

PRODUCT

# SynJet<sup>®</sup> Cooler for LED Spot Light with Heat Sink

Assembly Guide

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 NUVENTIX

## Version History

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Version and Date	Changes
Version 0.1, November 2009	Preliminary Review Draft (rev 11/06)
Version 0.2, December 2009	Preliminary Release
Version 0.3, February 2010	Preliminary Release

### Safety

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This section discusses safety precautions that should be taken when assembling the SynJet Spot Light Cooler with Heat Sink.

Failure to follow these instructions carefully may result in personal injury as well as incorrect assembly leading to overheating of components.

### Electrical

The SynJet Spot Light Cooler voltages and currents are low and are typically not a hazard. The customer-supplied LED driver circuit card and connections may have higher voltages present. This could be a risk during rework operations. Be sure all electrical power is disconnected.

### Hot Surfaces

The LED and the heat sink surface nearby could be hot to touch, even though the LED and SynJet Spot Light Cooler are operating as specified. This could become a risk during a rework and test operation. Allow the assembly to cool before working on it.

### Sharp Corners

The heat sink may have pointed corners or sharp edges. Use care when handling and during assembly.

### FCC Part 15 (Class B) Compliance Notice

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This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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# Chapter 1

## Introduction

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This document provides information necessary to develop a production process for integrating the SynJet Spot Light Cooler with Heat Sink as elements of an overall lighting assembly.

The SynJet Spot Light Cooler (SLC) is available in several cooling performance levels, as described in the *SynJet Spot Light Cooler with Heat Sink Product Specification*. This assembly document is applicable to all five product models.

### Audience

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The audience for this assembly guide is the luminaire assembly and manufacturing process development team. Marketing and Engineering team members may find background information in this document useful.

### Related Information

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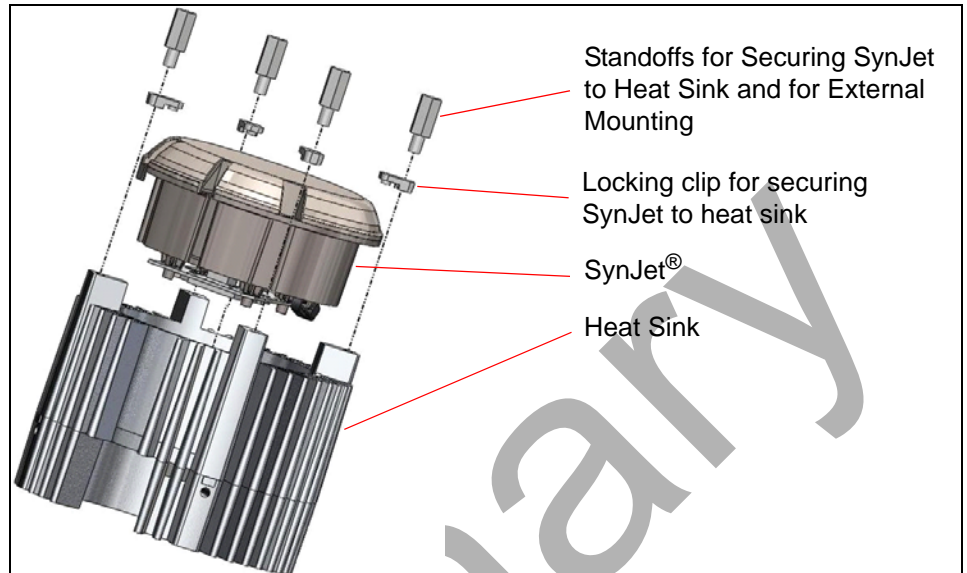
For additional information, refer to the following:

- *SynJet Spot Light Cooler with Heat Sink Product Specification*
- *SynJet Spot Light Cooler with Heat Sink Design Guide*
- *Nuventix Technology Overview*
- *SynJet Spot Light Cooler with Heat Sink 2D Drawings*
- *SynJet Spot Light Cooler with Heat Sink 3D CAD Model, STEP file format*
- *SynJet Variable Control Application Note*
- *The Nuventix web site at [www.nuventix.com](http://www.nuventix.com) for:*
  - Latest Document Updates
  - New Application Notes

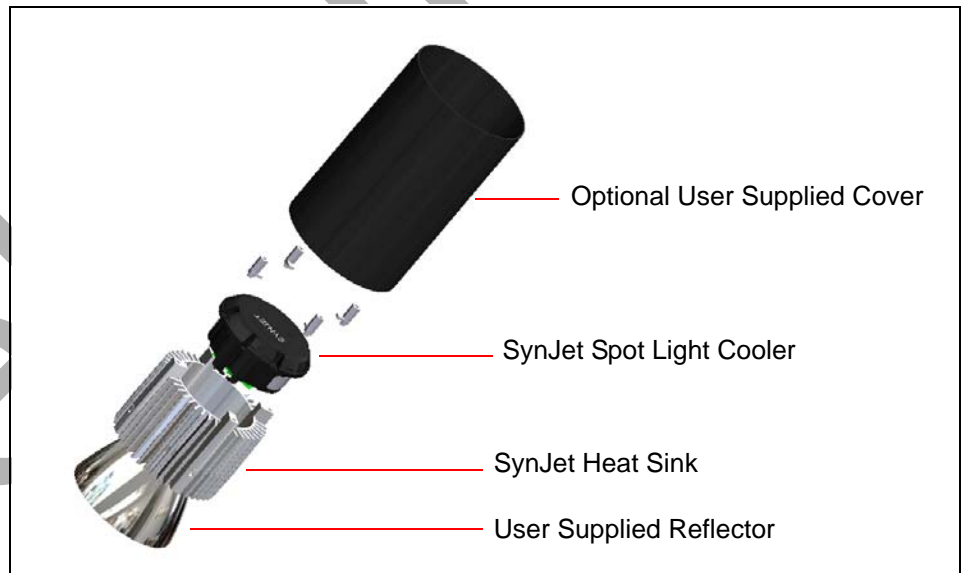
### Components

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The following figures illustrate the components of the SLC. The exploded assembly shows the SynJet Cooler and the SynJet heat sink. It also shows optional user supplied items such as the reflector and a cosmetic cover cylinder.



**Figure 1:** SynJet Spot Light Cooler and Heat Sink



**Figure 2:** SynJet Spot Light Cooler and Heat Sink With User Supplied Cover and Reflector

The following table describes each component.

**Table 1: Component Description**

Component	Description
SynJet Spot Light Cooler	The SynJet Spot Light Cooler is the air mover of the cooling system. The SynJet module works by creating turbulent, pulsated air-jets that are directed precisely into the heat sink fin channels where thermal management is needed.
Heat Sink and User Supplied Attachments - LED Array and Reflector	The heat sink spreads the heat dissipated from the LED Array over a large surface area. The LED Array attaches to the flat heat sink surface and the reflector will attach to the LED or the Heat Sink.
SynJet Spot Light Cooler Driver Board	The driver board contains the components needed to operate the SynJet Spot Light Cooler.
SynJet Cooler to Heat Sink Attachment Points	The four attachment standoffs mate with tapped holes in the heat sink. The standoffs screw into the 4 M3 mounting holes on the heat sink and secure the locking clips to the heat sink and SynJet. For screw size information and details, see the SynJet Spot Light Cooler 2D Drawings.
SynJet Cooler - Attachment Points for User Supplied Optional Cosmetic Cover and/or External Mounting Bracket	The designer can use the standoff screws and/or the tapped holes in the heat sink for attachment of a cover or mounting hardware. The Twist-Lock Bumps on the heat sink can also be used for attachment. See the SynJet Spot Light Cooler 2D Drawings for details.
User Supplied Optional Cover Cylinder and/or Reflector	The user may add an optional cover for product style and attachment requirements. This cover may attach to the heat sink. It may be part of the fixture external attachment assembly.

## Packaging

The SynJet Spot Light Coolers and heat sinks are shipped boxed in quantities based on ease of handling, shipping costs, and customer requirements. Contact Nuventix Sales for details.

## Requirements

For assembly, the following customer-supplied items are required:

- Four standoff screws are required for attachment of the heat sink to the cooler. Refer to the 2D Drawings for screw size information.
- All screws for user designed attachment of LEDs, reflector, luminaire cover, and external mounting.
- Loctite purple (222MS). This should be applied to all screws to ensure a tight fit for the entire lighting product life.
- Thermal Interface Material - for best heat transfer from the LED Array to the heat sink surface, a TIM should be used to insure good thermal contact.

## Handling

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The thermal, mechanical, and electrical integrity of the luminaire can be significantly influenced in the assembly process.

The LED drive circuit, the SynJet driver circuit, plus other power and control circuits in the luminaire, have typical industry levels of built-in ESD tolerance. However, unusual environmental conditions and handling can create exceptional levels of ESD that could cause damage.

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**IMPORTANT!** Electrostatic Discharge (ESD) is a significant cause of electronic circuit failure. A failure may:

- be immediate
- occur later due to a weakened component
- appear as an early service life failure.

An industry-standard assembly and test area must have proper ESD protected work stations. In addition, the staff must have ESD prevention education.

The SynJet Spot Light Cooler electronics require industry-standard care and use of proper ESD protection during assembly and test.

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When handling the SynJet Spot Light Cooler, use care with the wiring and the circuit card. The SynJet Spot Light Cooler is designed for normal assembly operations. With excessive force, the wires and components can be over-stressed and broken.

The SynJet Spot Light Cooler plastic housing has been designed to withstand normal assembly forces. Clamping or force fits can create very strong local forces that could damage or weaken the cooler housing, thus creating an early life failure risk.

The SynJet Spot Light Cooler contains magnets. Small particles of iron, screws, and other magnetic materials from secondary machining or that are loose in the assembly area may be attracted to the housing or the PCBA. They could interfere with performance or cause a failure. Be sure any particles are removed after machining and the assembly work area is clean.

If secondary machining operations are performed on the heat sink, remove the SynJet Spot Light Cooler to avoid damage to the housing or circuit card.

## Thermal Interface Material

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Thermal interface material (TIM) is important between surfaces that transfer heat. Refer to the *SynJet Spot Light Cooler with Heat Sink Design Guide* for additional information on selection and use of TIM.

For the best heat transfer, properly clean and prepare the transfer mating surfaces. Refer to the TIM supplier's recommendations for surface preparation.

Nuventix does not specify or supply a specific TIM. This is the responsibility of the luminaire design team's thermal engineer. Nuventix Sales can provide support and consultation.

# Chapter 2

## Assembly Instructions

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This chapter shows you how to assemble the SynJet Spot Light Cooler with Heat Sink. It includes suggestions for the assembly with customer specified LEDs, reflector, and cover. This chapter includes:

- Preparation Steps - describes steps required prior to assembly
- Mounting Features and Assembly - includes figures that show various SynJet Spot Light Cooler and heat sink mounting features, partial assemblies, and an assembled SynJet Spot Light Cooler with heat sink
- Assembly Overview with more detailed process sequence steps.

### Preparation

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The face of the heat sink is machined for improved flatness. Depending upon the luminaire design, secondary machining operations by the customer may be necessary for attachment of the LEDs to the face of the heat sink. Since the face of the heat sink is not coated, it can be machined more easily. If additional tapped holes are added to the heat sink, these machining operations should also be done prior to assembly. For specific customer needs, custom mounting features may be special ordered.

Heat transfer is significantly improved by cleaning the heat sink surface after machining operations and prior to attachment of the LEDs.

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**IMPORTANT!** The surface must:

- be clean
  - have high spots and roughness removed
  - conform to surface drawing specification
- 

The SynJet Spot Light Cooler is shipped with the ends of the control and power wires stripped and tinned. If a connector is used to connect the power supply, the wires are ready for the customer to crimp or solder them to the connector.

See the following table for further information.

**Table 2: Power and Control Wiring Specification**

	VDC	Gnd	Control	Overall Length	AWG (Stranded)	Wire Diameter
Power and Control	Red	Black	Blue	600 mm	26	1.02 (±0.04) mm
	Red	Black	Blue	240 mm	26	1.02 (±0.04) mm

## Mounting Features and Assemblies

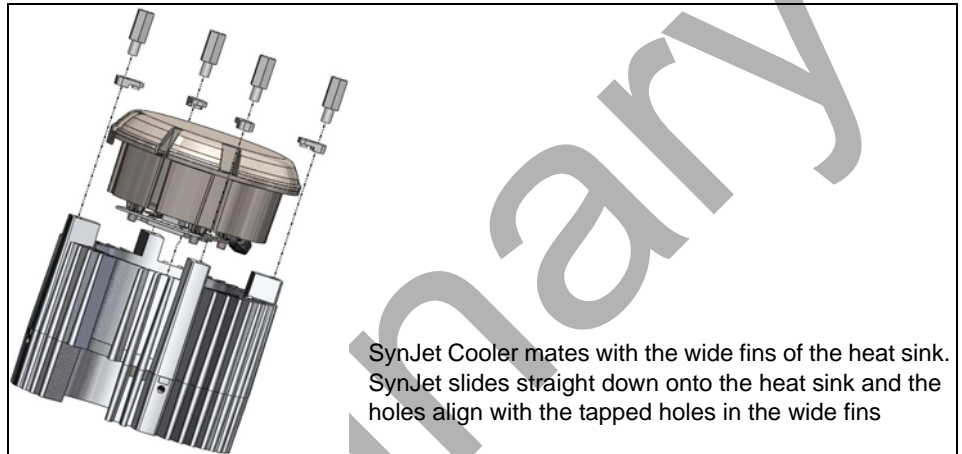
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### SynJet Spot Light Cooler Attachment to Heat Sink

This section provides assembly graphics and is followed by an assembly outline. This outline gives the recommended process steps for integration.

Detailed descriptions of each of the assembly elements and their mounting and wiring features are provided.

This section discusses attachment of the heat sink to the SynJet Spot Light Cooler.



**Figure 3: SynJet Spot Light Cooler Tabs**

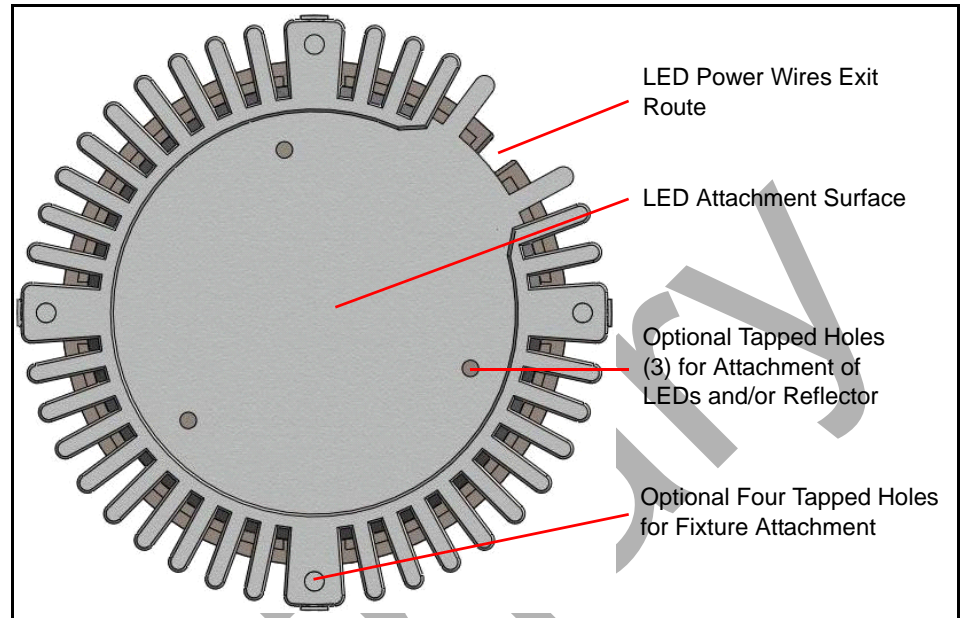
The lower rim of the cooler has four tabs with holes that can be aligned with the tapped holes in the four flat areas on the wide fins on the heat sink. The alignment should also be checked for proper wire exit routing. The four screws used for attachment should have Loctite 222 MS applied to the threads to assure a tight fit for the life of the luminaire. They should be tightened to a torque value of 0.45 N-m (4 inch-lbs)  $\pm$  10%. Refer to the SynJet Spot Light Cooler 2D Drawings for dimensions, sub-assembly views, tapped hole positions, and screw sizes.

To attach the heat sink and cooler, complete the following steps.

1. Align the cooler's power wire bundle with the notched wide heat sink fin. Be sure they are routed correctly from the PCBA.
2. Push the cooler gently onto the heat sink, shifting it slightly so it also aligns the four screw holes in the cooler and the heat sink. Check the notch again for correct wire routing.
3. Apply Loctite 222MS to the screw threads.
4. Align the standoff screws and locking clips with the holes and tighten the four screws.

### LED Attachment and Wiring

This section provides information on connecting the SLC with heat sink to an LED or LED array.



**Figure 4: LED Mounting**

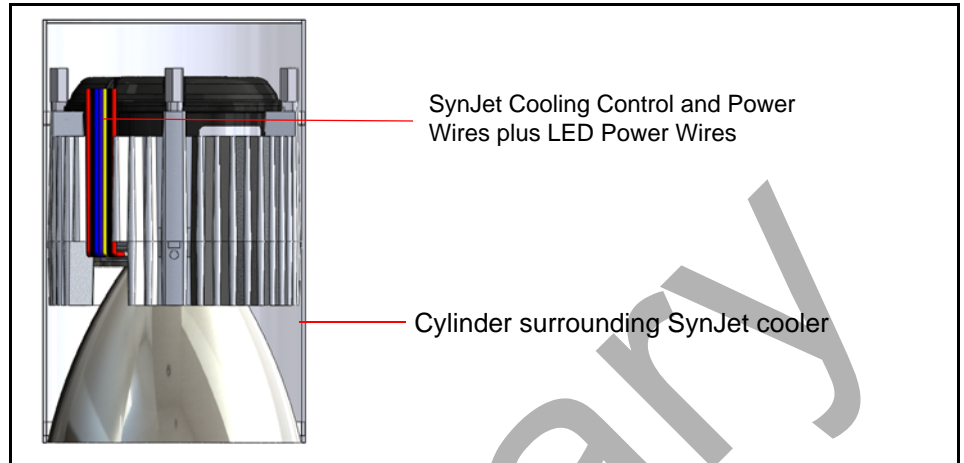
### Mounting Surface for LEDs

To mount an LED array or MCPCB to the SynJet Spot Light Cooler, the inner center of the heat sink has a flat surface area as shown in the figure above. The LED array is attached to this surface. This surface is machined and provides a flat surface to make good thermal contact with the LED array, MCPCB, or other mounting board. Standard mounting options for various LED hole patterns are available. Nuventix can add custom hole patterns. Requests for custom holes should be reviewed with Nuventix Sales. TIM is usually added to provide better heat transfer.

The customer may perform a secondary machining operation to add features to the mounting surface (such as additional threaded holes) dependent upon application needs. The customer may alternatively choose to use a thermal epoxy method to attach the LEDs and provide a good thermal path.

### Wire Routing

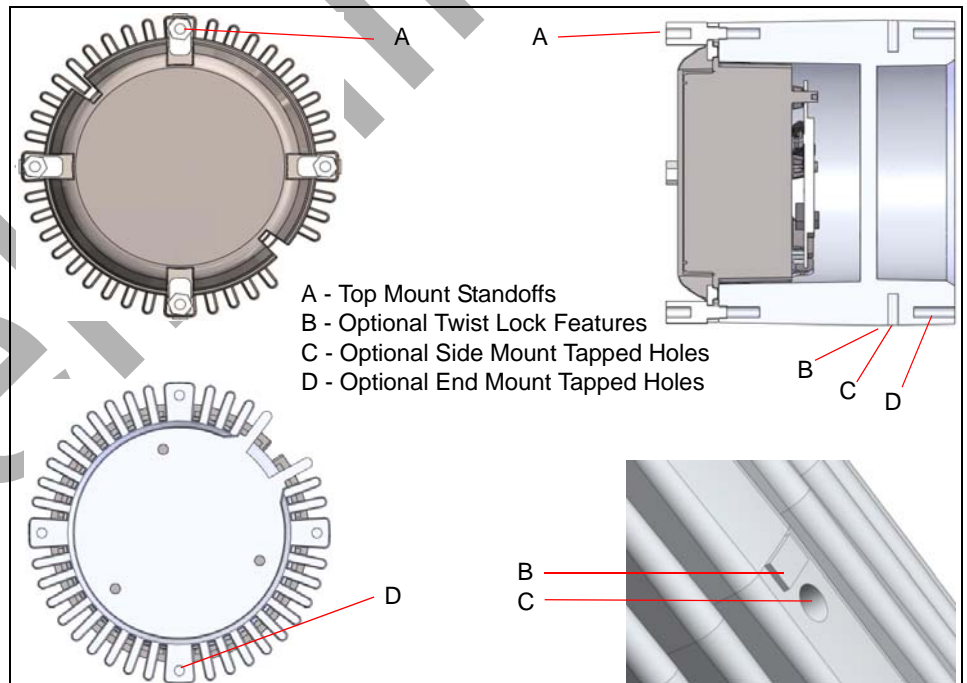
The Figure 5 shows the wires emerging from the SynJet Cooler and LED array and their routing along the heat sink fin channel to exit the assembly for connection to the power source. The figure shows a cylinder surrounding the SynJet Cooler, heat sink, and reflector. The wires may exit through the side or the end of the cylinder.



**Figure 5:** SynJet Cooler and LED Array Wire Routing

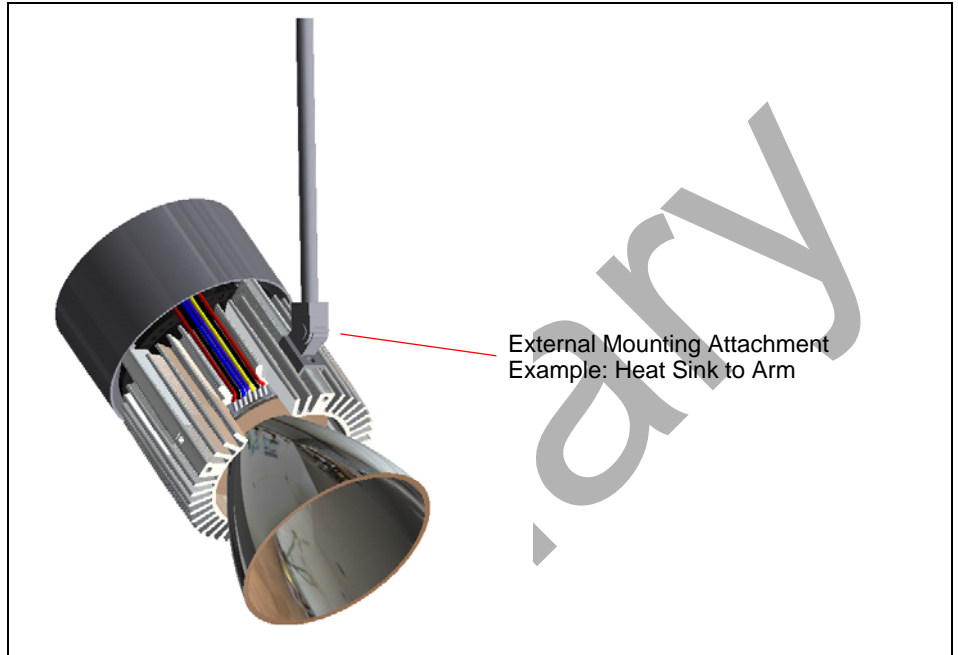
**External Mounting Attachment Options**

Figure 6 shows the three perimeter rows of optional external attachment holes; one row in the SynJet cooler attachment end of the heat sink, one at the light exit end of the heat sink, and one at the mid-point of the heat sink.



**Figure 6:** External Attachments Points

**Example 1** Figure 7 and Figure 8 show concept design examples using one of the center perimeter heat sink holes to attach the light fixture to the support arm.



**Figure 7:** Attachment to Support Arm

**Example 2**



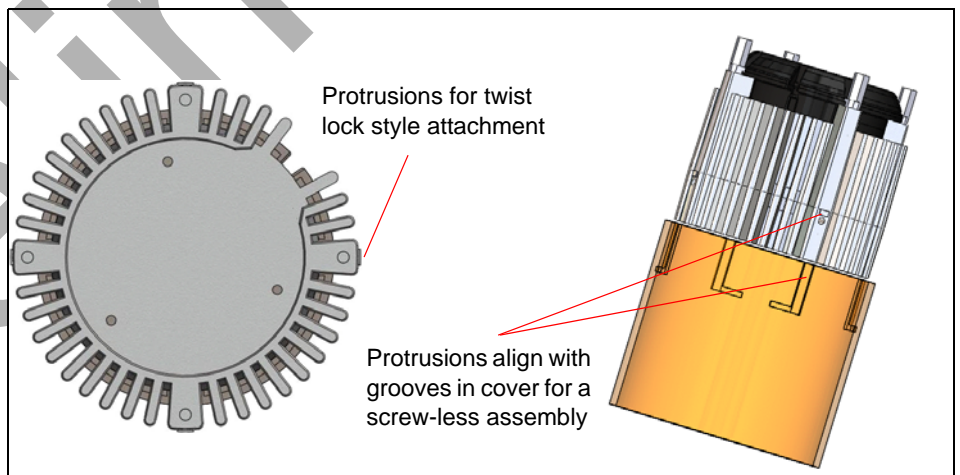
**Figure 8:** Attachment to Support Arm

**Example 3** Figure 9 shows a concept design example using one of the center perimeter heat sink holes to attach the light fixture to the support arm.

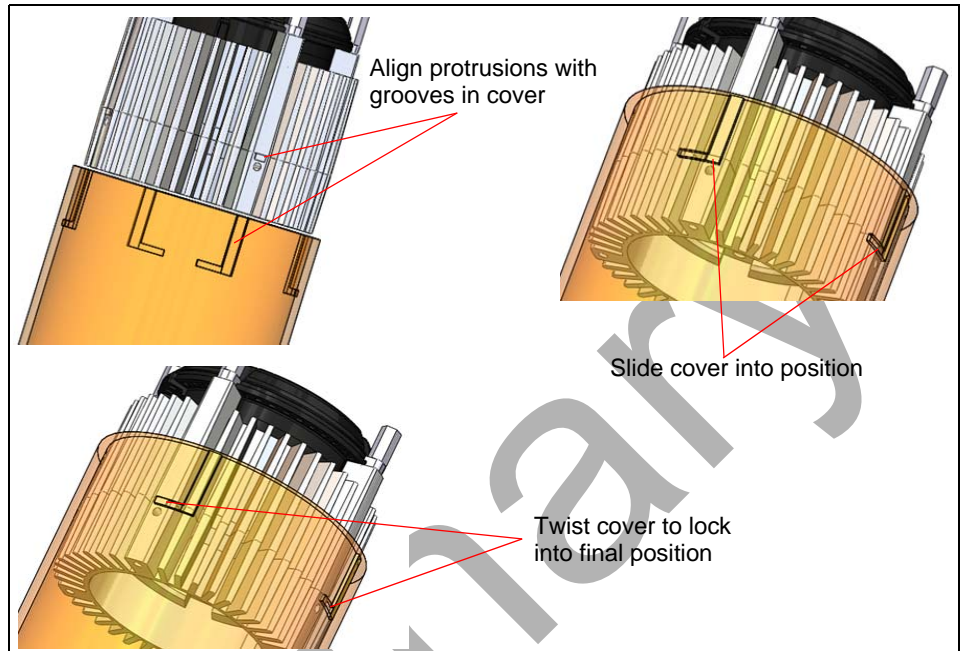


**Figure 9: Attachment to the Center Perimeter Heat Sink Hole**

**Example 4** The following figures provide information on quick twist lock cover attachment.



**Figure 10: Twist Lock Feature**



**Figure 11: Twist Lock Assembly**

## Assembly Overview

The SynJet Spot Light Cooler is at the heart of the final assembly.

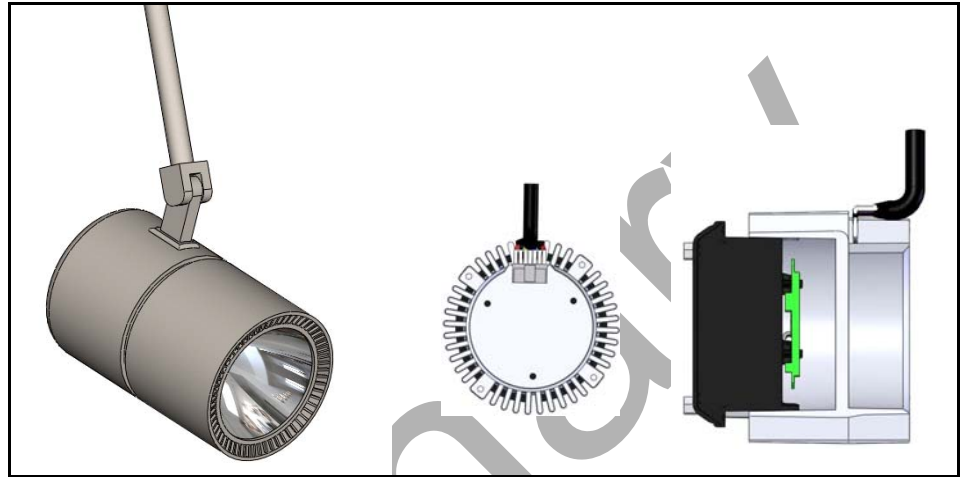
This section outlines a suggested assembly process. It may be used as a guide and checklist to be fine-tuned to the specific luminaire product.

The components for the process include the SynJet Spot Light Cooler, heat sink, LEDs, optics or diffuser, power connections, and LED driver electronics, plus customer sub-assembly parts. The final step is integration with the luminaire.

This paragraph and the next figure give an overview and general comments on important considerations for the assembly process.

1. The figure below shows a completed assembly sample on the left. The cross-section on the right has the external cylinder and reflector removed for a clear understanding of the assembly. This is an example, one style of many, a luminaire designer may create.
2. Each design will have several basic points for consideration in the assembly flow process.
  - a. In this example, the complete light engine - SLC with heat sink plus LEDs - is first assembled.
  - b. The Rear Half Cylinder is then attached to this sub-assembly using the attachment points on the heat sink.
  - c. The SynJet power wires and the LED power wires are planned to route directly to the tunnel in the arm. They should not wrap around the Cooler or heat sink more than necessary.

- d. In this design the rear half of the cylinder attaches to the heat sink and thus holds the weight of the assembly and the front half of the cylinder attaches to the rear half with a quick twist lock.



**Figure 12: Assembly and Wire Routing**

#### Heat Sink

To assemble the heat sink, LED, and optics complete the following steps:

1. Complete secondary machining operations on the heat sink.
2. Apply TIM.
3. Attach the LED Array MCPCB with reflector to the heat sink face.
4. Route LED power wires through the heat sink holes.
5. Add any clips or other fastening features to the heat sink attachment points for later optional addition of a cover or external mounting bracket.

#### Integration

To integrate the luminaire with the SynJet Spot Light Cooler, complete the following steps:

1. Align and mount the SynJet Spot Light Cooler to the luminaire using the holes in the heat sink or a customer designed bracket.
2. Connect power to the SynJet Spot Light Cooler and the LEDs.
3. Turn the power on and then off to test the assembly.

#### Operation

When power is turned on, the SynJet Spot Light Cooler begins operating immediately.

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**NOTE:** Due to its extremely quiet air flow, you must be in close proximity to feel the air flow and hear the cooler operating.

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## Disclaimer/Warranty

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Customers are responsible for testing products for their unique applications. Any information furnished by Nuventix and its agents is believed to be accurate and reliable. However, since every potential application cannot be anticipated, Nuventix makes no warranties as to the fitness, merchantability, or suitability of any Nuventix products for any specific or general uses. Nuventix shall not be liable for incidental or consequential damages of any kind.

## Contact Nuventix

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