

INSTRUCTION MANUAL

for the

BIRNS Aquila

Models 5746 and 5747

Publication No. MAN-5746-101, Dated 99 Jan 27
Copyright 1999 BIRNS, Inc., All Rights Reserved

BIRNS, Inc.
1720 Fiske Place, Oxnard CA 93033-1863 USA
Tel: 805-487-5393 Fax: 805-487-0427
Internet: www.birns.com Email: service@birns.com

Table of Contents

INTRODUCTION.....	Page 1
Scope and Applicability	Page 1
SAFETY PRECAUTIONS	Page 2
GENERAL INFORMATION	Page 3
Purpose	Page 3
Features/Benefits	Page 3
THEORY OF OPERATION.....	Page 4
PRODUCT DESCRIPTION.....	Page 5
The BIRNS Aquila Light	Page 5
Power Cable	Page 6
UNPACKING YOUR SYSTEM.....	Page 7
How to contact BIRNS	Page 8
BASIC SET-UP AND OPERATION.....	Page 9
GENERAL INSTRUCTIONS	Page 10
PREVENTATIVE MAINTENANCE.....	Page 11
Introduction	Page 11
Checking Cables for Radiation Damage	Page 12
O-Ring Replacement — General	Page 13
O-Ring Replacement — Instructions	Page 14
CORRECTIVE MAINTENANCE.....	Page 18
Replacing the Lamp	Page 18
Replacing the Connector (BEM2P-S)	Page 19
Removing/Replacing the Lens (35C-003)	Page 20
TROUBLE-SHOOTING.....	Page 21
TECHNICAL SPECIFICATIONS.....	Page 22
Materials	Page 22
Physical	Page 22
Electrical	Page 22
Lighting/Photometric	Page 23
Table A — Table of Available Lamps	Page 23
Environmental	Page 23
APPENDICES.....	Page 24
Appendix A — Applicable Drawings	Page 25

INTRODUCTION

Scope

This Manual provides basic information and requirements for operation and maintenance of the BIRNS Aquila Underwater Camera Light.

Applicability

This Manual is applicable to the following Models:

Model 5746 BIRNS Aquila (Stainless Steel)

Model 5747 BIRNS Aquila (Black Aluminum)

SAFETY PRECAUTIONS

- The lamp in the BIRNS Aquila is a tungsten-halogen lamp. Do not scratch the lamp glass or subject glass to undue pressure; either may cause breakage or shattering.
- If the lamp is broken, shut off power immediately.
- Wait until the entire fixture is cool to the touch before performing any maintenance on it. **The tungsten-halogen lamp normally operates at very high temperatures! Burn risk and fire hazard exists from hot lamps! Wait until unit is completely cool before removing or handling the lamp!**
- Always de-energize the power and disconnect the power cable when opening the unit or performing any maintenance on it. **Do not perform any maintenance on the Aquila when the power is “ON”.**
- **Do not use the BIRNS Aquila out of the water!** It is designed for underwater use, and relies on the water for cooling. It may be energized for brief periods (<30 seconds) out of water to verify operation, but it must not be used for any extended time out of the water.
- Read and understand all instructions prior to performing any operation or maintenance work on the unit.

GENERAL INFORMATION

General

The BIRNS Aquila is the one of the world's most advanced nuclear-grade underwater camera lights. Its small size, low voltage capability, proper color rendition, non-browning lens, fast relamping and easy decontamination make the BIRNS Aquila an excellent choice for use with underwater nuclear-grade cameras. The BIRNS Aquila is based on proven BIRNS nuclear lighting technology, in concert with the brilliance and excellent color rendition of tungsten-halogen lamps.

Purpose

The purpose of the BIRNS Aquila Underwater Camera Light is:

- To provide brilliant illumination of items, to be used in concert with underwater nuclear-grade cameras.
- To provide general-purpose high-intensity illumination in any underwater applications where remote viewing is required.

Features/Benefits

The BIRNS Aquila provides:

- Brilliant, precise illumination
- Excellent color rendition
- 30-second tool-free relamping
- Commercially-available lamps
- Non-browning lens
- Nuclear-grade materials
- Easy cleaning and decontamination
- Rugged underwater-type connectors
- O-ring seals, in designated grooves, based on proven sealing technology
- Safe, reliable low-voltage operation
- Sturdy, rugged construction
- Lamp operating in dry, one-atmosphere chamber

Theory of Operation

General

Tungsten-halogen lamps are a subset of incandescent lamps, which are based on a filament (a thin electrically-conductive wire) contained within a glass bulb. The tungsten filament of the lamp provides electrical resistance in an electrical circuit; this resistance generates heat in the filament when the circuit is energized. This heat is sufficient to cause the filament to become “white-hot” and emit visible light, i.e. to incandesce. This incandescence produces luminous flux which is emitted by the underwater lighting fixture, travels to the target, and reflects to the viewer, thereby illuminating the target.

Tungsten is the primary material of choice for most incandescent lamps, due to its high melting point (3655 K) and the high strength and ductility of tungsten wire. Only a portion of the total radiation from an incandescent source is in the visible region of the spectrum; most of the rest is radiated as waste heat. As the temperature of the filament increases, the source’s radiation in the visible region increases faster than that in the infrared; hence, the efficacy of an incandescent lamp is directly related to the temperature of its filament. Maximum lighting efficacy (approximately 53 lumens/watt) would be achieved by operating a tungsten filament at its melting point (3655 K), but lamp lifetime considerations necessitate operation at lower filament temperatures (usually between 2950 K and 3450 K), at the expense of lighting efficacy.

The tungsten-halogen cycle operating within the lamp is a closed-loop regenerative one. Hot tungsten evaporates from the filament during incandescent operation. Rather than deposit on the inner surface of the bulb as in the past, the tungsten gas chemically combines with the halide gas fill and circulates inside the bulb, transported by convection currents. Thereafter it redeposits onto the filament and separates again into its tungsten and halide components, maintaining a clean bulb wall.

Operating Position

These lamps exhibit very little change in efficacy or electrical characteristics when operated in a horizontal (rather than vertical) position. They can consequently be operated in any position, with no significant effect on light output.

PRODUCT DESCRIPTION

Introduction

The complete BIRNS Aquila includes everything necessary to provide general-purpose high-intensity underwater illumination for cameras and remote viewing inside nuclear containment. It includes the Aquila, and power cables with durable underwater connectors.

The BIRNS Aquila Light

The Aquila Light is constructed entirely of heavy-gauge electropolished Type 304 Stainless steel (Model 5746) or durable hard black-anodized 6061-T6 aluminum (Model 5747). Its lens is made of non-browning quartz, and is recessed for protection against mechanical impact. Vent holes allow for thorough cooling water flow over the lens, regardless of operating position. All parts are securely assembled; this notwithstanding, however, the Aquila can be relamped, without tools, in 30 seconds.

A lamp with integral aluminized glass reflector forms the heart of the BIRNS Aquila. The entire luminaire has been designed and constructed such that no wires or solder joints are used, making the assembly simple and easy to maintain. A quartz lens encloses the lamp in a dry, one-atmosphere chamber, so that no water ever comes into contact with the lamp itself; the lamp is not subjected to the pressure, thermal shock, corrosive effect etc. of the underwater environment.

The BIRNS Aquila uses a rugged glass-reinforced epoxy (GRE) connector. These connectors seal with captivated o-rings in the mating cable connector, and are the same as those used on our deep-ocean lighting systems.

Power Cable

The Power Cable provides electrical continuity between the power source and the Aquila Light. These cable assemblies are terminated in durable polychloroprene (neoprene) connectors with permanently embedded power sockets, protected by a rugged hexagonal electropolished 304 stainless steel locking sleeve; this also serves as a retention device to prevent inadvertent disconnection of the connector halves.

The cable itself is made either of BIRNS Super-Vutron or BIRNS Aquaprene cable.

BIRNS Super-Vutron cable (color-coded yellow) is jacketed with smooth chlorinated polyethylene (CPE) and insulated with ethylene propylene diene monomer (EPDM). This cable is often used in the nuclear industry, as its insulation is radiation-tolerant, its jacket is easy to decontaminate, and it meets the requirements of IEEE-383. It experiences “mild to moderate” radiation damage at 8×10^5 R (8×10^3 Gy), and “moderate to severe” damage at 4×10^6 R (4×10^4 Gy); CERN does not recommend it for use above 10^8 R (10^6 Gy).

BIRNS Aquaprene cable (color-coded black) is jacketed with neoprene (polychloroprene) and insulated with styrene rubber (STR). Aquaprene is our standard cable, has good resistance to most general environmental and chemical conditions, and has found wide acceptance. It experiences “mild to moderate” radiation damage at 2×10^6 R (2×10^4 Gy), and “moderate to severe” damage at 5×10^6 R (5×10^4 Gy); CERN does not recommend it for use above 10^8 R (10^6 Gy).

UNPACKING YOUR SYSTEM

Step 1 - Unpack

1. Open the BIRNS Aquila cardboard carton and remove the polystyrene packing. Remove the Aquila from the polystyrene and its polyethylene bag.
2. Note the Instruction Manual. Remove the Manual; read and understand it thoroughly prior to putting the Aquila into service.
3. Open the carton containing the Power Cable. Remove the Cable from the carton and polyethylene bag(s).

Step 2 - Verify Receipt

Your Aquila System includes the following components. Please verify that you have received all items listed below:

1. BIRNS Aquila Light, Model 5746 or Model 5747
- 2.** Power Cables (according to your order)
3. Spare lamps and/or spare parts (according to your order)

Step 3 - Inspect for Damage

Carefully inspect all items for damage. Obvious damage to shipping or packing materials may signal potential damage to the goods themselves.

Signs of actual or potential damage include:

- Items broken, bent, chipped or cut
- Items scraped or burnt
- Loose parts, clinking or rattling sounds

Should any of these signs be evident, save all packing materials and immediately file a claim with the carrier. Notify your distributor and/or BIRNS directly, in writing, describing the damage.

How to contact BIRNS

Voice

You can contact BIRNS by telephone on:

- +1-805-487-5393 (International)
- 1-888-BIRNS-88 (Nationwide toll-free)

We have customer service personnel available to take calls Monday through Friday, 08:00-16:00 PST. In addition, we have 24-hour voice mail to take calls at other times.

Data

You can contact BIRNS in writing by:

Mail: BIRNS, Inc.
P.O. Box 909
Oxnard CA 93032-0909 USA

24-hour Fax: 1-805-487-0427

Email: service@birns.com (or through our Internet address: www.birns.com)

Physical

You can ship goods to our receiving department at:

BIRNS, Inc.
Attention: (Name of your BIRNS customer service representative)
1720 Fiske Place
Oxnard CA 93033-1863 USA

Note: please always contact us prior to shipping items to us, and label the goods as for the attention of your customer service representative.

BASIC SET-UP AND OPERATION

The BIRNS Aquila System is designed to be “plug and play”. After unpacking the system and inspecting for damage, follow these steps:

1. Plug in the Power Cable.

- a. Mate one end of the Power Cable to the Aquila Light. (For detailed instructions, see “Mating and Unmating the Underwater Connectors”.)
- b. Plug the other end of the Power Cable into a power outlet (of the proper voltage for the lamp which you are using),

2. Energize the circuit.

3. Your BIRNS Aquila System is ready for use!

Note: The BIRNS Aquila is designed for underwater use, and relies on the water for cooling. It may be energized for brief periods (<30 seconds) out of water to verify operation, but it must not be used for any extended time out of the water. Otherwise, overheating and damage may result.

GENERAL INSTRUCTIONS

Mating and Unmating the Underwater Connectors

Note: The BIRNS Aquila connector has two pins: one large and one small (the large pin is visibly larger than the small one). The cable connector has two corresponding sockets -- one large and one small; the large socket is aligned with the raised 'BIRNS' name tab on the outside of the cable connector.

Note: These connectors are true underwater connectors and, when properly mated, will seal to depths of 20,000 FSW (6,000M). However, they are not underwater mateable! Do not attempt to mate or unmate these connectors underwater!

Note: Mate and unmate these connectors only while the circuit is de-energized. This is a much safer practice, and will avoid unnecessary wear and tear on the connectors.

To mate the connectors:

1. Verify that the Aquila connector and the cable connector have the same number of sockets and pins. Ensure that both connectors are clean and dry.
2. Align the large pin of the Aquila connector with the raised flat 'BIRNS' tab on the side of the cable connector.
3. Gently push the cable connector straight onto the Aquila connector until it bottoms. (You may hear a 'pop' sound as air escapes the cable connector – this is normal.)
4. Screw the stainless steel hexagonal locking sleeve clockwise onto the Aquila connector.

Note: Do not over-tighten the locking sleeve!

To unmate the connectors:

5. Turn the locking sleeve counter-clockwise until it is free of the Aquila connector threads.
6. Pull the cable connector straight back until it 'pops' off of the Aquila connector.

PREVENTATIVE MAINTENANCE

The BIRNS Aquila requires very little preventative maintenance. The only preventative maintenance required is limited to periodic inspection and/or replacement of the elastomeric items, specifically the Power Cables and the sealing O-rings.

Introduction

The sealing O-rings and the cable jackets (and primary cable insulation) used in the BIRNS Aquila Power Cables are affected by prolonged exposure to ionizing radiation. The effects of radiation on elastomeric materials are to change the properties of the elastomer; ultimately, those property changes are detrimental to the performance of the sealing O-rings and the Power Cables. (For further information on this subject, please request a copy of our technical paper, "General Effects of Radiation on Elastomeric Materials".)

Briefly stated, the effect of radiation on these elastomeric materials is primarily scission of their intermolecular bonds which will make them abnormally soft and/or "gooey" or "sticky". However, sometimes a secondary effect is present — the abnormal cross-linking of intermolecular bonds — which causes embrittlement and makes the materials "hard", "dry", or "brittle". (This is also the effect often caused by prolonged exposure to elevated temperatures or IR radiation.) Unfortunately, it is impossible to accurately predict the expected lifetime of elastomeric materials in the field, and it is not feasible to determine the extent of radiation damage by electrical or other "remote" tests. Therefore, we rely on periodic visual and/or tactile inspection to determine if materials require replacement.

Checking Cables for Radiation Damage

The Power Cables' jackets should be periodically inspected for radiation damage. The length of time between inspections depends on the expected level of radiation in the application the cables should be inspected more frequently when used in high-radiation fields), but does not need to be done as a separate function — while doing other work on the lights, while changing lamps for example, the cables can be inspected; in this way, it's possible to minimize labor costs and radiation exposure time. However, no more than five (5) years should pass between cable inspections, and we recommend that the cables be replaced not less than once every 10 years of use.

To inspect the cables, simply run them through your (gloved) hands while visually inspecting them, and:

- Look for signs that the cable is “sticky” or “gooey” or abnormally soft, especially if those symptoms are present in only a small portion of the cable. These are unmistakable symptoms of severe radiation damage, and require immediate cable replacement.
- Look for signs that the cable is “brittle”, cracked or split, or the cable jacket is abnormally hard, especially if present in only a small portion of the cable. These are signs that the cable has suffered elevated temperature (or, possibly, radiation) damage, and requires immediate cable replacement.
- Look for signs of mechanical damage: abrasion, cuts, kinks, etc. Damage such as this does not always require cable replacement, but cable replacement is always required if the damage is severe. (We define “severe” mechanical damage as damage which causes a decrease in the functionality of the cable.) For example, if the cable had showed reduced electrical resistance between conductors after sustaining the damage, we would strongly recommend that it be immediately replaced.

O-Ring Replacement — General

Different opinions exist regarding the preventative replacement of o-rings. O-rings do have a limited life, but that lifetime is so affected by the unique conditions of your environment and usage that it is impossible to predict, and therefore impractical to recommend a precise time frame for preventative o-ring replacement.

Furthermore, the very act of replacing o-rings involves some risk. For example, the new o-ring could become damaged in the process, or may be incorrectly installed, or some particle or hair might fall into the o-ring groove, any of which may cause the new o-ring to leak — ironically, even when the old o-ring still sealed.

In practice, we recommend that O-rings be replaced once every five (5) years of use, and in no case less than once every eight (8) years. If your application or environment is particularly severe, or if you experience repeated O-ring related problems, you may consider decreasing this period to once every three (3) years of use, or in extreme cases even less.

Prior to O-ring installation, we strongly recommend that the O-rings be lightly lubricated with food-grade pure Silicone spray. A thin film of lubricant is sufficient, evenly applied over the entire O-ring surface. Although Silicone grease also works well, it is crucial to note that grease is incompressible and, if over-applied, will interfere with the seal. Spray, on the other hand, cannot be over-applied because excess will simply drip off.

O-Ring Replacement — Instructions

To replace the Rear-Nut O-Ring (59A-189):

1. Remove the Rear Nut (56F-018) from the Housing.
2. Remove the Lamp from the Rear Nut. Set the Lamp aside.
3. Remove the O-ring from its groove in the Rear Nut (56F-018), and discard.

Note: We recommend the use of BIRNS O-ring extraction tools for this procedure. If BIRNS tools are not available, any small probe will work, as long as its tip is smaller than about half the width of the O-ring. The probe should be made of materials softer than 6061 Aluminum (E.g. plastic or brass); if not, then take great care not to damage the O-ring groove.

4. Lightly lubricate the replacement O-ring with Silicone O-ring spray or grease.
 - a. If you use spray, simply spray the entire surface of the O-ring until it is thoroughly wet and shiny. Allow the excess to drip off before O-ring installation.
 - b. If you use grease, apply a small amount of grease onto the (gloved) tip of your index finger. Then, holding the O-ring between that index finger and your thumb, pull the O-ring with your other hand such that it revolves through the grease on your fingertip and the grease is spread evenly along the entire surface area of the O-ring. Do not allow grease to accumulate on the O-ring; the resulting grease film should not be thicker than about 0.010 inches (0.3 mm thick).

Note: A thin film of lubricant is sufficient. Grease is incompressible and, if over-applied, will interfere with the seal!

5. Gently install the new O-ring into the groove. Press the O-ring into its groove, and slide your (gloved) finger over its entire surface to “smooth” the O-ring into the groove, and to ensure that the lubricant is evenly distributed.
6. Carefully replace the Lamp, and install the Rear Nut into the Aquila. Connect the cables, and put the Aquila into service.

To replace the Lens O-Ring (59A-188):

1. Remove the Rear Nut (56F-018) from the Housing.
2. Remove the Lens Ring (56A-022) from the Housing, by turning it counter-clockwise until it comes out of the Housing.
3. Remove the Lens (35C-002): reach your two thumbs into the Housing from the back. Position your thumbs near the outer edge of the lens. Gently but firmly press your thumbs against the back of the Lens until it pops out of the Housing.
4. Remove the O-ring from its groove in the Housing, and discard.

Note: We recommend the use of BIRNS O-ring extraction tools for this procedure. If BIRNS tools are not available, any small probe will work, as long as its tip is smaller than about half the width of the O-ring. The probe should be made of materials softer than 6061 Aluminum (E.g. plastic or brass); if it is not, then take great care not to damage the O-ring groove.

5. Lightly lubricate the new replacement O-ring with Silicone O-ring spray or grease.
 - a. If you use spray, simply spray the entire surface of the O-ring until it is thoroughly wet and shiny. Allow the excess to drip off before O-ring installation.
 - b. If you use grease, apply a small amount of grease onto the (gloved) tip of your index finger. Then, holding the O-ring between that index finger and your thumb, pull the O-ring with your other hand such that it revolves through the grease on your fingertip and the grease is evenly spread along the entire surface area of the O-ring. Do not allow grease to accumulate on the O-ring; the resulting grease film should not be thicker than about 0.010 inches (0.3 mm thick).

Note: A thin film of lubricant is sufficient. Grease is incompressible and, if over-applied, will interfere with the seal!

6. Gently install the new Lens O-ring into the groove. Press the O-ring into its groove, and slide your (gloved) finger over its entire surface to "smooth" the O-ring into the groove, and to ensure that the lubricant is evenly distributed.
7. Replace the Lens. Carefully position the Lens into place, and gently push it straight into its recess, such that the entire circumference of the Lens engages the O-Ring simultaneously. Continue pushing the Lens into place until it is completely seated.
8. Install the Lens Ring (56A-022) by screwing it into the Housing clockwise until it seats against the Lens.
9. Install the Rear Nut (56F-018) into the Housing. Connect the cables, and put the Aquila into service.

To replace the Lamp Cushion O-Ring (59A-190):

- 1 Remove the Rear Nut (56F-018) from the Housing.
- 2 Remove the Lamp Cushion O-Ring (59A-190) from the housing, and discard.
3. Install a new Lamp Cushion O-Ring into the housing.

Note: This particular O-Ring requires no lubrication, as it does not perform any sealing function. This O-Ring is strictly a cushion for the lamp.

Caution: **Lubrication should *not* be applied to this O-ring, as its close proximity to the lamp may cause burning of the lubrication.**

4. Install the Rear Nut (56F-018) into the Housing. Connect the cables, and put the Aquila into service.

To replace the Connector O-Ring (59A-002):

1. Remove the Rear Nut (56F-018) from the Housing.
2. Remove the Lamp from the Rear Nut. Set the Lamp aside.
3. Remove the Connector (BEM2P-S) from the Housing by turning it counter-clockwise until it is free of the Rear Nut.
3. Remove the O-ring from its groove in the Connector, and discard.

Note: We recommend the use of BIRNS O-ring extraction tools for this procedure. If BIRNS tools are not available, any small probe will work, as long as its tip is smaller than about half the width of the O-ring. The probe should be made of materials softer than 6061 Aluminum (E.g. plastic or brass); if it is not, then take great care not to damage the O-ring groove.

4. Lightly lubricate a replacement O-ring with Silicone O-ring spray or grease.
 - a. If you use spray, simply spray the entire surface of the O-ring until it is thoroughly wet and shiny. Allow the excess to drip off before O-ring installation.
 - b. If you use grease, apply a small amount of grease onto the (gloved) tip of your index finger. Then, holding the O-ring between that index finger and your thumb, pull the O-ring with your other hand such that it revolves through the grease on your fingertip and the grease is evenly spread along the entire surface area of the O-ring. Do not allow grease to accumulate on the O-ring; the resulting grease film should not be thicker than about 0.010 inches (0.3 mm thick).

Note: A thin film of lubricant is sufficient. Grease is incompressible and, if over-applied, will interfere with the seal!

5. Gently install the new Connector O-ring into the groove. Press the O-ring into its groove, and slide your (gloved) finger over its entire surface to "smooth" the O-ring into the groove, and to ensure that the lubricant is evenly distributed.
6. Install the Connector by screwing it into the Rear Nut clockwise until it seats.
7. Carefully replace the Lamp, and install the Rear Nut into the Aquila. Connect the cables, and put the Aquila into service.

CORRECTIVE MAINTENANCE

Replacing the Lamp

To replace the lamp:

1. De-energize the circuit. Remove the Aquila from service, and decontaminate as necessary.

Caution: Do not perform any maintenance on the Aquila when the power is “ON”.

2. Wait for the unit to cool down, until it is cool to the touch.

Caution: The lamp normally operates at very high temperatures! Burn risk and fire hazard exists from hot lamps! Wait until unit is completely cool before removing or handling the lamp!

3. Disconnect the Power Cable from the Aquila.

4. Remove the Rear Nut (56F-018) from the Housing (28B-017) by turning it counter-clockwise until it is free of the Housing.

5. Remove the Lamp by pulling it straight out of the Rear Nut (56F-018). (It is retained by two spring-loaded sockets in the Connector, so you might feel some resistance.)

6. Remove a new Lamp from its packaging. Inspect it for damage before use.

Note: Do not touch the Lamp with your bare fingers. Always use a tissue or a clean cloth to touch either the bulb itself, or the interior of the reflector.

Caution: Do not use a lamp if it has been scratched, cracked or damaged in any way!

7. Gently install a new Lamp into the Rear Nut by inserting it, base first, into the interior of the Connector. Align the two pins in the base of the Lamp with the two sockets in the Connector. Firmly, but not forcibly, push the Lamp such that its two pins enter the two sockets, until the Lamp stops and cannot go any further.

Caution: Excessive installation force may break the Lamp!

8. Carefully insert the Lamp and the Rear Nut straight into the Aquila. Take care not to bump the lamp on the way in!

Caution: The lamp can easily be cracked or broken by careless handling! Do not impact the lamp on the inner surface of the Housing!

9. Install the Rear Nut (56F-018) by turning it clockwise, ‘hand-tight’, until it seats all the way.

Note: Do not use a wrench or tool to tighten the Rear Nut or the connector's locking sleeve. This may damage the units.

- 10 Connect the Power Cable, and put the Aquila into service.

Replacing the Connector (BEM2P-S)

To replace the Connector:

1. Remove the Rear Nut (56F-018) from the Housing.
2. Remove the Lamp from the Rear Nut. Set the Lamp aside.
3. Remove the Connector (BEM2P-S) from the Housing by turning it counter-clockwise until it is free of the Housing.
4. Install a new Connector by screwing it into the Rear Nut clockwise until it seats.
5. Carefully replace the Lamp, and install the Rear Nut into the Aquila. Connect the cables, and put the Aquila into service.

Removing/Replacing the Lens (35C-003)

Note: Under normal circumstances the Lens would not be removed or replaced; its removal is not necessary for relamping.

To replace the Lens:

- 1 Remove the Rear Nut (56F-018) from the Housing, and set it aside.
- 2 Remove the Lens Ring (56A-022) from the Housing, by turning it counter-clockwise until it comes out of the Housing.
- 3 Remove the Lens (35C-002): reach your two thumbs into the Housing from the back. Position your thumbs near the outer edge of the lens. Gently but firmly press your thumbs against the back of the Lens until it pops out of the Housing.
- 4 Remove the Lens O-ring (59A-188) from its groove in the Housing, and discard it.
- 5 Lightly lubricate new replacement O-rings with Silicone O-ring spray or grease.

Note: A thin film of lubricant is sufficient. Grease is incompressible and, if over-applied, will interfere with the seal!
- 6 Gently install the new Lens O-ring into the groove. Press the O-ring into its groove, and slide your (gloved) finger over its entire surface to “smooth” the O-ring into the groove, and to ensure that the lubricant is evenly distributed.
- 7 Install a new Lens. Carefully position the Lens into place, and gently push it straight into its recess, such that the entire circumference of the Lens engages the O-Ring simultaneously. Continue pushing the Lens into place until it is completely seated.
- 8 Install the Lens Ring (56A-022) by screwing it into the Housing clockwise until it seats against the Lens.
- 9 Install the Rear Nut (56F-018) into the Housing. Connect the cables, and put the Aquila into service.

TROUBLE-SHOOTING

Problem	Probable Cause	Corrective Action
Lamp burns out	<ol style="list-style-type: none">1. Normal if reasonable life time.2. Possible over-voltage.	<ol style="list-style-type: none">1. Replace lamp.2. Check input voltage, and/or contact BIRNS.
Intermittent light output	<ol style="list-style-type: none">1. Loose or bad contact in connector or plug.	<ol style="list-style-type: none">1. Check wiring and/or contact BIRNS.
Extremely difficult to mate connectors	<ol style="list-style-type: none">1. Possible mismatching of connectors.2. Insufficient connector lubrication.	<ol style="list-style-type: none">1. Ensure connectors are properly aligned.2. Lightly lubricate connectors.
Cable becomes brittle or hard	<ol style="list-style-type: none">1. Too much heat.	<ol style="list-style-type: none">1. Replace cable.
Cable becomes soft or sticky	<ol style="list-style-type: none">1. Too much radiation.	<ol style="list-style-type: none">1. Replace cable.
Leakage	<ol style="list-style-type: none">1. O-ring(s) damaged.2. Parts not tightened properly.3. Lens cracked/damaged.	<ol style="list-style-type: none">1. Replace o-ring(s).2. Tighten parts as necessary.3. Lens Dome.

TECHNICAL SPECIFICATIONS

Materials : Aquila Models 5746 and 5747

All Housing Parts:	Stainless steel type 304, electropolished (Model 5746)
All Housing Parts:	6061-T6 Aluminum, hard black anodized (Model 5746)
Lens:	Non-browning fused silica or Quartz
O-rings:	Silicone 70 (S1224-70)
Connector body:	Glass-reinforced epoxy (GRE) E-484
Connector pins:	Brass 360 per ASTM B16, gold-plated per MIL-G-45204

Materials : Power Cables

Connector locking sleeve:	Stainless steel type 304, electropolished
Connector body:	Polychloroprene (neoprene), vulcanized
Connector sockets:	Beryllium copper, gold-plated per MIL-G-45204

Cable:

Super-Vutron: Chlorinated Polyethylene (CPE) jacket; Ethylene Propylene Diene Monomer (EPDM) insulation

Aquaprene: Polychloroprene jacket; Styrene rubber (STR) insulation

Physical : Aquila Light

Length:	4.70 inches (119 mm)
Diameter (maximum):	2.38 inches (60 mm)
Weight in air:	11.5 ounces (326 g) (Model 5747)

Electrical

Current:	AC or DC; voltage per lamp requirements
Cable size:	16 AWG type SO, 2 conductor (standard)
Cable current rating:	12 amperes maximum
Cable voltage rating:	600 volts maximum

Lighting/Photometric

Lamp type:	Tungsten-halogen, 2-pin/GX5.3 base
Bulb Designation:	MR-16, 50.5 mm (2.0 inch) nominal diameter
Max. Overall Length:	44.5 mm (1.75 inch)
Filament type:	CC-6 (coiled coil)
Start time:	<1 second to 95% of peak output
Restart time:	<1 second to 95% of peak output on power re-application after interruption of any duration
Operating Position:	Universal (i.e. any position)
Rated Average Lifetime:	See Table A, Table of Available Lamps ¹

Table A — Table of Available Lamps

Lamp Part No.	Volts	Watts	Color (K)	Rated Life (Hours)
32C-001	12	25	2,925	3,000
32C-002	12	50	3,050	3,000
32C-003	12	100	3,350	200
32C-004	24	200	3,400	50
32C-005	24	250	3,400	50
32C-015	30	50	3,450	25

Environmental

Protection level:	IP68
Depth rating:	100 FSW (30 M) plus 50% safety margin

Expected Radiation Tolerance

Cable:	
Super-Vutron:	4 x 10 ⁶ R (4 x 10 ⁴ Gy)
Aquaprene:	5 x 10 ⁶ R (5 x 10 ⁴ Gy)
O-Rings:	3 x 10 ⁹ R (3 x 10 ⁷ Gy)

¹These ratings are determined by the lamp manufacturer based on laboratory tests under controlled conditions. Your own field results may vary.

APPENDICES

Appendix A — Applicable Drawings

Drawing	Title	Description
57470110	Aquila Assy.	Provides top-level overview