

PRODUCT

SynJet[®] PAR25 LED Cooler with Heat Sink

Assembly Guide

Version 1.0
June 2009



 NUVENTIX

Version History

Document Name: SynJet PAR25 LED Cooler with Heat Sink Assembly Guide

Document Number: MKTG-DOC-00048.

Version and Date	Changes
Version 1.0, June 2009	Initial release.

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Chapter 1

Introduction

This document provides information necessary to develop a production process for integrating the SynJet PAR25 LED Cooler with Heat Sink as elements of an overall lighting assembly.

The SynJet PAR25 LED Cooler is available in four cooling performance levels, as described in the *SynJet PAR25 LED Cooler w/HS Product Specification*. This assembly document is applicable to all four product models.

Audience

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 Documents

For additional information, refer to the following:

- *SynJet PAR25 LED Cooler w/HS Product Specification*
- *SynJet PAR25 LED Cooler with Heat Sink Design Guide*
- *SynJet Variable Level Cooling Control Application Note*
- *SynJet PAR25 LED Cooler with Heat Sink 2D Drawings*
- *SynJet PAR25 LED Cooler with Heat Sink 3D CAD Model, STEP file format*
- Visit www.nuventix.com for the above documents and latest additions.

Components

The SynJet PAR25 LED Cooler assembly consists of the SynJet PAR25 LED Cooler and heat sink.

The SynJet PAR25 LED Cooler with Heat Sink is shown assembled in the [Figure 1](#).



Figure 1: SynJet PAR25 LED Cooler Assembled

[Appendix A](#) shows and describes all components in greater detail.

Refer to the 2D mechanical drawings for key dimensions of the SynJet PAR25 LED Cooler with Heat Sink.

Packaging

The SynJet PAR25 LED 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 screws, M 2.5 x 0.45 8 mm, are required per cooler. Select a screw head type that is compatible with the production assembly process. The four screws ship with the cooler for small evaluation projects.
- Loctite purple (222MS). This should be applied to all screws to ensure a tight fit for the entire lighting product life.

Handling

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 PAR25 LED Cooler electronics require industry-standard care and use of proper ESD protection during assembly and test.

When handling the SynJet PAR25 LED Cooler, use care with the wiring and the circuit card. The SynJet PAR25 LED Cooler is designed for normal assembly operations. With excessive force, the wires and components can be over-stressed and broken.

The SynJet PAR25 LED 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 PAR25 LED 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 PAR25 LED Cooler to avoid damage to the housing or circuit card.

Safety

This section discusses safety precautions that should be taken when assembling the SynJet PAR25 LED 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 PAR25 LED 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 could be hot to touch, even though the LED and SynJet PAR25 LED 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.

Thermal Interface Material

Thermal interface material (TIM) is important between surfaces that transfer heat. Refer to the *SynJet PAR25 LED 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 of the luminaire design team's thermal engineer. Nuventix Sales can provide support and consultation.

Chapter 2

Assembly Instructions

This chapter shows you how to assemble the SynJet PAR25 LED Cooler with Heat Sink. It includes suggestions for the assembly with customer specified LEDs and drive electronics. This chapter includes:

- Preparation Steps - describes steps required prior to assembly
- Mounting Features and Assembly - includes figures that show various SynJet PAR25 LED Cooler and heat sink mounting features, partial assemblies, and an assembled SynJet PAR25 LED Cooler with heat sink
- Assembly Overview with more detailed process sequence steps.

Preparation

The face of the heat sink is machined for improved flatness. Usually, secondary machining operations by the customer are 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 tapped holes are added to the heat sink for assembly attachment to the luminaire, these machining operations should be done prior to assembly also. For specific customer needs, custom mounting features may also be special ordered.

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

IMPORTANT! The surface must:

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

The SynJet PAR25 LED Cooler is shipped with the ends of the 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. This connector is most easily added early in the assembly process. If no connector is used, the wires can be soldered or otherwise attached to the power supply. See the following table and figure for further information.

Table 1: Power and Cooling Control Wiring Specification

	Signal	Color	Overall Length	AWG (Stranded)	Wire Diameter
Power	+5 Vdc	Red	150 mm	26	1.02 mm
	GND	Black	150 mm	26	1.02 mm
Control ¹	I/O 1	Blue	150 mm	26	1.02 mm
	I/O 2	Purple ²	150 mm	26	1.02 mm

1. Cooling level control is an option. Wires are present only with the option.
2. In some early coolers, I/O 2 was yellow.



Wire	Signal
Blue	I/O 1
Purple	I/O 2
Black	GND
Red	+5 Vdc

Figure 2: Wiring Diagram

The following table shows the variable level cooling controls and indicates standard settings.

Table 2: Variable Level Cooling Control

	I/O 1 (Blue)	I/O 2 (Purple)
Standard Performance ¹	1 ²	1
High Performance	0 ²	1
Silent	1	0
Off	0	0

1. If Level Control is not used, this is the default setting.
 2. I/O 1 and I/O 2 inputs are standard CMOS logic levels:
 1 = Open or High
 0 = Gnd or Low

Mounting Features and Assemblies

SynJet PAR25 LED 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 PAR25 LED Cooler.

The rim of the cooler has four holes that can be aligned with the four thick, wide fins on the heat sink. The thick, wide fins have a hole in their upper end. It is tapped for an M 2.5 x 0.45 8 mm screw (see the following figure). The rim of the cooler also has two thin, wide fins. They are thin to help create a wire bundle passage. The two notches on opposite sides in the body of the cooler plastic form the other half of the passage. The passage that aligns with the LED power wire feed-through hole in the heat sink face is used to route external power to the LEDs. The passage on the opposite side routes power and control wires from the SynJet PCBA to their external connections.

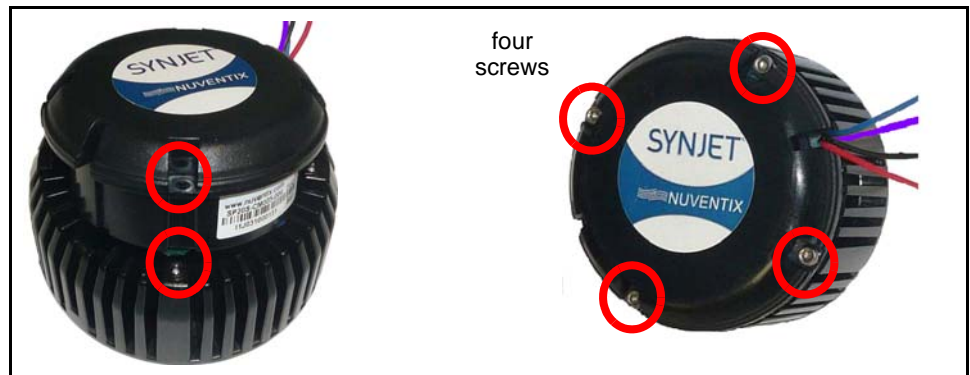
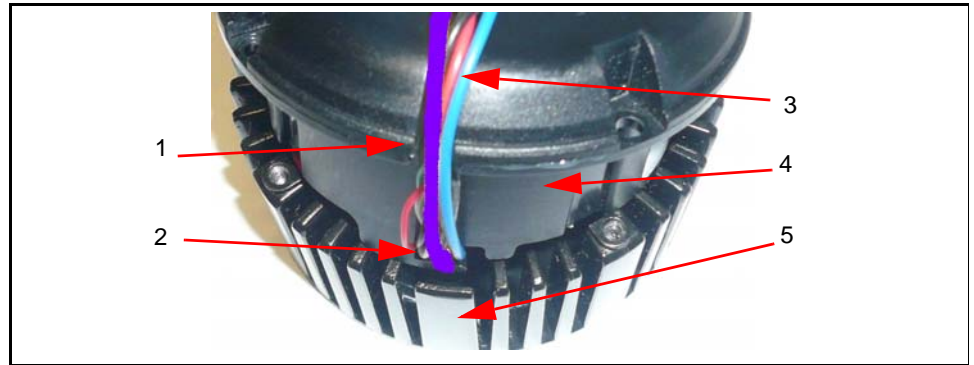


Figure 3: Screw Placement

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

1. Align the cooler's power wire notch and wire bundle with the thin wide heat sink fin. Be sure they are captured by the strain relief next to the PCBA.
2. Push the cooler gently into the heat sink basket, shifting it slightly so it also aligns the four screw holes in the cooler and the heat sink. Check the notch on the opposite side to be sure it is clear for addition of the LED wiring in Step 5.



- | | |
|-----------------------------------|--|
| 1 exit notch | 2 strain relief and retainer for wires from PCBA |
| 3 SynJet power and control wires | 4 housing recess |
| 5 thin, wide fin for wire passage | |

Figure 4: Routing SynJet Wires (Strain Relief, Passage, and Exit Notch)

- Place the SynJet PAR25 LED Cooler power and control wires in a channel on the opposite side of the cooler. See the following figure.



Figure 5: Running SynJet PAR25 LED Cooler Power and Control Wires

- Tighten the four screws holding the cooler in the heat sink. Be sure to apply Loctite 222MS. The recommended torque is $0.56 \text{ N-m} \pm 0.11$ ($5.0 \text{ in-lbs} \pm 1.0$).
- Feed the LED power wires through the hole in the heat sink face (see [Figure 6](#)) and through the passage to the exit notch in the cooler cover. They exit on the opposite side from the SynJet wiring. LED power wire routing is shown in [Figure 7](#) and in [Figure 8](#).

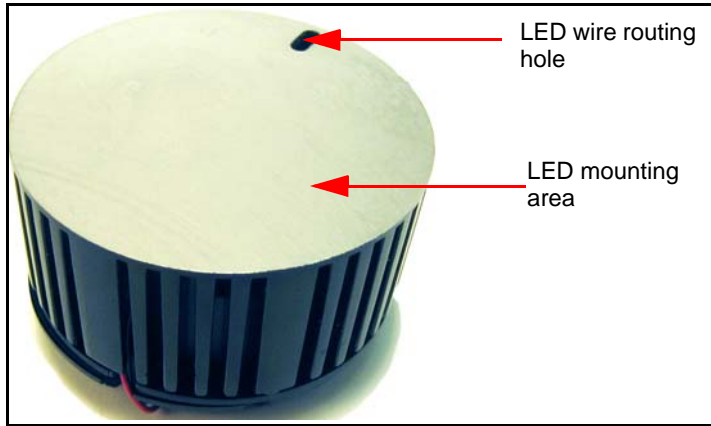


Figure 6: Heat Sink Face

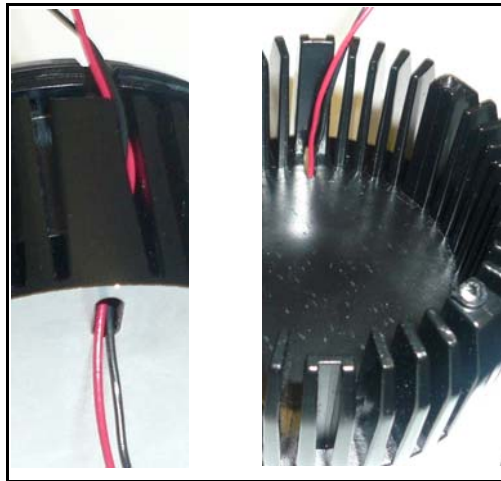


Figure 7: LED Power Wire Routing



Figure 8: Heat Sink Face with LEDs Attached

LED Attachment and Wiring

Figure 6 shows the center of the heat sink face used to attach the LED. Figure 8 shows the LED power wire routing from the face of the heat sink to the external LED power source.

Typically the face would have holes drilled and tapped to attach LEDs. Figure 8 shows LEDs attached to the heat sink surface. Holes may also be added for the reflector and luminaire attachments.

Figure 9 shows the space between the PCBA and the inner edge of the heat sink surface. LED attachment screws or mounting bracket screws should not protrude into this space more than 1mm to avoid the wires and PCBA components.

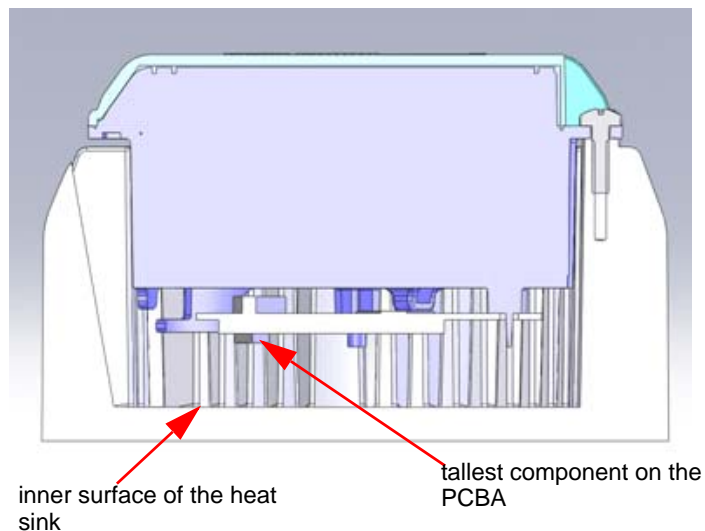


Figure 9: Section View of Assembly

Figure 10 shows the completed assembly of the heat sink and SynJet PAR25 LED Cooler.



Figure 10: Assembled SynJet PAR25 LED Cooler with Heat Sink

Assembly Overview

The SynJet PAR25 LED Cooler is the primary functional component 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 PAR25 LED Cooler, heat sink, LEDs, optics or diffuser, power connections, and LED driver electronics. The final step is integration with the luminaire. Refer to the 2D mechanical drawing for details and a schematic of the SynJet PAR25 LED Cooler with Heat Sink components.

SynJet PAR25 LED Cooler

To assemble the SynJet PAR25 LED Cooler and LED electronics, complete the following steps:

1. Attach to SynJet PAR25 LED Cooler stripped/tinned power wires to DC power for SynJet PAR25 LED Cooler electronics.
2. Verify operation, with quick power on check. If this a Variable Control Cooler, the cooling levels should also be verified. Refer to [Table 2](#).

Heat Sink

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

1. Complete secondary machining operations on the heat sink.
2. Attach the LEDs to the heat sink.

NOTE: TIM is recommended.

3. Route LED power wires through the heat sink holes.
4. Attach the heat sink to the cooler using the four screws. If an external mounting bracket is required, install it now.
5. Add a connector to the LED driver wires.
6. Attach the optics or diffuser.

Integration

To integrate the luminaire with the SynJet PAR25 LED Cooler, complete the following steps:

1. Align and mount the SynJet PAR25 LED Cooler to the luminaire using secondary machined holes in the heat sink or a customer designed bracket attached to the four screws which also attach the heat sink to the cooler.
2. Connect power to the SynJet PAR25 LED Cooler and the LEDs.
3. Turn the power on and then off to test the assembly.

Operation

When power is turned on, the SynJet PAR25 LED Cooler begins operating immediately.

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

Appendix A

SynJet PAR25 LED Cooler Components

The following sections provide information on the components of the SynJet PAR25 LED Cooler.

Heat Sink

The LEDs shown on the heat sink are added by the user.

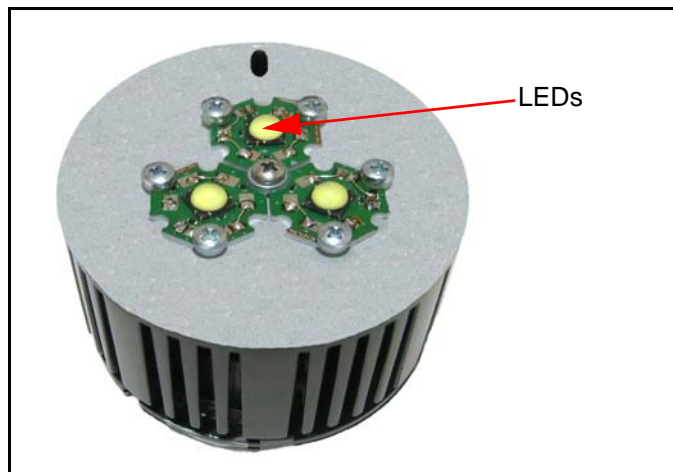


Figure 11: SynJet PAR25 LED Cooler Heat Sink

SynJet PAR25 LED Cooler Driver Board

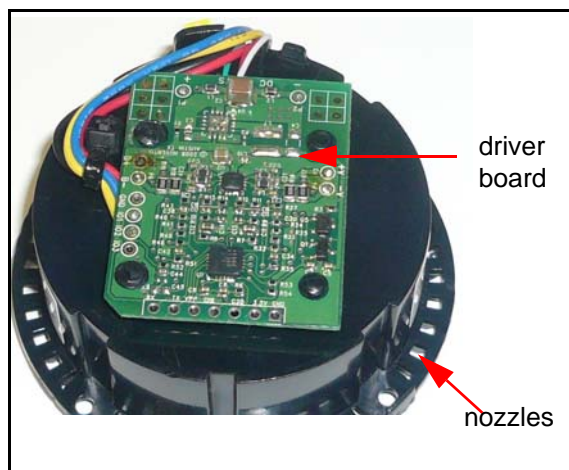


Figure 12: SynJet PAR25 LED Cooler Driver Board

SynJet PAR25 LED Cooler

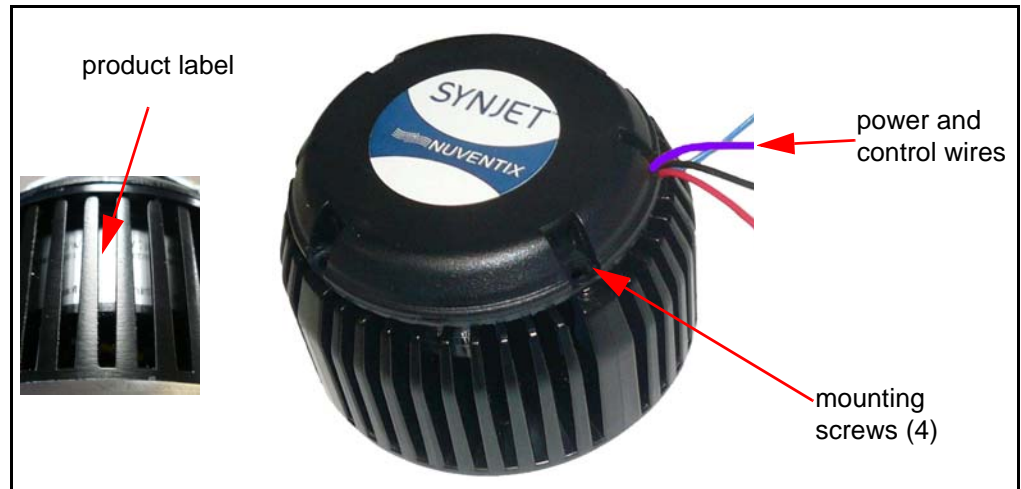


Figure 13: SynJet PAR25 LED Cooler

The following table describes each component.

Table 3: Component Description

Component	Description
SynJet PAR25 LED Cooler	The SynJet PAR25 LED Cooler is the air mover of the cooling system. The SynJet PAR25 LED Cooler creates turbulent pulses of air, i.e., synthetic jets, which are directed between heat sink fins.
Heat Sink	The heat sink spreads the heat dissipated from the LEDs over a large surface area. The heat sink is die cast aluminum and is coated, except on the heat sink face, with an electro-coating for protection. Shown with LEDs mounted on the face.
SynJet PAR25 LED Cooler Driver Board	The driver board contains the components needed to operate the SynJet PAR25 LED Cooler.
Power Wires	The red and black power wires are the electrical interface to an external DC power supply. The purple and blue wires are optional and control the cooling level. The wires have stripped and tinned ends for easy soldering or connection to a connector.
Mounting Screws	Four M 2.5 x 8 mm screws secure the SynJet PAR25 LED Cooler to the heat sink. Recommended torque is 0.56 N-m \pm 0.11 (5.0 in-lbs \pm 1.0). Apply Loctite 222MS to all screws.
Product Label	The product label contains pertinent information such as part number, revision, operating voltage, manufacturing information, and patent notification.

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