechanism, Mylar® tabs were attached to the verso down the left edge. The 6 tabs were made of a Mylar® strip attached with pressure sensitive Tyvek® tape to a 4cm square of RK-20 Japanese tissue that had been adhered to the verso of the work with 2% w/v methyl cellulose.

Modification of the mechanism

As this work was significantly taller in height than *Night revels of Lao Li* (200cm as opposed to 127cm) the roll and the mechanism required modification prior to its use. Workshop staff were consulted and the following changes were made:

- The Lift table was exchanged for one with a lower platen, subsequently allowing the work to hang at the required height.
- A longer and wider diameter roll (240mm) was used. Additionally, due to the impasto areas on the work, the roll was covered in a layer of thick Cell-Air® foam and then covered with glassine paper. The join along the glassine was covered in Tyvek® tape, which was used for its slick surface texture. The Mylar tabs were then secured to this.
- All three upright threaded support rods were required to stabilise and support the increased weight and height of the roll. The third rod, positioned where the work feeds off the roll onto the wall, was covered in Cell-Air® to prevent possible abrasion damage if the work accidentally came into contact with the rod.
- To provide further stability, two cross braces were also attached to the side of the mechanism (see Figure 9).

Figure 9: Installation of *King of the beasts*

Installation

The process of installation was basically carried out in the same way as described for *Night revels of Lao Li* with the following minor differences:

- A laser sightline was used during the installation of the work as a trial to see if this differed greatly in terms of time taken to 'mark up' the wall and ease of use for installation. It was found to be efficient and effective; with the only drawback being that it would periodically switch itself off throughout the installation period and needed to be switched back on.
- Long padded lengths of cardboard were used to assist in holding the ends of the work against the wall during installation. This was to help counteract the strong curl of the work over the length of each side. The board in use can be seen in Figure 9.
- The pinning sequence varied. The pinholes in this work are quite close together, at an average of 9cm apart along the upper and lower edges and 9-13cm down the side edges. During the installation process it was more expedient to pin every second hole along the upper edge. When this was completed it was ensured that work was aligned correctly. Pins were then placed along the lower edge from the centre out, again in every second hole. The side edges were then pinned, and then finally the remainder of the pins were placed in all existing pinholes.
- Thumbtacks sprayed with flat white enamel paint were used. A 2mm long spacer of silastic laboratory tubing (1.02mm ID x 2.16mm OD) was placed over the shaft of each pin to hold the head from the surface of the work in order to prevent any further indentations from the head of the thumbtack.

Again, the mechanism proved very effective in installing this artwork in a safe and efficient manner, particularly in terms of the work's safety and the health and safety of the staff involved.

CONCLUSION

On the two occasions when the mechanism was used, it proved to be a very effective and efficient aid in what would otherwise be cumbersome and challenging installations.

Although this device has made the task of installation considerably easier, there are improvements to the mechanism which we plan to implement that will streamline its overall design and performance. We are currently looking at constructing the mechanism predominately from metal to create a stable structure over a range of sizes.

Our ultimate aim is to create a mechanism which is readily adaptable to the varying dimensions and range of substrates of the rapidly expanding QAG | GoMA contemporary collection.

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PlusMinus, 2008, 'Circular movement of the ball bearing around a fixed point', accessed 21 November 2008 <http://wpcontent.answers.com/wikipedia/commons/3/30/BallBearing.gif>.

EQUIPMENT LIST

Commercially-made roll dispensers
Blick Art Materials
P.O. Box 1267
Galesburg, IL 61402-1267
United States

Phone: + (309) 343-6181 (International)
Facsimile: + (309) 343-5785Product item 12909-1000
Rack without casters single roll
< http://www.dickblick.com/products/vertical-paper-roll-racks/#photos>

Hydraulic adjustable lift table
Available from Materials Handling Ltd
30 Boron Street
P.O. Box 104
Sumner Park, Brisbane 4074
Queensland, Australia
Phone: +61 (0) 7 3376 9799
Facsimile: +61 (0) 7 3376 9899
Email: sales@materialshandling.com.au
<http://www.materialshandling.com.au/pc-249-51-mobile-scissor-lift-tables.aspx> Search: Scissor lift platforms>Ergonomic lift Devices>Mobile Scissor Lift Table [This firm no longer stocks the model we used however the following model is the closest in terms of size and features] Product code SKU MLT300 Capacity: kg 300; Type: Manual; Action: Single; Deck size: 500 x 830 mm; Height: 285-880 mm

Ball Bearing Pillar Block Housing
Available from Blackwoods
Contact person Scott Longton
[Email Scott.Longton@blackwoods.com.au]
164 Saltwater Creek Road
Maryborough 4650

Phone: +61 (0) 7 4121 2329
Facsimile: +61 (0) 4123 1167
Email: eBusiness@blackwoods.com.au
2 separate parts; Ball Bearing Pillar Block/ Housing & Nachi Bearing size 20mm
02175633
Steel Rods 20mm diameter with thread on end & M20 Nuts

Inline Skate board wheels
101 Albert Street
Brisbane 4000
Phone: +61 (0) 7 3220 0157
Facsimile: +61 (0) 7 3221 5150
Email: skate@skatebiz.com.au
Inline Skate board wheels
Product item: Recreational inline wheel size diameter 80mm, hardness of wheel =78a in urethane compound (Clear) [Clear wheels were selected so as not to mark the wall]

MATERIALS LIST

Cell-Air | Foam
Signet
1/57 Assembly Street
Sailsbury QLD 4107
Phone: 1300 744 638

Filmoplast®P-90 tape, 20mm x 50M
Archival Survival
PO Box 1139,
Doncaster East Vic 3109
Phone: 1300 78 11 99
Fax: 1300 78 11 46
Email: info@archivalsurvival.com.au
Website: www.archivalsurvival.com.au/index.htm

Preservation Australia
PO Box 210
Enmore NSW 2042
Phone: 1300 651 408
Fax: 1300 651 406
Email: info@preservationaustralia.com.au
Website: www.preservationaustralia.com.au

Klucel G ® (hydroxypropylcellulose)
Talas
330 Morgan Ave
Brooklyn, NY 11211
Phone: 212-219-0770
Fax: 212-219-0735
Website: http://talasonline.com/

Lascaux Acrylic Adhesive 360HV and 489HV ® (thermoplastic copolymer butyl-methacrylate dispersion thickened with acrylic butyl-ester.)
Talas
330 Morgan Ave
Brooklyn, NY 11211
Phone: 212-219-0770
Fax: 212-219-0735
Website: http://talasonline.com/

Light Impressions® Unbuffered Renaissance™ 45 gsm watermarked tissue, 825mmx100m
Archival Survival
PO Box 1139,
Doncaster East Vic 3109
Phone: 1300 78 11 99
Fax: 1300 78 11 46
Email: info@archivalsurvival.com.au
Website: www.archivalsurvival.com.au/index.htm

Mylar®/Melinex® 516 Polyester (FILMYL75UM-100) DuPont™
Archival Survival
PO Box 1139,
Doncaster East Vic 3109
Phone: 1300 78 11 99
Fax: 1300 78 11 46
Email: info@archivalsurvival.com.au
Website: www.archivalsurvival.com.au/index.htm

Methyl cellulose (High Substitution)
Fisher Scientific UK
Bishop Meadow Road
Loughborough Leicestershire LE11 5RG
E-mail: UK.international@thermofisher.com
Website: http://www.fisher.co.uk/

Nitrile gloves (Ansell)
Non-Sterile, Synthetic, powder-free examination gloves, Medical Grade Quality, contains no nautral nubber latex, thiyram free
Labtek Pty. Ltd.
PO Box 5316
Brendale QLD 4500
Phone: 07 3881 1388

PVC piping (PVC: a hard-wearing synthetic resin made by polymerizing vinyl)
Pipe King
32 Clinker Street
Darra 4076
Phone: +61 (0) 7 3715 8844
Facsimile: +61 (0) 7 3715 8855
Email: brisales@pipeking.com.au
Product code SW150 Item Storm
Water Pipe 150 mm diameter page 10
Product code SW225 Item Storm Water
Pipe 225 mm diameter page 11
http://www.pipeking.com.au/products/catalogue.pdf

RK-20 Japanese Kozo Tissue (Japanese Restoration Paper on Roll 1 x 61 metres 40gsm)
Paper Nao
4-37-28 Hakusan
Bunkyo-Ku
Tokyo 112-0001JAPAN

Silastic laboratory tubing (CAT NO 508-005)
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PO Box 322
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Phone: 07 3899 1300

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Phone: 1300 78 11 99
Fax: 1300 78 11 46
Email: info@archivalsurvival.com.au
Website: /www.archivalsurvival.com.au/index.htm

Tyvek® Tape (self adhesive), 38mm wide x 46M roll
Pressure sensitive, permanent acrylic adhesive with a white, spun-bonded polyethylene carrier.
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Email: info@archivalsurvival.com.au
Website: /www.archivalsurvival.com.au/index.htm

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BIOGRAPHIES

Kim Barrett has been Conservator, Works on Paper at the Queensland Art Gallery since 2008. She worked as Exhibition Conservator at the State Library of Queensland from 2007-2008, Conservator at the Museum and Art Gallery of the Northern Territory from 2000-2007 and Paper Conservator at the Australian National Maritime Museum from 1998-1999. Kim has a B.App. Science in the Conservation of Cultural Materials (1997) and a Graduate Certificate in Applied Science, Cultural Heritage Studies, Photographic Conservation Specialisation (2003) from the University of Canberra.

Samantha Shellard has been Conservator, Works on Paper at the Queensland Art Gallery | Queensland Gallery of Modern Art since 2002. She worked as Paper Conservator at the State Library of Victoria from 1995-2002. She has a BAppSc in the Conservation of Cultural Materials (1994) from the University of Canberra.

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