Horizontal Systems

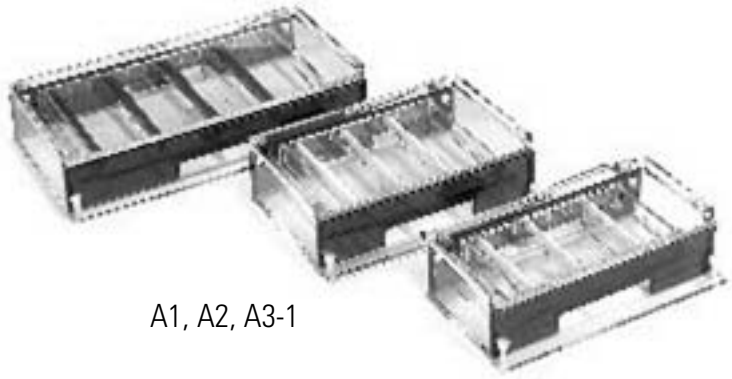
Models A1, A2, A3-1, A5, and M6

Operating and Maintenance Manual 7007301 Rev. 0

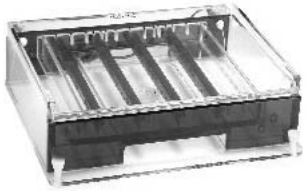


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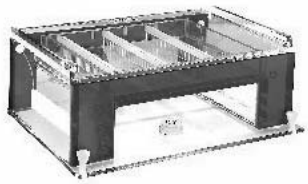
Owl Separation Systems



A1, A2, A3-1



A6



A5

MANUAL NUMBER 7007301

REV	ECR/ECN	DATE	DESCRIPTION	By
0	--	4/10/12	Transfer to Marietta (was 3/2005)	ccs



Important Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

Caution All internal adjustments and maintenance must be performed by qualified service personnel. ▲

Warning To avoid the risk of personal shock, always disconnect the gel box from the power supply. Further, the power supply must be equipped with a shutdown-on-disconnect circuit. Do not move the unit unless the power source to the unit has been disconnected. ▲

Statement of Proper Use: Use this product only for its intended purpose as described in this manual. Do not use this product if the power leads are damaged or if any of its surfaces are cracked.

Running conditions for this unit should not exceed the name plate readings found on the lower buffer chamber.

This Owl System is designed to meet IEC 1010-1 safety standards (IEC 1010-1 is an internationally accepted electrical safety standard for laboratory instruments).

Material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. Thermo Fisher Scientific makes no representations or warranties with respect to this manual. In no event shall Thermo be held liable for any damages, direct or incidental, arising out of or related to the use of this manual.

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Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.



Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.

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Section 1 General Information

The Model A1 horizontal large system has the smallest footprint of the large format device, giving you a space saving device for your extended runs. This system is ideal for detailed RNA/DNA analysis. The unit runs from 8 to 96 samples on one gel. A wall comb is available for running shorter gels and conserving agarose. A programmable power inverter may be used for field reversal electrophoresis.

The Model A2 horizontal large system is a simple, convenient and fast system for detailed DNA/RNA analysis on multiple samples. This system offers the widest variety of comb options and when used with a wall comb you can cast varying length gels to conserve agarose.

The Model A3-1 horizontal wide system can run from 25 to 600 samples on one gel. The gel can be cast in varying lengths to help conserve agarose when fewer samples need to be run utilizing a wall comb. This unit comes with built in buffer exchange ports to allow for buffer recirculation on extended runs, if needed. The large number of comb slots gives you sample and resolving distance flexibility.

The Model A6 horizontal wide system offers a simple, convenient and fast method for screening multiple samples on a single agarose gel. 25 to 500 samples can be run simultaneously on one gel; producing clear, tight banding patterns with no “smiling”.

The Model A5 recirculation system offers convenience and versatility. The A5 recirculation system prevents formation of pH and ionic gradients for high resolution and uniform reproducible results. The A5 is ideal for long runs, multiple sample sets or RNA gels. This unit delivers clear results for samples run over long time periods. It also eliminates uneven migration, band distortion or disassociation of pH dependent glyoxylated RNA molecules that can result when ionic depletion occurs. Because the recirculation system is built right into the buffer chamber, no external pumps, tubing or stir bars are required.

The models listed above incorporate the end gate gel casting system. The UVT gel tray incorporates gasketed end gates which provides a leakproof seal without tape. Built in leveling ensures the casting of flat, uniformly thick gels. Sample loading is greatly enhanced using micro well pipette format combs (and a multichannel pipette) engineered specifically for use with this system. Using these combs and a multichannel pipette, samples may be loaded directly from a 96-well plate, 8 or 12 at a time. Sample loading with a multichannel pipette speeds up transfer and reduces chance of sample order error. Comb slots on the UVT gel tray are positioned so that you can run multiple sample sets of equal distances simultaneously.

Unpack and Check Your Order

Before starting, unpack the unit and inventory your order. If any parts are missing, contact Technical Services within 7 days of purchase.

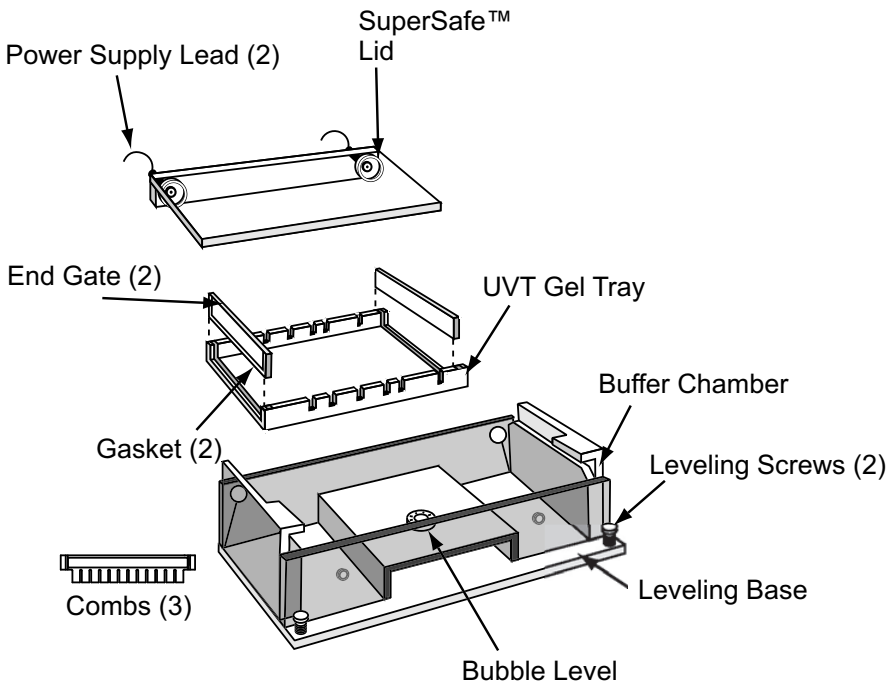


Figure 1-1. A1 and A2 Exploded Parts Diagram

A1 & A2 Parts List

- Buffer Chamber with Three Point Leveling Base
- Combs: (3) 12, 16, and 20 well, 1.5mm Thick
- Super Safe™ Lid with attached Power Supply Leads (2)
- UV Transmissible (UVT) gel tray wth Gasketed End Gates (2)
- Bubble Level

See Section 8 for replacement parts or optional combs.

Specifications and Recommended Running Conditions

Model	A1	A2
Gel Size (W x L in cm.)	13 x 25	20 x 25
Buffer Capacity	1.6L	2.3L
Time Requirements (hours)	1-4	1-4

Unpack and Check Your Order (cont.)

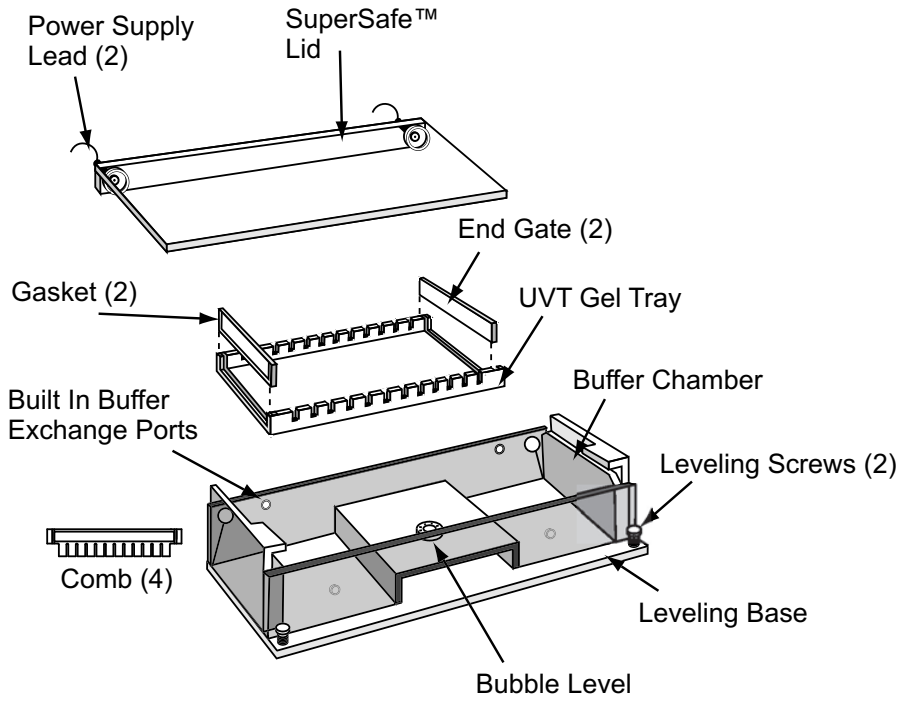


Figure 1-2. A3-1 Exploded Parts Diagram

A3-1 Parts List

- Buffer Chamber with Three Point Leveling Base
- (4) Combs:
- (2) 25 well
- (2) 50 well, 1.5mm Thick
- Super Safe™ Lid with attached Power Supply Leads (2)
- UV Transmissible (UVT) gel tray with Gasketed End Gates (2)
- Built in Buffer Exchange Ports
- Bubble Level

See Section 8 for replacement parts or optional combs.

Model	**A3-1**
Gel Size (W x L in cm.)	23 x 40
Buffer Capacity	4.5L
Voltage Requirements (V)	20-250

Unpack and Check Your Order (cont.)

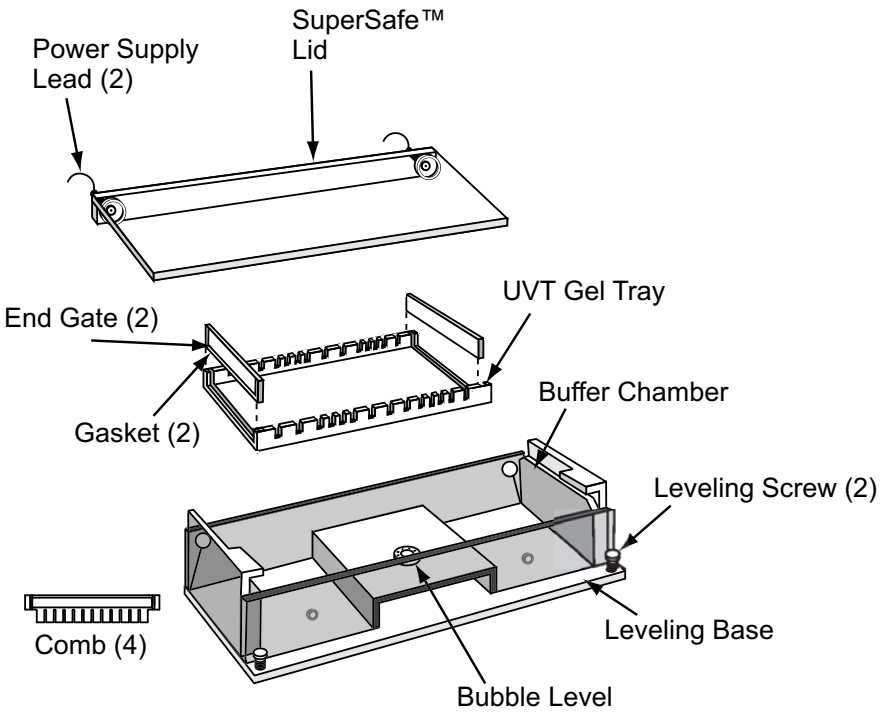


Figure 1-3. A6 Exploded Parts Diagram

A6 Parts List

- Buffer Chamber with Three Point Leveling Base
- (4) Combs
- (2) 25 well
- (2) 50 well, 1.5mm Thick
- Super Safe™ Lid with attached Power Supply Leads (2)
- UV Transmissible (UVT) gel tray wth Gasketed End Gates (2)
- Bubble Level

See Section 8 for replacement parts or optional combs.

Specifications and Recommended Running Conditions

Gel Size (W x L in cm.) . . . . . .23 x 25
Buffer Capacity 3000ml
Voltage Requirements (V) 20-250

Unpack and Check Your Order (cont.)

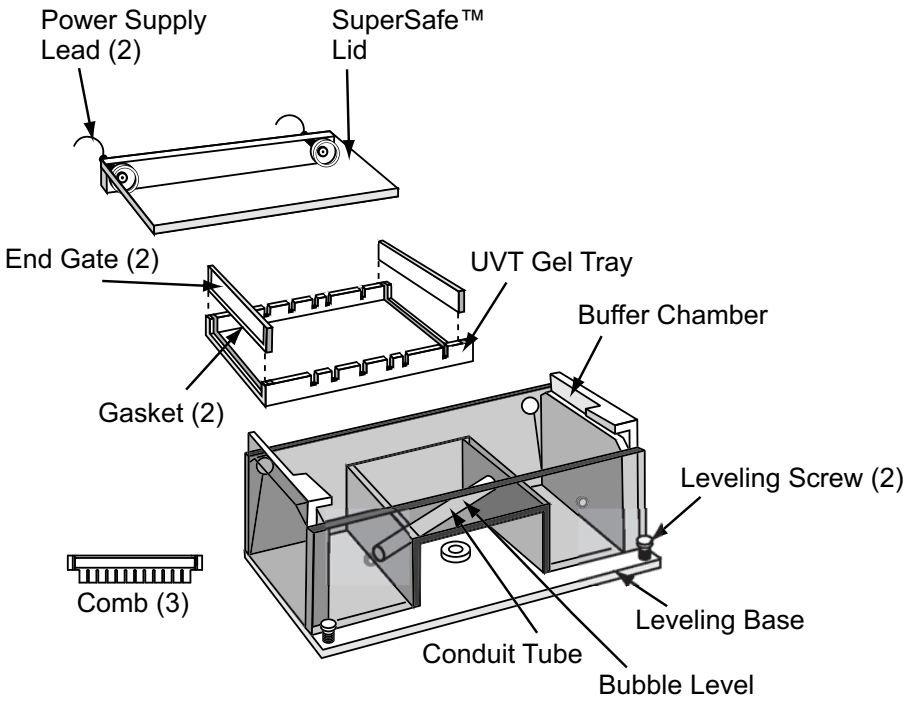


Figure 1-4. A5 Exploded Parts Diagram

A5 Parts List

- Buffer Chamber with Three Point Leveling Base
- (3) Combs 16, 24, & 36 well, 1.5mm Thick
- Super Safe™ Lid with attached Power Supply Leads (2)
- UV Transmissible (UVT) gel tray wth Gasketed End Gates (2)
- Bubble Level

See Section 8 for replacement parts or optional combs.

Model A5

Gel Size (W x L in cm.) . . . . . .20 x 25
Buffer Capacity 2.0L
Voltage Requirements (V) 20-250

Section 2 Setting Up

1. Remove the SuperSafe™ lid from the buffer chamber. The SuperSafe™ lid is attached to the back of the unit at the junction of the lids attached power supply leads to the banana plugs located on the unit. To remove, hold the front of the buffer chamber with one hand and pull the lid off; sliding off evenly by holding the center of the back of the lid.

2. For shipping and convenient storage, the UVT gel tray is packaged inside the unit with the gasketed end gates in position upon arrival. Lift the UVT gel tray out of the buffer chamber.

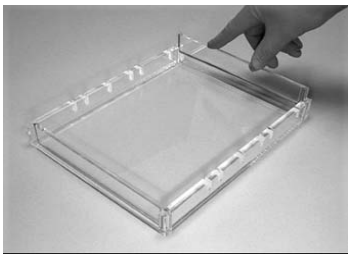


Figure 2-1. End Gates

3. To cast gels, place the UVT gel tray into the chamber making sure the gel tray rests level and centered on the platform. Slide the gasketed end gates into the outermost grooves on either side of the gel tray. The end gates should be inserted tightly into the grooves with the gasket side facing out.

4. **Leveling the unit** - Larger size gels make the need to cast and run a level gel is very important for consistent reproducible results. Level the unit using the thumbscrews on each side of the front of the unit by slowly turning one thumbscrew at a time and lining up the bubble in the level with the center circle (the rear screw is for stability only).

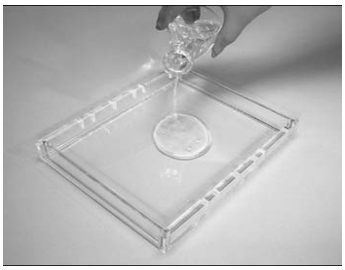


Figure 2-2. Pour

5. **Preparing the gel** - Using electrophoresis grade agarose and compatible electrophoresis buffer, the gel may be prepared in various ways. The percentage of agarose and the electrophoretic buffer used is determined by the size of the samples to be separated and further recovery of the samples (see Table 5-1. The agarose and buffer are mixed and heated over a heat source, in a microwave oven, or in an autoclave until the agarose is completely dissolved. The prepared gel then must be cooled to below 60°C before casting to avoid warping the UVT gel tray, due to excessive heat. If numerous gels are to be run in one day, a large volume of gel may be prepared and placed in a covered bottle stored between 40-60°C in a water bath. This provides a ready gel supply in a warm liquid form that will solidify quickly when gels are cast. For further tips on sample preparation and visualization, see Table 5-1.

6. Pour or pipette the correct amount (see Table 5-2) of warm agarose (<60°C) onto the UVT gel tray that has been placed into position in the gel box. Immediately after pouring, insert the desired comb or combs into the comb slots to form the sample wells. If only a small portion of gel is required for proper sample separation, multiple combs may be used to run 2, 3, 4, 5 or 10 sets (depending on model) of equal distance samples simultaneously expanding the number of samples per gel that may be run. To conserve agarose, a wall comb may also be used to divide and use a smaller portion of the length of the gel tray. If a wall comb is used, pipette a bead of agarose along the bottom and side edges of the wall comb once it has been placed in the tray to seal the combs edges to the trays bottom and sides. Once this bead is solidified, the cooled gel may be poured as described. Alternately, regular tape cut slightly longer then the comb can be placed flat along the combs surface and the comb angled into place in the gel tray. Extra tape is then placed on the outside of the comb in the excess tray area to reinforce the corners. Allow the gel to solidify completely.

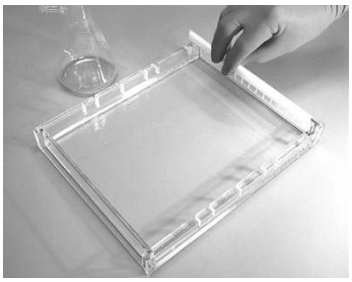


Figure 2-3. End Gates

Migration Distance

- Run one sample set on a gel in each tray.
- Run two sample sets on a gel of equal length (comb slots) in each tray.
- Run three sample sets on a gel of equal length samples (comb slots) in each tray.
- Run four sample sets on a gel of equal length samples (comb slots) in each tray and so on up to 12 rows.

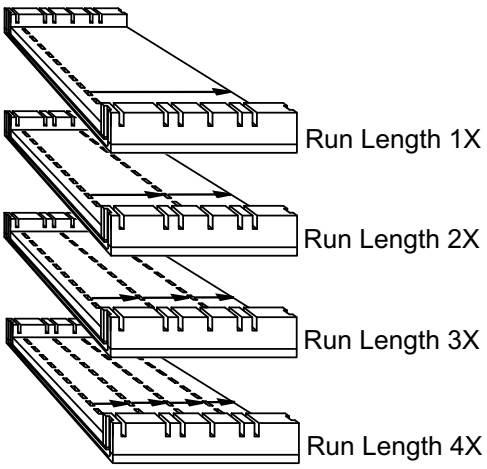
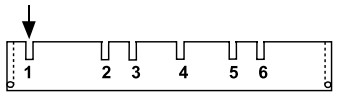


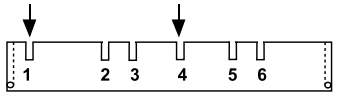
Figure 2-4. Migration Distance

Migration Distance (continued)

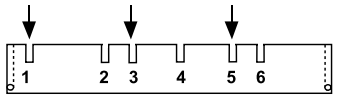
The following charts show the specific tray options for each model.



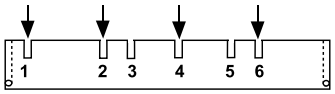
One comb for a 23.2 run length



Two combs for two 11.4cm run lengths



Three combs for three 7.5cm run lengths



Four combs for four 5.5cm run lengths

Figure 2-5. A1, A2 and A5 Migration Distance

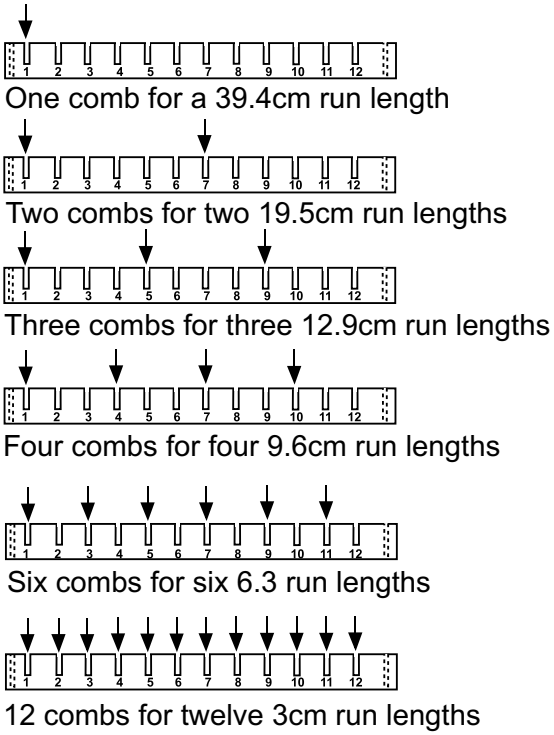


Figure 2-6. A3-1 Migration Distance

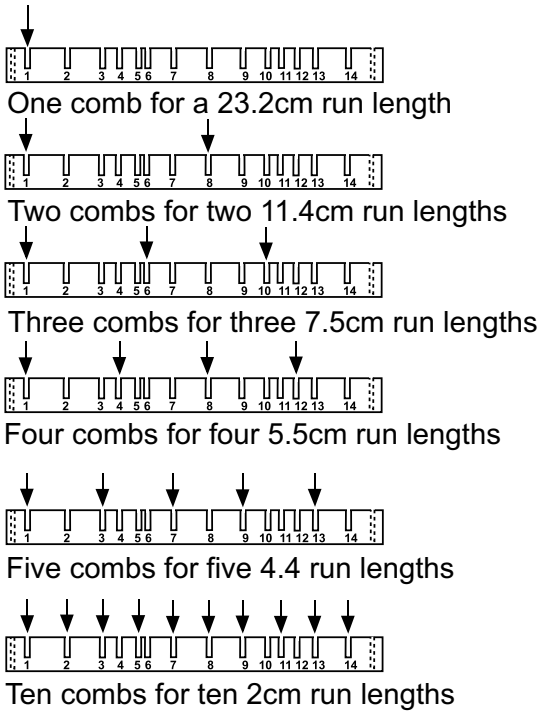


Figure 2-7. A6 Migration Distance

Section 3 Using the System

1. Place the gel tray in the buffer chamber, lift the end gates out of the gel tray. This running position exposes the open ends of the agarose to the buffer.

2. Pour enough compatible running buffer into the unit to fill both buffer chambers and completely cover and submerge the gel. Correct buffer level is clearly marked on the units side wall as “FILL LINE”. See Recommended Running Conditions (Section 1) for approximate buffer volumes needed for your unit. Too little buffer may cause the gel to dry out during the run, while excess buffer may decrease DNA mobility and cause band distortion.

3. Carefully remove the comb (or combs) by tapping lightly to loosen, and slowly lifting straight up out of the gel tray to avoid damage to the wells.

4. Load prepared samples into the wells. Samples should be mixed with a sample loading buffer; giving weight to the samples so that they drop evenly into the wells and containing tracking dyes to monitor the gel run. See available comb section for approximate well volumes (Section 8 - Comb Options).

5. Carefully slide the SuperSafe™ lid with attached power supply leads onto the unit. This will connect the power cords to the banana plug electrodes and complete the circuit. Plug the other end of the power supply leads into an appropriate power supply.

6. Turn on power supply. Refer to Table 4-1 for running conditions. Carefully monitor the gel run to avoid samples running into the path of another set of samples.

Model A5 Self-Recirculation System

The Model A5 Self-Recirculation System has a unique built-in recirculating system designed to self recirculate buffer. Bubbles are collected at the cathode end of the unit and shunted through a conduit tube from the cathode end of the buffer chamber to the anode end of the buffer chamber. The bubbles displace buffer creating an effective recirculation within the chamber.

The self recirculating system reduces formation of pH gradients for high resolution and uniform, reproducible results. The self-contained recirculation system requires no external pumps, tubing or stir bars. As shown in the diagram, a trap at the cathode end of the buffer chamber (1) collects the hydrogen bubbles produced at the electrode during electrophoresis. The bubbles are then shunted into a conduit tube (2) to the anode end of the chamber. This flow of bubbles displaces buffer (3) to create an internal recirculation system. See page 10 and 24 for Owl Self Recirculating devices.

See Section 8 - Buffer Exchange Port Option, available for A1, A2 and A6 models.

Section 4 Finishing Up

1. When the gel run is complete and tracking dye has migrated as far through the gel as desired, or to the end of the gel, turn off the power supply and slide off the SuperSafe™ lid to disconnect from the power source. Carefully remove the tray containing the gel (wear gloves if ethidium bromide is present). The UV Transmissible (UVT) gel tray makes visualization and photography with a UV light source easy without the need to remove the gel from the tray.

2. The buffer chamber, SuperSafe™ lid, UVT gel tray and combs should be rinsed under warm running water after each use. An RNase/DNase decontaminate may be used.

Caution This electrophoresis system must never be autoclaved, baked, or microwaved! ▲

Table 4-1. Specifications and Recommended Running Conditions

Model	A1	A2	A3-1	A5	A6
Gel Size (W x L in)	13 x 25	20 x 25	23 x 40	20 x 25	23 x 25
Buffer Capacity	1.6L	2.3L	4.5L	2.0L	3000ml
Voltage Requirements (V)	20-250	20-250	20-250	20-250	20-250
Time Requirements (hours)	1-4	1-4	1-6	1-6	1-4

Section 5 Technical Tips

Running a Standard Ladder

It is recommended to always run a sample lane of a known “standard ladder” or “marker” to determine concentration and size of separated fragments after the gel run, and to aid in photodocumentation and analysis. Migration patterns and fragment sizes for commonly used DNA molecular weight markers are shown in this figure.

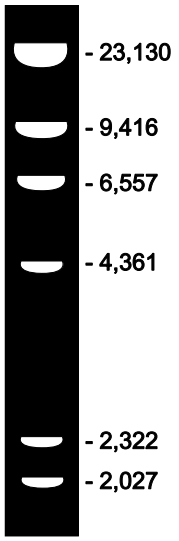


Figure 5-1. Sample Lane

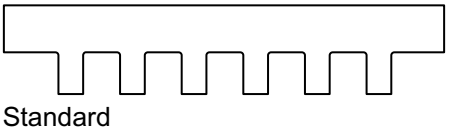
Loading Samples

It is sometimes easier to load the sample wells dry before placing buffer into the buffer chamber. After the gel solidifies, if cast within the buffer chamber, remove the gel tray from the buffer chamber and place the tray on the lab bench. Carefully remove the sample combs by tapping and lifting straight up. Samples mixed with loading buffer that does not contain dye may be easier to load dry, especially in larger gel units to avoid cross contamination. After loading all sample lanes, place the gel tray into the buffer chamber in the running position with the gel edges facing out toward the buffer chambers with the gasketed end gates removed and slowly fill the chamber with buffer.

Comb Options

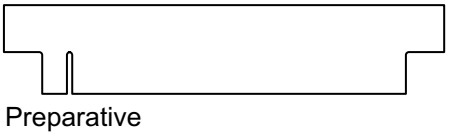
Standard

1.0mm and 1.5mm thickness: for all models. Combs are hand fabricated for high quality precision in low volumes. Each comb has an acrylic spine with Lexan® teeth.



Preparative

Preparative combs are manufactured with an acrylic spine and Lexan® teeth. Used for extremely large samples.



Multi Load Comb

For use with 8-12 channel pipettes. These unique combs are designed to allow accurate easy loading from a 96 well plate.

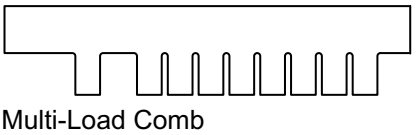


Figure 5-2. Comb Options

Custom Combs

Calll Technical Services for more information.

Wall Comb

The wall comb is used in your existing U.V. Transmissible (UVT) gel tray to allow the ability to cast smaller gels using the existing gel tray and the comb slots. There are various ways to use the wall comb to ensure a leak proof seal. The following two are the fastest and easiest.

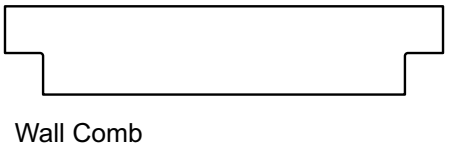


Figure 5-3. Wall Comb Option

Wall Comb (continued)

Tape Method

Using casting tape, transparent tape, or masking tape, cut a piece long enough to cover the full length of the wall comb with about 1/2" overhang at each end. Half the width of the tape should be free. Firmly press the tape all along the comb leaving the three open edges loose. Place the comb with tape into the gel tray at the desired comb slot position. The taped side of the comb should be facing away from where the gel will be cast. Angle the comb as it is being placed into the comb slot so the loose taped edge is free. Once positioned into the gel tray, firmly press the tape to the bottom and sides of the gel tray to form a leakproof seal. Small extra pieces of tape may be added to the corners afterwards to reinforce the edges. Add cooled (<60°), slightly thickened agarose to the gel tray and allow to solidify completely. To remove comb, gently remove excess tape and loosen tape from the bottom and sides of the gel tray. Carefully pull comb straight up and out of the comb slot.

Note The edge of the gel may appear irregular, once submerged in running buffer, the gel run will be unaffected. ▲

Agarose Plug Method

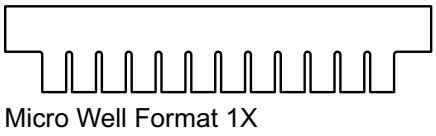
Place the wall comb into the desired comb slot. Prepare agarose as usual and remove about 3ml to a test tube. Allow this aliquot to cool and thicken enough to make a thin partially solid worm of agarose. Using a Pasteur pipette or other transfer device, gently place a small stream of agarose all along the three comb edges at the bottom of the gel tray and sides to form a leakproof seal. Allow “plug” to solidify completely checking that all exposed areas are filled in with agarose. Next, add cooled agarose (<60°) to the gel tray. After the gel is completely solidified; rock the comb back and forth slightly to loosen it when removing to avoid damage to the gel. Adding running buffer to the buffer chamber prior to removing comb(s) may make the comb removal easier.

Helpful Tips

- Cooling the agarose slightly more than usual will help eliminate leaking because the gel thickens as it solidifies and is less likely to leak. To avoid visible solids due to uneven cooling, gently swirl the agarose. Exact temperature of the agarose depends on the type used, but the gel should be thickened yet still evenly liquid so it is pourable and consistent.

- Gels of higher concentrations (>0.5%) are also easier to work with, especially when using the agarose plug method.

Micro Well Format Combs



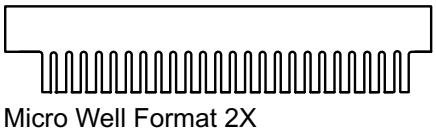


Figure 5-4. Micro Well Combs

Micro well format combs, available with many Owl horizontal and sequencing devices, are meant to be used in conjunction with an 8- or 12-channel pipette. The pipette is manufactured to be used with a 96 well (8 wells wide x 12 wells long) multichannel plate. The key here is the constant distance of 9mm between the center of each well in the multichannel plate. The multichannel pipette is set up so that the pipette tips are exactly 9mm apart, and a researcher can take up 8 (or 12) samples simultaneously from the plate.

To be able to load these samples simultaneously onto a gel, the “center to center” distance between sample wells in the gel must be exactly 9mm. The micro well format comb that would give this exact distance would be a 1x micro well format comb. However, the ability to space wells exactly 9mm apart is dependent on the total width of the gel and the number of sample wells that the researcher wants in the gel. There are four options that fit the use of a 9mm “center to center” pipette tip format. The 9mm spacing represents a 1x option micro well format. By decreasing the center to center distance in factors of 9mm, one can fit more samples in a given amount of space with the ability to use the same micro well format pipette. The 2x is 9 divided by 2, the 3x is 9 divided by 3 and the 4x is 9 divided by 4.

Micro Well Format Combs (continued)

Therefore, it is possible to have a greater number of teeth in a comb and maintain the use of the multichannel pipette, by having the multichannel pipette fill every other well rather than every well. This type of multichannel pipette format comb is called a 2x multichannel pipette format comb. For example, the 50 tooth comb for the A6 device has "center to center" distances between teeth of 4.5cm. This means that a researcher would load lanes 1, 3, 5, 7, 9, 11, 13, and 15 with the first pass of the pipette and 2, 4, 6, 8, 10, 12, 14 and 16 with the second pass, and so on until all of the lanes are filled.

When using an 8 (or 12) channel pipette, the number of sample wells that can be filled must be a multiple of 8 (or 12). A 25 well micro well format comb would have one extra sample and a 50 well micro well format comb would have 2 extra samples, which a researcher could fill with a single channel pipette, and is generally used for standards.

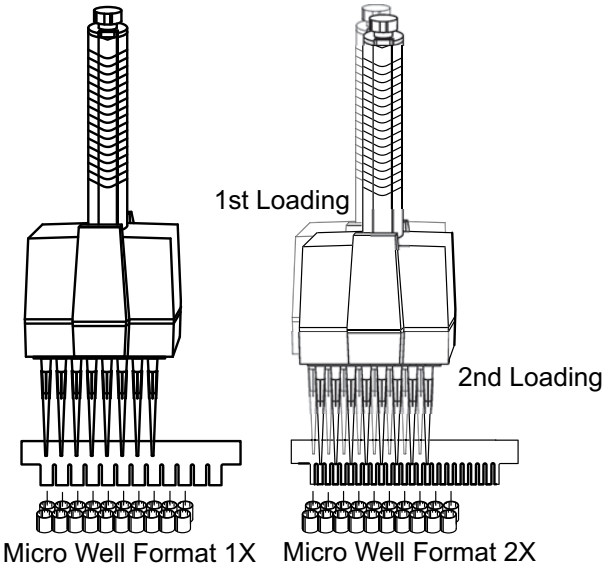


Figure 5-5. Loading Micro Wells

Why Recirculate Buffer?

During electrophoresis, gradual ionic depletion of the running buffer forms an ionic and pH gradient across the system (acetate and phosphate buffers are especially prone to ionic depletion). Such gradients can cause uneven migration and banding patterns or cause pH-dependent glyoxylated RNA molecules to disassociate. Buffer recirculation ensures uniform ionic strength throughout the system.

Why Recirculate Buffer? (continued)

Comparison of buffer pH with and without recirculation during agarose gel electrophoresis

50ng samples of HindIII digested DNA were run on duplicate gels, with and without buffer recirculation. pH measurements were taken at the anode and cathode ends at various time intervals and plotted against time.
Running condition: 1% agarose gel in 10mM NaH2PO4, pH 7.0, 114V, constant voltage.

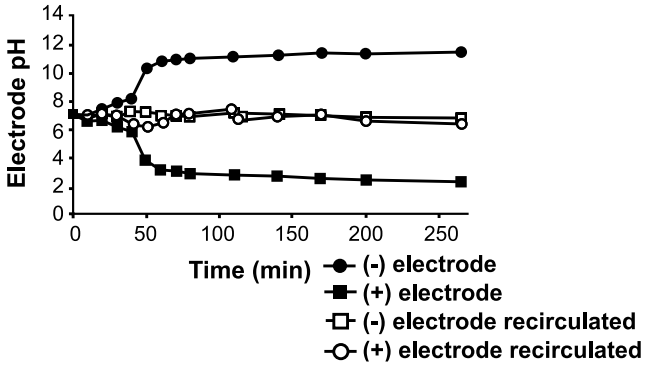


Figure 5-6. Comparison

Sample Well / Comb Configuration

Hg = height of gel used Hs = height of well used for sample volume
Hw = well height

How to determine well sample volume:

There are two volumes to consider when determining the sample volume for a horizontal gel. 1) Gel volume, which is Width x Length x Gel Height and uses centimeters and 2) Sample volume which is Tooth Width x Comb Thickness x Apparent Well Height, and uses millimeters.

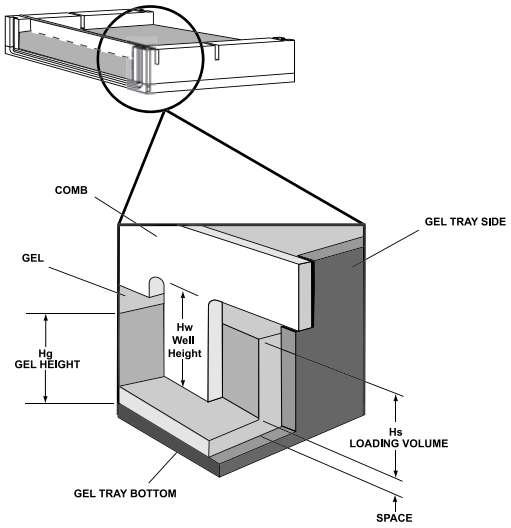


Figure 5-7. Determine Volume

How to determine well sample volume (continued):

Gel height is generally set to a height between 0.25 cm and 1.0 cm. Therefore, once you choose the height, the volume is the gel dimensions given in the catalog for each gel box (I.D.) times this height. Once the gel height (Hg) is chosen, the well volume and then the sample volume can be calculated. The well height (Hw) is 1.5 mm less then the gel height: Hw = Gel Height – 1.5 mm. Using the well height, the volume of the well is calculated: Vw = (Well Height) (Tooth width x comb thickness). The loading volume is a 0.75 safety factor applied to the well volume: Vs = (Vw) (.75)

For Owl combs, there are two thicknesses, 1.0mm and 1.5mm. This is the depth. The width of the well is determined by the number of teeth. For a given gel box, as the number of teeth increase, the volume of each tooth decreases.

Reagent Information

There are various types of agarose commerically available that may be used. Besides standard ultra pure electrophoresis grade agarose, there are also numerous low melting point products for easy sample recovery, as well as speciality products formulated for specific uses to separate/recover very small or very large fragments etc.

To visualize and photograph the samples after the gel run for a permanent record, the gel may be stained during or following the run with a variety of stains. The most common stain for DNA is ethidium bromide. Ethidium bromide may be added directly to the gel and running buffer to quickly and easily visualize and photograph the separated fragments following the gel run without the need for additonal staining.

If this is not added, then following the gel run the gel may also be soaked in a concentrated ethidium bromide solution and rinsed for the same visualization. The ethidium bromide is added to both the gel (after heating) and the electrophoresis buffer at a concentration of 0.5µg/ml.

Ethidium bromide is a potential carcinogen. Care in handling the powder and stock solution must be taken. Always wear gloves when handling the powder, solutions and all gels that contain any amount of ethidium bromide.

Table 5-1. Mobility range of DNA in different percentage agarose gels

Agarose % (w/v)	Approximate range of separated DNA fragments (kb)
0.3	60 to 5
0.5	30 to 1
0.7	12 to 0.8
1.0	10 to 0.5
1.2	7 to 0.3
1.5	4 to 0.2
2.0	3 to 0.1
3.0	<0.1

It should be noted, an increased agarose % gives better separation of small fragments and also bands very close together that tend to be more difficult to separate, visualize and photograph. A specialty agarose product formulated to increase resolution of low molecular mass samples may also be used.

Example: A good mid range gel percentage would be 0.7%, or 0.7g agarose in 100mls electrophoresis buffer (TBE or TAE), following heating and dissolving the agarose, 10µl of ethidium bromide stock solution (5mg/ml) is added. The gel would be run with compatible electrophoretic running buffer (1X TBE or 1X TAE) that also contained ethidium bromide 1 liter of the running buffer would contain 100µl of this 5mg/ml ethidium bromide stock solution.

Preparation & Properties of TAE and TBE Electrophoresis Buffer Systems:

These buffers are used because they both have a basic pH which gives the phosphate group of the DNA a net negative charge allowing migration of the DNA toward the positive anode in the electrophoresis chamber.

TAE - Tris acetate with EDTA (40mM Tris base 40mM acetic acid,1mM EDTA)

50X stock solution, pH ~8.5	1X working solution
242g Tris base	40mM Tris acetate
57.1ml glacial acetic acid	1mM EDTA
18.61g Na2EDTA - 2H2O (MW 372.24)	
Distilled H2O to 1 liter final volume	

TBE - Tris borate with EDTA (89mM Tris base, 89mM boric acid, 2mM EDTA)

10X stock solution	**1X working solution**
108g Tris base	89mM Tris base
55g boric acid	89mM boric acid
7.44g Na2EDTA - 2H2O (MW 372.24)	2mM EDTA
(or 40 ml 0.5 M EDTA, pH 8.0)	
Distilled H2O to 1 liter final volume	
Do not adjust pH	

Buffer	**Suggested Uses and Comments**
TAE Buffer	Use when DNA is to be recovered
	For electrophoresis of large (>20kb) DNA
	Applications requiring high resolution
	Has low ionic strength and low buffering capacity - recirculation may be necessary for long runs (>4hrs.)
TBE	Buffer For electrophoresis of small (<1kb) DNA
	Better resolution of small (<1kb) DNA
	Decreased DNA mobility
	High ionic strength and high buffering capacity - no recirculation needed for extended run times

TBE buffer reacts with the agarose making smaller pores and a tighter matrix. This reduces broadening of the DNA bands for sharper resolution.

Ethidium Bromide

Ethidium bromide is ideal for the flurometric detection of nucleic acids in gel electrophoresis. The addition of ethidium bromide to both the prepared gel and running buffer is a convenient way to monitor separation and keep a photographic log of gel runs. Ethidium Bromide is prepared as 10mg/ml in distilled water and used as a stock working solution of 5.0µg/ml in the electrophoresis buffer and gel. Mix ethidium bromide powder or tablet thoroughly into solution checking for any precipitate and store at room temperature protected from light.

Amount of Agarose to prepare:

Gel volume is determined by the following formula and may be adjusted according to need or preference:

Table 5-2. Amount of Agarose

gel width(cm) X gel length (cm) X gel thickness (cm) = ml of agarose

		Agarose Volume in ml per gel thickness in cm.			
Model #	**Gel size(cm)**	**0.25cm**	**0.5cm**	**0.75cm**	**1.0cm**
A1	13x25	81ml	163ml	244ml	325ml
A2	20x25	125	250	375	500
A3-1	23x40	230	460	690	920
A5	20x25	125	250	375	500
A6	23x25	144	288	432	575

Agarose Gel Loading Buffer

Samples are prepared and combined with gel loading buffer before being applied to the prepared gel. Sample buffer usually contains similar components to the running buffer, dyes for visibility, and glycerol to provide some weight to the samples. This increased sample density and color allows easy visualization of the samples and ensures samples load evenly into the wells and do not float out during loading. Dyes also migrate toward the anode end of the electrophoresis chamber at predictable rates allowing the gel run to be monitored.

The most commonly used loading buffer is glycerol, bromophenol blue, and xylene cyanol.

Section 6 Troubleshooting

Problem	Solution
Agarose leaks into chamber when casting the gel	Check to see if the gasket is correctly seated in groove and even all the way around. Remove gasket and reseat by smoothing out gently with your thumb from one end to the other. Gasket material may have a tendency to absorb salts from the running buffer. After each use, rinse the end gates under warm running water to bring back spongelike consistence of the gasket material. Gaskets may eventually become brittle with frequent use. Contact Technical Services to purchase replacement gaskets. Check to make sure gasketed end gates have been placed with in UVT gel tray with gaskets facing out
Bands seem to be running at an angle.	Check to be sure that the unit is properly leveled for casting and running the gel by using the front thumbscrews on the base. Thumbscrews should be adjusted until the bubble in the level lines up with the levels center circle. Always center the gel tray holder on the platform and cool the agarose to below 60°C before pouring to avoid warping the UVT gel tray (s).
Samples seem to be running unevenly in certain areas.	Check that the platinum electrode wire is intact running flat and evenly across the outer corners and up the side to the junction of the banana plug area. This problem could also be caused by regular casting with very hot agarose gel (>60°C) which may damage the gel tray over time. Always cool the melted agarose to below 60°C before casting to avoid warping the UVT gel tray (s). Warping the UVT gel tray will cause all subsequent gels to be cast unevenly.
Samples do not band sharply and appear diffuse in the gel.	Gels should be allowed to solidify completely before running. For standard agarose, this would be about 30 minutes, if low melting point agarose is used, it may be necessary to completely solidify gels at a cooler temperature in the refrigerator or cold room. Gels should be submerged in 3-5mm of buffer to avoid gel dry out, but excess buffer >5mm can cause decreased DNA mobility and band distortion.

Problem	Solution
Bands are not sharp, clear, and even.	Always follow the proper procedure for preparing the agarose product according to the manufacturers instructions. When preparing the agarose be sure all the agarose powder is in solution before heating. In general, add powdered agarose to distilled water and swirl to mix. Make sure all the powder is equally wet to ensure proper melting. Heat in a microwave oven, boiling water bath, or hot plate with occasional swirling to melt and mix completely. Cool agarose liquid to below 60° and cast. **Note:** High percentage gels may thicken and solidify rapidly and should be cast while still a liquid.
Samples are not moving as expected through the gel, remaining in the wells, or diffusing into the gel.	Check that a complete power circuit is achieved between the unit and the power supply. Platinum wire and banana plugs should be intact. To test, simply fill the unit with running buffer and attach to the power supply without a gel or gel tray in the unit. The platinum wires on both sides of the unit should produce small bubbles as the current passes through. If a complete circuit does not exist there will be few to no bubbles. Contact Technical Services to schedule a repair.
When the comb is removed from the gel, some sample wells are ripped and damaged.	Always make sure to allow the gel to solidify completely before moving the gel tray, unit, or removing the comb. To avoid damage to the sample wells, gently rock the comb back and forth lightly to loosen, then slowly pull the comb straight up out of the gel tray. This rocking helps to avoid suction as the comb is removed. Alternatively, once casting is complete, simply submerging the gel with running buffer will help loosen the comb. Using a higher percentage of agarose that forms a tighter gel matrix may remedy this problem as well.
The gel seems to run slower under the usual running conditions.	The volume of running buffer used to submerge the gel should only be between 3-5mm over the gel surface. Gel should be completely submerged to avoid the gel from drying out, which can smear the bands and possibly melt the gel (s) due to overheating. If excessive running buffer is added, the mobility of the DNA decreases and band distortion may result. Excess buffer causes heat to build up and buffer condensation inside the unit may result.

Additional Sources for Reference

Maniatis T., E. F. Fritsch and J. Sambrook. Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY.

Short Protocols in Molecular Biology, - A Compendium of Methods from Current Protocols in Molecular Biology, Edited by Fredrick M. Ausubel, et. al.

Adams, D., and R. Ogden, Electrophoresis in Agarose and Acrylamide Gels, Methods in Enzymology, Vol. 152 (1987) Academic Press, Inc.

Fotador, U.. Simultaneous Use of Standard and Low-Melting Agarose for the Separation and Isolation of DNA by Electrophoresis, BioTechniques, Vol. 10, No. 2, (1991)

Boots, S. Gel Electrophoresis of DNA ; Analytical Chemistry, Vol. 61, No. 8, April 15, 1989

Section 7 Care and Cleaning

Caution Organic solvents cause acrylic to “craze” or crack. Clean all Owl acrylic systems with warm water and a mild detergent. Do not use ethanol or other organic solvents to clean Owl products. Do not autoclave, bake, or microwave your unit. Temperatures over 50°C can damage to the acrylic. ▲

Note If an RNase free electrophoresis system is desired, there are various methods to rid the system of RNA contamination. For fast and easy decontamination, use RNase Away®*. Spray, wipe or soak labware with RNase Away, then wipe or rinse the surface clean; it instantly eliminates RNase. RNase Away eliminates the old methods that include treatment with 0.1% Diethyl Pyrocarbonate (DEPC) treated water and soaking in diluted bleach. DEPC is suspected to be a carcinogen and should be handled with care. This electrophoresis system should never be autoclaved, baked, or placed in a microwave. ▲

To order RNase Away, contact Technical Services:

Part Number	Description
7000	250ml bottle
7002	475ml spray bottle
7003	1 liter bottle
7005	4 liter bottle

**Rnase Away® is a registered trademark of Molecular BioProducts*

Care of Acrylic

The following chemical compatibility chart is supplied for the convenience of our customers. Although acrylic is compatible with most solvents and solutions found in the biochemical laboratory, some solvents can cause substantial damage. Keep this chart handy to avoid harm to your apparatus by the use of an inappropriate solvent.

Codes:

S - Safe (no effect, except possibly some staining)

A - Attacked (slight attack by, or absorption of, the liquid)
(slight crazing or swelling, but acrylic has retained most of its strength)

U - Unsatisfactory (softened, swollen, slowly dissolved)

D - Dissolved (in seven days, or less)

This list does not include all possible chemical incompatibilities and safe compounds. Acrylic products should be cleaned with warm water, a mild detergent such as Alconox™, and can also be exposed to a mild bleach solution (10:1). In addition, RNAse removal products are also safe for acrylic.

Table 5-1. Chemical Compatibility for Acrylic-Based Products

Chemical	Code	Chemical	Code	Chemical	Code
Acetic acid (5%)	S	Ethyl alcohol (50%)	A	Naptha	S
Acetic acid (Glacial)	D	Ethyl alcohol (95%)	U	Nitric acid (10%)	S
Acetic Anhydride	A	Ethylene dichloride	D	Nitric acid (40%)	A
Acetone	D	Ethylene glycol	S	Nitric acid concentrate	U
Ammonia	S	2-Ethylhexyl Sebacate	S	Oleic acid	S
Ammonium Chloride (saturated)	S	Formaldehyde (40%)	S	Olive oil	S
Ammonium Hydroxide (10%)	S	Gasoline, regular, leaded	S	Phenol 5% solution	U
Hydroxide (10%)	S	Glycerine Heptane (commercial grade)	S	Soap solution (Ivory)	S
Ammonium Hydroxide concentrate	S	Hexane	S	Sodium carbonate (2%)	S
Aniline	D	Hydrochloric acid (10%)	S	Sodium carbonate (20%)	S
Benzene	D	Hydrochloric acid concentrate	S	Sodium chloride (10%)	S
Butyl Acetate	D	Hydrochloric acid (40%)	U	Sodium hydroxide (1%)	S
Calcium chloride (saturated)	S	Hydrogen peroxide (3% solution)	S	Sodium hydroxide (10%)	S
Carbon tetrachloride	U	Hydrogen peroxide (28% solution)	U	Sodium hydroxide (60%)	S
Chloroform	D	Isooctane	S	Sodium hydrochlorite (5%)	S
Chromic acid (40%)	U	Isopropyl alcohol (100%)	A	Sulfuric acid (3%)	S
Citric acid (10%)	S	Kerosene (no. 2 fuel oil)	S	Sulfuric acid (30%)	S
Cottonseed oil (edible)	S	Lacquer thinner	D	Sulfuric acid concentrate	U
Detergent Solution (heavy duty)	S	Methyl alcohol (50%)	A	Toluene	D
Diesel oil	S	Methyl alcohol (100%)	U	Trichloroethylene	D
Diethyl ether	U	Methyl Ethyl Ketone	U	Turpentine	S
Dimethyl formamide	U	Methylene chloride	D	Water (distilled)	S
Dioctyl phthalate	A	Mineral oil (white)	S	Xylene	D
Ethyl acetate	D				

Section 8 Optional Equipment

Optional Multi-Load Tray and Combs

Multiple sample loading configured for use with an 8 or 12 channel pipette is available by using the multi-load tray (A2-RL-12 and A2-RL-24) and combs (A2-RL-18D).



Figure 8-1. Multi-Load Tray

Buffer Exchange Port Option, for Models A1, A2, and A6

The buffer exchange port option is used to recirculate the buffer during extended gel runs. Recirculation is used to prevent buffer depletion of certain low ionic running buffers, for extended runs, multiple sample sets, or for RNA gels. If your unit has the buffer exchange port option, it will be fitted with two white buffer port terminals and will contain two separate port inserts packaged in a small plastic bag located inside the unit upon arrival. Ports are attached to a user supplied pump.



Figure 8-2. Buffer Exchange Port Option

How these work…

The inserts are pushed into the attached ports on the side wall of the unit with the black O-ring side facing in. The insert will "snap" into place in the port in the "open" position and is ready to circulate buffer. Appropriate tubing is then connected to the small outer ringed ends of the ports for circulation using a separate recirculator or peristaltic pump. To close the port, which also releases the insert, you simply press the flat metal button and the insert detaches. The port is now in the "closed" position.

Note Buffer may also be passed through a heat exchanger. ▲

Contact Technical Services to order replacement parts.

A1 Replacement Parts	
Item Description	**Catalog No.**
Complete System	A1
Complete System with Buffer Exchange Ports	A1-BP
Accessories	**Catalog No.**
Power Supply Leads	PSL-5
UVT Gel Tray with Gasketed End Gates	A1-UVT
Replacement Gaskets (1 pair)	A1-GK
Replacement End Gates (1 pair)	A1-EG

A2 Replacement Parts	
Item Description	**Catalog No.**
Complete System	A2
Complete System with Buffer Exchange Ports	A2-BP
Accessories	**Catalog No.**
Power Supply Leads	PSL-5
UVT Gel Tray with Gasketed End Gates	A2-UVT
Multi Load UVT Gel Tray with Gasketed End Gates w/24 slots	A2-RL-UVT
Multi Load UVT Gel Tray with 12 Combs (A2-RL-18D)	A2-RL-12
Multi Load UVT Gel Tray with 24 Combs (A2-RL-18D)	A2-RL-24
Replacement Gaskets (1 pair)	A2-GK
Replacement End Gates (1 pair)	A2-EG

A3-1 Replacement Parts	
Item Description	**Catalog No.**
Complete System	A3-1
Accessories	**Catalog No.**
Power Supply Leads	PSL-5
UVT Gel Tray with Gasketed End Gates	A3-UVT-1
Replacement Gaskets (1 pair)	A3-GK-1
Replacement End Gates (1 pair)	A3-1-EG

A6 Replacement Parts	
Item Description	**Catalog No.**
Complete System	A6
Complete System with Buffer Exchange Ports	A6-BP
Accessories	**Catalog No.**
Power Supply Leads	PSL-5
UVT Gel Tray with Gasketed End Gates	A6-UVT
Replacement Gaskets (1 pair)	A3-GK-1
Replacement End Gates (1 pair)	A3-1-EG

A5 Replacement Parts	
Item Description	**Catalog No.**
Complete System	A5
Accessories	**Catalog No.**
Power Supply Leads	PSL-5
UVT Gel Tray with Gasketed End Gates	A2-UVT
Multi Load UVT Gel Tray w/24 Comb Slots	A2-RL-UVT
Multi Load UVT Gel Tray w/12 Combs (A2-RL-18D)	A2-RL-12
Multi Load UVT Gel Tray w/24 Combs (A2-RL-18D)	A2-RL-24
Replacement End Gates (1 pair)	A2-EG
Replacement Gaskets (1 pair)	A2-GK
Bubble Level	BBL-1

Comb Options – Model A1								
Catalog Number	**Comb Type**	**Number of Teeth**	**Thickness of Teeth**	**Width of Teeth**	**Recommended Loading Volumes[1]**			
					0.25cm²	**0.5cm²**	**0.75cm²**	**1.0cm²**
A1-8C	Standard	8	1.0 mm	13.9 mm	10 ul	36 ul	63 ul	89 ul
A1-8D	Standard	8	1.5	13.9	16	55	95	133
A1-12C	Standard	12	1.0	8.7	7	23	39	55
A1-12D	Standard	12	1.5	8.7	10	34	59	83
A1-16C	Standard	16	1.0	6.1	5	16	27	39
A1-16D	Standard	16	1.5	6.1	7	24	41	58
A1-20C	Standard	20	1.0	4.5	3	12	20	29
A1-20D	Standard	20	1.5	4.5	5	18	30	43
A1-24C	Standard	24	1.0	3.5	3	9	16	22
A1-24D	Standard	24	1.5	3.5	4	14	24	33
A1-MTC[3]	Micro Well	14 (1X)	1.0	7.2	5	19	32	46
A1-MTD[3]	Micro Well	14 (1X)	1.5	7.2	8	28	49	69
A1-PREP	Prep	2	1.5	117/5	130/6	455/20	775/34	1100/48
A1-WALL	Wall	1	1.5	130				
XCM	Custom		1.0, 1.5, 2.0, 3.0					

[1] Loading Volume is calculated as 75% of total well volume (see page 11)

[2] Gel Thickness

[3] 8 & 12 Channel Pipette Format

Comb Options – Model A3-1 & Model A6								
Catalog Number	**Comb Type**	**Number of Teeth**	**Thickness of Teeth**	**Width of Teeth**	**Recommended Loading Volumes[1]**			
					0.25cm²	**0.5cm²**	**0.75cm²**	**1.0cm²**
D3-MTC[3]	Micro Well	25 (1X)	1.0 mm	7.5 mm	6 ul	20 ul	34 ul	48 ul
D3-MTD[3]	Micro Well	25 (1X)	1.5	7.5	8	30	51	72
D3-MT2C[3]	Micro Well	50 (2X)	1.0	3	2	8	14	19
D3-MT2D[3]	Micro Well	50 (2X)	1.5	3	3	12	20	29
D3-WALL	Wall	1	1.5	230				
XCM	Custom		1.0, 1.5, 2.0, 3.0					

[1] Loading Volume is calculated as 75% of total well volume (see page 11)

[2] Gel Thickness

[3] 8 & 12 Channel Pipette Format

Comb Options – Model A2 and A5								
Catalog Number	**Comb Type**	**Number of Teeth**	**Thickness of Teeth**	**Width of Teeth**	**Recommended Loading Volumes[1]**			
					0.25cm²	**0.5cm²**	**0.75cm²**	**1.0cm²**
A2-8C	Standard	8	1.0 mm	22.7 mm	17 ul	60 ul	102 ul	145 ul
A2-8D	Standard	8	1.5	22.7				
A2-12C	Standard	12	1.0	14.5				
A2-12D	Standard	12	1.5	14.5				
A2-16C	Standard	16	1.0	10.5				
A2-16D	Standard	16	1.5	10.5				
A2-20C	Standard	20	1.0	8.0				
A2-20D	Standard	20	1.5	8.0				
A2-24C	Standard	24	1.0	6.5				
A2-24D	Standard	24	1.5	6.5				
A2-28C	Standard	28	1.0	5.0				
A2-28D	Standard	28	1.5	5.0				
A2-32C	Standard	32	1.0	4.0				
A2-32D	Standard	32	1.5	4.0				
A2-36C	Standard	36	1.0	3.5				
A2-36D	Standard	36	1.5	3.5				
A2-MTC[3]	Micro Well	14 (1X)	1.0	7.2	5	19	32	46
A2-MTD[3]	Micro Well	14 (1X)	1.5	7.2	8	28	49	69
A2-MT2C[3]	Micro Well							
A2-MT2D[3]	Micro Well							
A2-RL-18D[3]	Micro Well							
A2-PREP	Prep	2	1.5	117/5	130/6	455/20	775/34	1100/48
A2-WALL	Wall	1	1.5	130				
XCM	Custom		1.0, 1.5, 2.0, 3.0					

[1] Loading Volume is calculated as 75% of total well volume (see page 11)
[2] Gel Thickness
[3] 8 & 12 Channel Pipette Format

THERMO FISHER SCIENTIFIC OWL PRODUCTS WARRANTY USA

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner.

During the first thirty-six (36) months, component parts proven to be non-conforming in material or workmanship will be replaced at Thermo's expense, including labor. Installation, calibration and certification is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any component or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo postage paid and replacement parts are shipped FOB destination.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-800-438-4851 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contract your local distributor for warranty information.

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THERMO FISHER SCIENTIFIC OWL PRODUCTS WARRANTY INTERNATIONAL

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner.

During the first thirty six (36) months, component parts proven to be non-conforming in material or workmanship will be replaced at Thermo's expense, excepting labor. Installation, calibration and certification is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

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Thermo Fisher Scientific
81 Wyman Street
P.O. Box 9046
Waltham, Massachusetts 02454-9046
United States

www.thermofisher.com

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