



DOI: <https://doi.org/10.56936/18290825-2026.20v.1-81>

## COMPARISON OF RADIANT HEAT FLUX FROM A LARGE-SURFACE AND CONVENTIONAL NEONATAL WARMER USING STANDARDIZED BLACK BODY PLACEMENT

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Received 3.09.2025; Accepted for printing 14.05.2026

### ABSTRACT

**Background:** Maintaining thermal stability in neonates remains a clinical challenge. Conventional resistive heat warmers (RHWs) may cause localized overheating, while large-surface warmers have been proposed as a safer alternative.

**Objective:** The objective of this study was to compare surface temperature stability and heat flux characteristics of test objects exposed to a conventional resistive heat warmer (RHW) and a prototype large-surface warmer, using a regulatory reference test methodology for incubators and radiant warmers.

**Methods:** Five calibrated Fluke Corporation test objects were placed on a pre-warmed mattress and exposed to each heating system. Both systems were evaluated across six servo-controlled temperature settings ranging from 36.0 to 37.0 °C. Surface temperature and heat flux at the upper surfaces of the test objects were recorded at 15-second intervals over a 60-minute period. Theoretical radiant heat flux requirements were calculated using the Stefan–Boltzmann law. Collected data were analyzed using descriptive statistics and independent *t*-tests to assess differences between the two warming modalities.

**Results:** The RHW delivered heat flux values approximately 6–7 times higher than those measured under the large-surface radiant warmer ( $p < 0.001$ ), with substantially greater temporal variability. In several settings, RHW heat flux exceeded the calculated theoretical requirements. In contrast, the large-surface radiant warmer maintained lower, more stable, and more uniform surface temperatures across all test objects. Both systems complied with the applicable standard thermal performance criteria.

**Conclusion:** The prototype large-surface radiant warmer demonstrated gentler and more consistent heat delivery compared with the RHW, supporting its potential as a safer thermal support method in neonatal care. Continuous heat flux monitoring may provide an additional indicator of thermal readiness and stability during neonatal warming.

**KEYWORDS:** neonatal warming, heat flux, radiant warmer, servo control, thermal safety

### CITE THIS ARTICLE AS:

KREICBERGA I., REZEBERGA D., MISKOVA A., VARDANYAN R., ARBUZOV G., TĒRVIDS T. (2026). Comparison of Radiant Heat Flux from a Large-Surface and Conventional Neonatal Warmer Using Standardized Black Body Placement; The New Armenian Medical Journal, vol.20 (1), 81-89; DOI: <https://doi.org/10.56936/18290825-2026.20v.1-81>

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