NORBIT

User manual for FCL-600 underwater lamps for aquaculture

Notice

We make every effort to provide the latest technical documentation. There may be updates. For this, please contact NORBIT Support for the latest information.

Disclaimer

While every effort is made to ensure the information given is accurate, NORBIT does not accept liability for any errors or omissions. All non-metric weights and measurements are approximate. Specifications, equipment, and other information in this document are subject to change without notice.

Release Notice

This is the March 20, 2024 release of the NORBIT FCL600 user and technical manual.

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Table of Content

1 Safety

When developing new products with associated user guides, the focus is on the safety of the users. We recommend that everyone who uses this product or carries out repairs, service or other maintenance on products supplied by NORBIT, familiarizes themselves with the contents of this user manual.

For the user's safety and to maintain the condition of NORBIT products, we strongly recommend following the safety procedures to prevent potential personal injury.

1.1 Safety symbols

The following safety symbols are used in this user manual:

:

Warning!
Indicates a risk of electric shock which could lead to death or serious injury, as well as possible danger to the welfare of the fish and their escape.

Warning!
Indicates danger that can lead to personal injury or damage to the FCL 600 lights.

Attention!
Indicates importance. Read carefully.

Note!
Indicates useful tips and recommendations for effective use of the product.

1.1.1 Other symbols

Personal Protective Equipment!
Indicates a requirement for the use of personal protective equipment.

1.2 Personal Safety

All individuals tasked with operating NORBIT Aqua's underwater lights must be thoroughly trained on the proper use of the equipment and made aware of the risks associated with misuse. NORBIT is not responsible for either injury or damages misuse of the lights due to improper use.

Warning!
Never look directly at lit underwater lights, as this can cause eye damage!

1.2.1 Requirements for Personnel

Assembly and operation must only be carried out by professionals or personnel who have received specific training. A specialist, per applicable national and local regulations, must carry out electrical connections of underwater lamps. Anyone who will install, use, or maintain NORBIT's FCL-600 underwater lamps must familiarize themselves with how these tasks are to be carried out and know about all possible dangers

associated with working with the product. The owner and operations manager are responsible for ensuring that all employees have read and understood the contents of this user manual before installation.

Tasks not mentioned in this user manual must be carried out by NORBIT service personnel or after possible written approval from NORBIT.

1.2.2 Safety equipment

When working on the edge of the cage, such as during the installation and maintenance of underwater lights, personal safety equipment like non-slip shoes and flotation devices are mandatory. To prevent harm to staff and equipment during the installation, upkeep, and potential repairs of NORBIT FCL-600 underwater lamps, adherence to all instructions provided by NORBIT Aqua in this user manual is crucial. Additionally, compliance with the laws and regulations of the country where the equipment will be installed is required.

1.3 Correct treatment of the equipment

1.3.1 Receipt of new equipment

Check that all the parts specified in the delivery note have been delivered. Contact NORBIT Aqua immediately if the order is incomplete or if something has been damaged during transport.
See Appendix B – Contact information.

1.3.2 Suspension and robes

Ensure that ropes and cables for the lamps do not conflict with ropes, cables, and other equipment inside the production unit (cage, pool, or tank), for example, the rotor spreader, camera, or sensors. This reduces the risk of damage in bad weather and reduces the risk of mechanical damage to the various parts.

1.3.3 Lamp and lens

Always check that the lamp and lens are intact and undamaged before its deployment. The lamp must always be submerged in water BEFORE it is lit, i.e. never above water or in a surface position. Lighting the lamp under water avoids fire and cracking damage due to overheated parts.

1.3.4 Cable

Check that the cable is not damaged when connecting to the power supply, avoiding any twists, breaks, or tears. Despite the cable's robust design, which includes a brass sleeve embedded in the lamp lid and solid kink protection, it should not be used to lift the lamp. This rule applies both on land and during maintenance after installation. Always use lifting ropes instead.

1.3.5 Disinfection of equipment

If equipment, ropes, and other related equipment are to be moved from one facility to another, it is required by law to disinfect everything to prevent possible infection. We recommend rinsing the equipment with fresh water after disinfection, as disinfectants are often powerful chemicals that can damage the materials.

1.3.6 Recommended knots

Warning!
Using a stable knot that is easy to open when underwater lamps are mounted and fixed in cages is important. There is a great risk of knots accidently loosening if they are not tied correctly, and the underwater lamp can fall into the production unit.

Ropes knots that have been used in or near seawater over time, can be difficult to untie. Regular maintenance in the aftermath of storms mean that underwater lamps must occasionally be taken up and removed from the cages. Then, it should be easy to untie the knots on the ropes and ropework. Use recommended knots for hanging all underwater lights.

We recommend using the "Clove Hitch" knot to attach underwater lamps to ropes and suspensions.

Warning!
This entire user manual must be read and understood before any work with the equipment is started, and it must be used as a guide during installation, use and maintenance.

2 Information

Thank you very much for choosing NORBIT Aqua as a supplier of your underwater lamps. This user manual is part of the equipment that must accompany the product.

Keep this user manual as long as your NORBIT Aqua underwater lights are in use and note all changes to/on the equipment at the back of the manual as they are made. An updated version of this manual can always be found at the following address:
https://norbit.com/no/products-and-solutions/
In addition, there is a QR code on the top of the lamp and on the side cover of the control unit (PDC), which, when scanned, leads to the page.

The purpose of this user manual is to enable the user to install, use and maintain the underwater lights safely and economically and to provide instructions for safe handling of the products. The user manual will also answer the most common questions related to daily use. All instructions must be followed.

Contact NORBIT if you need more information about NORBIT Aqua underwater lamps' installation, use or maintenance. See Appendix D - Contact information.

2.1 Revisions

Rev	Date	Issued	Issued by	Reviewed by	Approved by
A	20.09.23	Date created	KCV	KR	GLA

2.2 Who to use this user manual

This user manual is part of the equipment belonging to the NORBIT Aqua FCL-600, referred to as the "underwater lamp" in this user manual. The equipment owner is responsible for the user manual being available to all users as long as the equipment is in use.

The Table of Contents contains links to the respective sections of the user manual.

Section 1 describes guidelines to ensure correct and safe installation and use.

Section 2 provides information on NORBIT Aqua, the product FCL-600, and an introduction to the use of the user manual.

Section 3 explains how the power supply unit (Power Distribution Cabinet; PDC) should be mounted and how power and control of the lamps are connected via this.

Section 4 describes how the lamps are to be installed.

Section 5 has a complete overview and description of maintenance procedures and a registration form for maintenance and disposal of NORBIT Aqua underwater lamps.

At the back of the user manual, there are two appendices:
Appendix A - Deviation form Appendix
Appendix B – Contact information

2.3 About NORBIT Aqua

NORBIT Aqua has a long history as manufacturers of underwater lamps, with thousands of units in use by breeders in Norway and internationally. We have broad expertise in lighting for fish farming and work hard to be a preferred partner for our customers in terms of technical solutions, professional expertise, and service within cage-based and land-based farming.

2.3.1 Technology for sustainable biology

By developing technology focusing on solving biological challenges, we contribute to the further development of a sustainable industry. Good operational performance and fish welfare are essential to achieving good results, and investment in our technology will help deliver both.

2.3.2 Our Mission

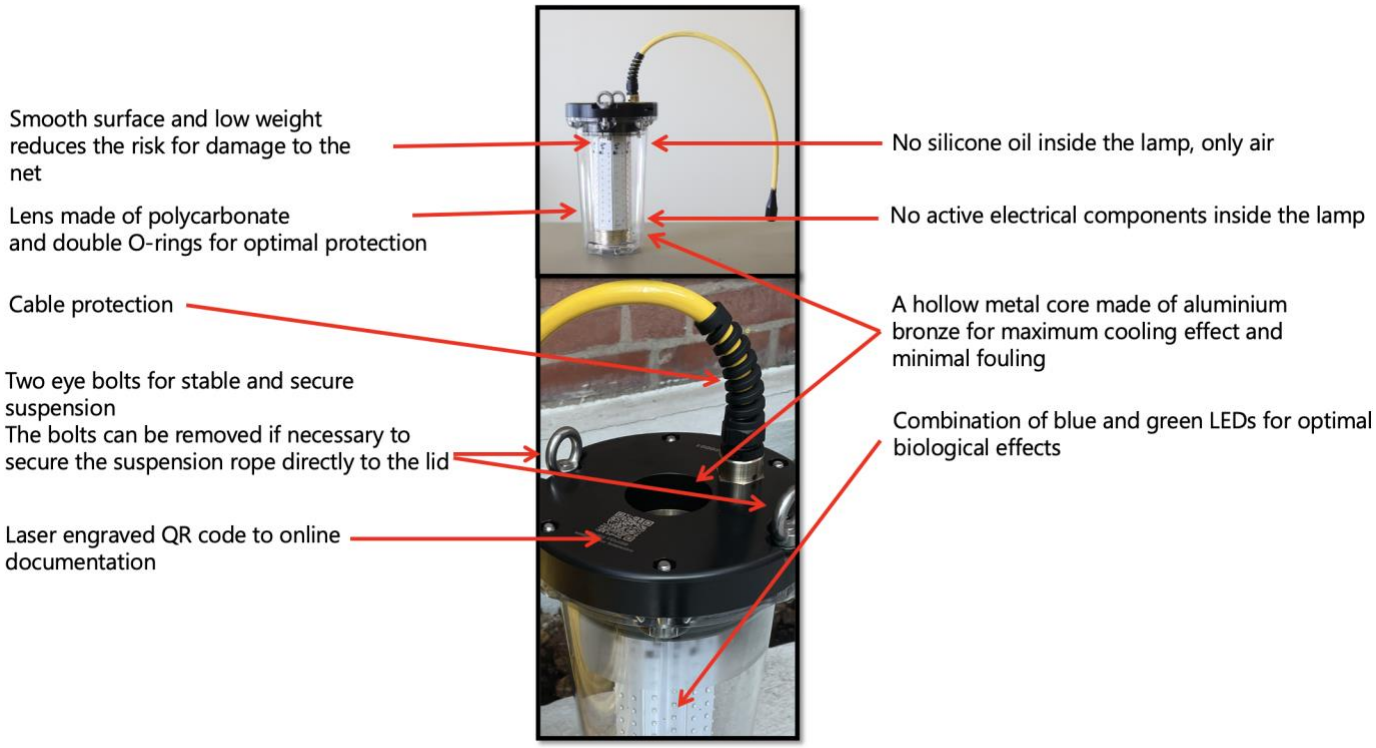
Our solutions and services will help optimize production and contribute to a sustainable, cost-effective, safe aquaculture industry. NORBIT Aqua supplies technology and services that contribute to solving biological challenges in the global aquaculture industry. Good fish welfare and operational performance ensure profitability for the customer. We base everything we deliver on that, from simple components to service assignments and complete installations. Solid aquaculture expertise, long experience and a high capacity for innovation characterize the company and enable us to deliver best-in-class solutions for both land-based and cage-based farming.

2.4 About NORBIT Aqua FCL-600

A stable and good light environment provides better fish welfare and increased profitability. Correct use of additional lighting in the marine phase reduces the proportion of sexual maturation, stimulates increased growth, and regulates the smoltification process in the hatchery phase. With underwater light, much faster growth and better feed utilization can also be achieved. NORBIT Aqua underwater lamps are suitable for fry and nursery fish in small tanks and vessels, as well as salmon, cod and species controlled by light in larger facilities. In the design, emphasis has been placed on good light distribution in the horizontal plane to avoid sharp gradients, the functional shape of the lamps, simple and safe installation, and simple maintenance.

Applications: Open, semi-closed and closed production units at sea, as well as large vessels and pools in-land-based production facilities.

NORBIT Aqua FCL-600 underwater lamp



NORBIT Aqua FCL-600 Description

SPECIFICATIONS	FCL- 600 Underwater lamp
WEIGHT	5,8 kg
HEIGHT/WEIGHT	32cm/20cm
IP (INGRESS PROTECTION CODE)	68
RAMP UP TIME 0-100%	10min
LUMINAIRE VOLTAGE	48V DC
LIGHT SOURCE	LED
CABLE LENGTH	30m (can be delivered with longer cable, for example, during deep operation)
WAVE LENGTHS	450-535nm
COOLING METHOD	Convection
CORE MATERIAL	Alu Bronze
LENS MATERIAL	Polycarbonate

Tabell 1. *Specifications for NORBIT FCL-600 Underwater lamps*

SPECIFICATIONS	POWER DISTRIBUTION CABINET (PDC)
WEIGHT	17.0kg
HEIGHT/WIDTH	13,3cm/94,4cm
DEPTH	17,0cm
IP (INGRESS PROTECTION CODE)	67
HOUSING MATERIAL	SEAWATER RESIST. ALU AND STAINLESS STEEL
TOTAL EFFICIENCY PER KIT (2 LAMPS)	1200W (2X600)
CABLE LENGTH	5m
SUSPENSION METHOD	Velcro straps
INPUT POWER	220VAC
OUTPUT POWER	48VDC

Tabell 2. *Specifications for NORBIT Aqua FCL-600 – Power Distribution Cabinet (PDC)*

2.5 About the Power Distribution Cabinet (PDC)

The control cabinet is the lamps' control unit and power supply. It is mounted under the handrail and weighs approx. 17kg. One person can assemble the control cabinet, but NORBIT Aqua recommends that two people participate in the assembly process.

The control cabinet generates sufficient heat to prevent ice formation, provided it's turned on with the corresponding lamps in operation. If it's not in use for extended periods, you should remove the cabinet from the cage and store it in a dry, temperature-controlled environment.

3 Mounting

3.1 Delivery Content

A standard pallet with lamps and control cabinet will contain the following:

- 4 control cabinets with 2x5 meter cable, hereafter referred to as PDC (Power Distribution Cabinet)
- 8 pcs FCL600 underwater lamps with 30meter cable
- 4 power plugs for connection to the 220V input on the PDC
- 8 blue Velcro straps for attaching the PDC
- 8 black Velcro straps for attaching cables to the handlebars
- 4 eyebolts with disc and nut for screwing into each PDC as secondary security

3.2 Preparations before mounting on the cage/cage

Before bringing lamps and PDC out onto the edge of the cage, it is recommended to make some preparations. A recommended lighting setup when using the NORBIT FCL600 is 4 lamps per cage (157-meters in circumference) powered by two PDCs. Since each PDC drives two lamps (Figure 1), power access to two PDCs is needed. Usually, the PDCs are placed directly above each other on the edge of the cage (figure 2). Hence, it's advisable to measure the distance from the cage's electrical cabinet to both PDCs, and adjust the power cord length accordingly. Both cables should then be fitted with the supplied power plugs, where current-carrying conductors are connected to points 1 and 2 and earth to the point marked with the symbol. ⏚

Figure 1. *One PDC powers two 600-watt lamps*

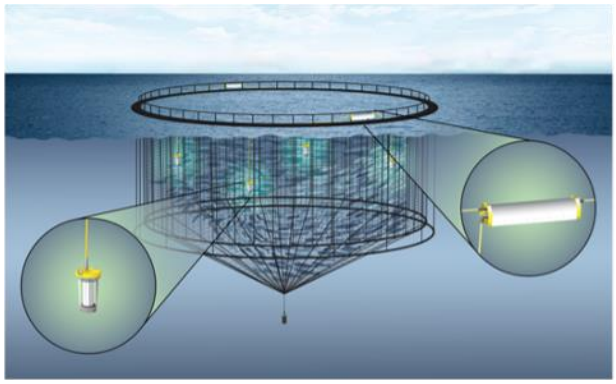


Figure 2. *Standard setup on a 157-meter cage.*

3.3 Installation on the cage

As depicted in Figure 3, you can easily mount the control cabinet (PDC) by fastening the two blue Velcro straps around the handrail.

Figure 3. *Velcro strap prepared for installation of PDC.*

Figure 4. *Correct attachment to hand row.*

The cables from the PDC are then attached to the handrail in each direction using the included black Velcro straps (Figure 4). It is recommended to lay the cable out from the PDC in an arc to avoid jerks in the cable. It is important to ensure that the power cord (on the left in Figure 4) which is connected to the PDC is also placed in a corresponding arc and fixed in the handrail. This is attached with insulating tape so that any jerks are caught by the cables, which are attached with Velcro tape.

The delivery includes stainless eyebolts. This purpose primarily acts as secondary protection, prevents the PDC from moving horizontally on the handrail, and reduces pendulum movement in storms. Before mounting on the handrail, the eyebolt should be screwed into the PDC and secured using the included washer and nut (figure 5). The bolt is mounted in a horizontal position as shown in Figure 3. It is also recommended to prepare the safety ropes that will go from the bolt out to the handstand in advance (Figure 6)

Figure 5. *Ready-mounted eyebolt*

Figure 6. *PDC mounted on handrail with secondary fuse.*

The next installation step is to connect the cables from the lamps and the cables from the PDC (Figure 8). Remember to take care of the blind caps placed in the connectors for protection. The connection is attached to the handrail and secured with insulating tape. The lamp cable must be attached to the right side of the power cable (Figure 4).

Figure 7. *Correct curve on cable*

Figure 8. *Connection of lamps to PDC*

Warning!
Please note that any treatment of electrical equipment carries a risk of electric shock. When working in and around water, this is particularly risky. Therefore, always use insulating gloves and footwear when working with electrical equipment.

Personal Protective Equipment!

Non-slip footwear and flotation devices are required to be worn when staying on the edge of the cage, for example in connection with carrying out work on underwater lamps and their accessories.

Warning!
Avoid blocking the opening in the lamp as it is important for cooling.

4 Placement and suspension of the lamps

4.1 Placement of lamps

If four lamps are installed, it is recommended to stretch two 16mm ropes directly over the cage from which two and two lamps can hang in a square orientation (Figure 9). This recommendation is based on field experience.

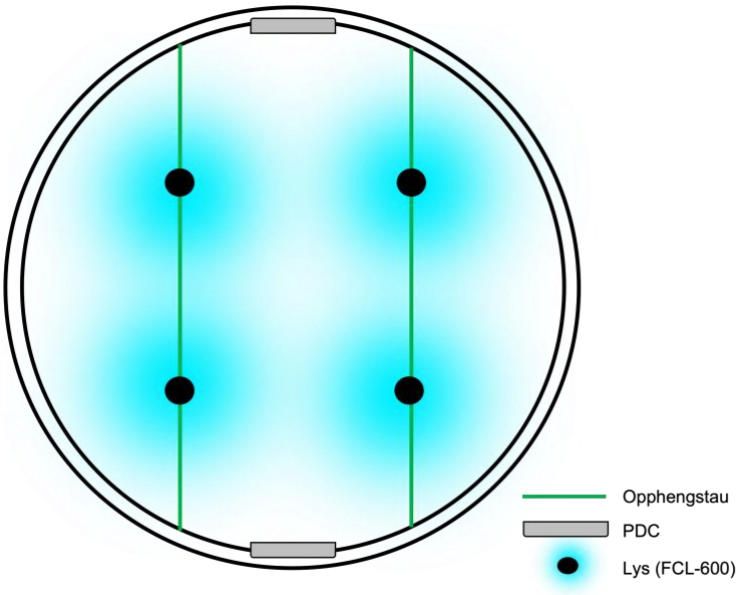


Figure 9. *Suggestions for placing lamps in pens.*

Figure 10. *Correct suspension of the FCL-600*

4.2 Suspension of the lamps

The lamps are suspended using a rope loop attached to the two eyebolts at the top of the lamp (Figure 10).

4.3 Connection of electricity

Screw the connector into the end of the PDC as shown in Figure 11. Please note, it's important to handle the protective cover on the connector with care.

Figure 11. *220-volt input on PDC.*

Figure 12. *Power cable correctly connected to PDC.*

Figure 13. *Silver button that lights the lamps.*

The lamps are lit by pressing the silver push button (Figure 13) at the right end of the PDC. A glowing blue ring around the button indicates that the lights are on.
To minimize stress on the fish, the lamps gradually reach their full brightness over a span of 10 minutes. When turning off, press the switch again, and the lamps will slowly dim to zero. Correct suspension and connection will give the product the desired function for many years.

Warning!
Please note that any treatment of electrical equipment carries a risk of electric shock. When working in and around water, this is particularly risky. Therefore, always use insulating gloves and footwear when working with electrical equipment.

Warning!
Never look directly at the light source, as this can be very harmful to the eyes

Warning!
Use knotted stakes to attach underwater lights to ropes for suspension

Warning!
Always use rope and the recommended knot to hang the underwater lights, and never hang them by the cable.

Warning!
The lamps must be hung so far inside the cage that they do not come into contact with the mesh bag.

Warning!
To avoid overheating and potential damage to the lamp, connect the power after immersing the lamp in the water.

Warning!
Improper suspension may invalidate the warranty.

5 Service and maintenance

Personal protective equipment!
Non-slip footwear and flotation devices are required to be worn when staying on the edge of the cage, for example in connection with carrying out work on underwater lamps and their accessories.

Warning!
Remove the lamps from the water before carrying out maintenance, repairs, and servicing. Maintenance should be performed on a stable platform, such as on a ship's deck or onshore.

5.1 General

Material selection and design have been made so that maintenance of the lamps will be as simple as possible.

For optimal use and functionality of the light, it's recommended to clean the exterior of the lamps regularly. Feel free to use a gentle scrub or brush to remove growth, scales and other things that stick to the outside of the lamp and cable. This maintenance must be carried out regularly, and the lamps are taken out of the water for checking and possibly cleaning. NORBIT recommends cleaning at least once per month and even more frequently during the summer months when algae and vegetation growth are at their peak.

POM (polyoxymethylene) and PC (polycarbonate), which are the external materials, can be disinfected between use in different locations and after any diseases in cages or vessels. It is recommended that all parts are rinsed with fresh water after disinfection.

The expected lifetime of the LED lamps is over 50,000 hours or 8 to 10 years.

NORBIT recommends cleaning at least once per month and even more frequently during the summer months when algae and vegetation growth are at their peak.

If a fault is detected with a lamp, contact:

support.aqua@norbit.com

5.2 Overview of maintenance, service intervals

ACTIVITY	COMMENT
Brush internal cooling channel	Performed before each adjournment
Replace the LED-panel	Performed when defective, by NORBIT Aqua or by agreement
Change connectors	Performed when defective, by NORBIT Aqua or by agreement
Changing the lens	Carried out by NORBIT Aqua or by agreement
Replacement of suspension straps	Replaced at signs of wear, checked before each shift

Table 3. *Maintenance overview with service intervals.*

5.2.1 Brushing of the cooling channel

Use a suitable brush to remove impurities from the cooling channel (Figure 14) before each application.

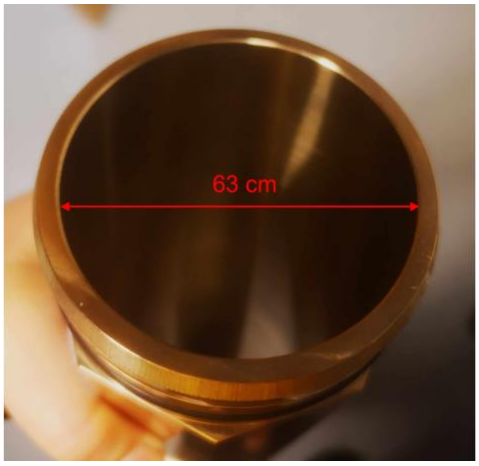


Figure 14. *The lamp's cooling channel*

5.2.2 QR code

A QR code is engraved in the lid of the underwater lamps. By scanning this, you are taken directly to the online user manual, quick guide, and product sheet in PDF format, as well as an installation video for the lamp and control cabinet.

5.2.3 Regular maintenance

Attention!
Sign for work done AFTER it has been done.

Date	ID-nr. lamp	Performed maintenance	Signature

5.2.4 Disposal

The product is to be regarded as inert and can be placed at an approved waste site and recycled within the category EE waste.

NORBIT Aqua will accept lamps and control cabinets at the end of their useful lives for safe disposal.

Appendix A – Deviation form

Notification of deviation	Number:

Unit:	Producer:	Prod. No.:	Purchased (year):

Deviation description:	
Suggestions for follow-up:	
Date and signature, reporting:	

Performed follow-up:	
Status:	
New action on notice of deviation no.	
Date and signature, follow-up:	

Appendix B – Contact information

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7041 Trondheim
Support: support.aqua@norbit.com