5.3.2 IRCA: Flexible, Foil, Heaters

5.3.2.1 Contact Information

Address	ESCC Chief Inspector
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5.3.2.1 Qualification

Current Qualification Certificate No.	In QML since:		Type Designation
184R	Apr. 1992	ESCC Detail Specification No. 4009/002	resistors, heaters, flexible, single and double layer
330F	Jan 2015	ESCC Detail Specification No. 4009/004	

APPLICABLE DOCUMENTS

ESCC Generic Specification No. 4009

ESCC Detail Specification Nos. 4009/002, 4009/004

IRCA S.p.A. Process Identification Document PID 5.34.16

5.3.2.2 List of Qualified Components

Single, Double layer heaters

Detail Specification	
4009/002	Variants 01 through 48 are qualified (Operating Temperature Range (°C): -65 to +200)
4009/004	Variants 01 through 48 are qualified (Operating Temperature Range (°C): -65 to +150)

Detailed spec #	Insulation material	Configurations									
		Double layers	Multiple circuits	Aluminum backing	3M 966 PSA	magnetically compensated	modules	strips	RICA patch	Nicolitch patch	RICA acrylic patch (WA)
002	Polyimide + FEP resin	x	x	x	x	x	x	x	x	x	
004	Polyimide + Acrylic resin	x	x	x	x	x					x

TYPE 4009/002: PHYSICAL DIMENSIONS AND HEATER OUTLINE

The Heating Area, S, shall be:

- Individual or Module, single layer heaters: 0.2 to 1300cm^2
- Strip, single layer heaters: 3.2 to 312cm2
- Individual or Module, double layer heaters: 1.6 to 1300cm2

The maximum weight of the heaters, excluding the weight of the terminal leads, shall be:

- Individual, strip or Module, single layer heaters: 50mg/cm2
- Individual or Module, double layer heaters: 75mg/cm2

The weight of the terminal leads shall be as specified in the applicable wire ESCC Detail Specification.

Heater Thickness

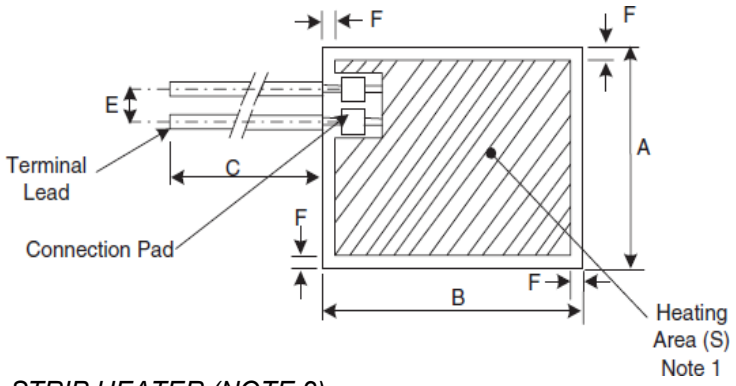
The maximum thicknesses for single layer and double layer heaters are as follows:

- 0.25mm maximum for Individual, Strip or Module, single layer heaters.
- 0.4mm maximum for Individual or Module, double layer heaters.

These maximum limits do not apply over the terminal lead and/or bridging tab connection areas.

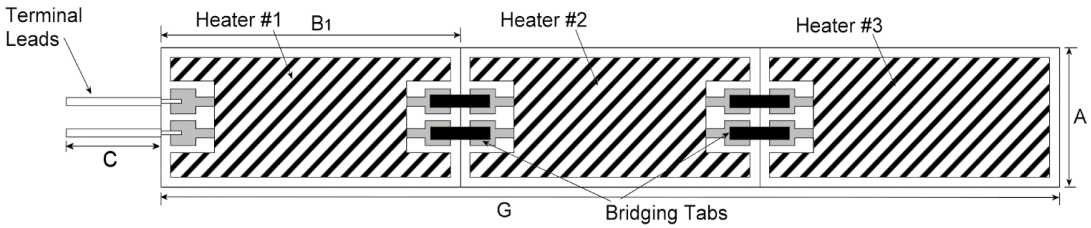
The general physical dimensions and heater layout shall be as follows (see Note 11). The heater type, construction, physical dimensions and heater layout applicable to a specific heater will be specified in the Heater Design Drawing held by the Manufacturer.

INDIVIDUAL (& STRIP, MODULE) HEATER



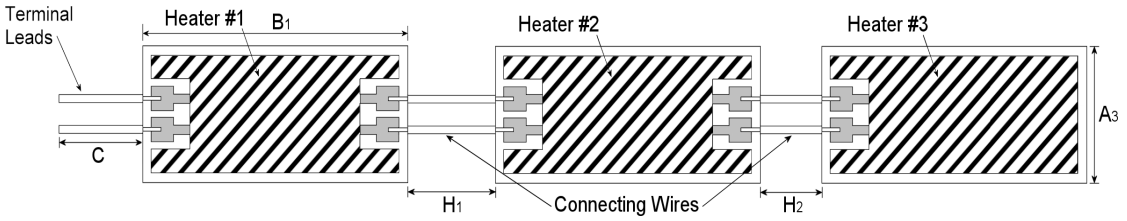
STRIP HEATER (NOTE 2)

Example with 3 individual heaters



MODULE HEATER (NOTE 3)

Example with 3 individual heaters



Symbol	Dimensions mm		Tolerance	Heater Type	Remarks
	Min	Max			
A	6	590	±0.5mm or ±0.5% (Note 4)	Individual	
A	6	15		Strip	Note 2
A1 to A5 (5)	8	200		Module	Note 3
B	8	600	±0.5mm or ±0.5% (Note 4)	Individual	
B1 to B5 (5)	300	590		Strip	Note 2
B1 to B5 (5)	10	590		Module	Note 3, 6
C	300	-	±10%	Individual, Strip & Module	
E	2	-	±0.5mm	Individual, Strip & Module	Note 7
F	0.4	-	-	Individual, Strip & Module	Notes 8, 9
G	610	2500	±0.5mm or ±0.5% (Note 4)	Strip	Note 10
H1 to H4 (5)	100	1000	±0.5mm or ±0.5% (Note 4)	Module	Note 3
S	Note 1		-	Individual, Strip & Module	Note 1

NOTES:

1. The Heating Area, S, is defined as the total area of the heater excluding the peripheral margin, and the terminal lead and/or bridging tab connection areas. The acceptable limits of S are specified in Para. 1.4.2. For Strip and Module heaters, the Heating Area is the total for all the individual heaters connected together.
2. A Strip heater is made up of 2 to 5 individual, single layer heaters connected together in series by means of bridging tabs welded to each individual heater's connection pads. All individual heaters in the Strip heater shall have the same width, dimension A, but may have different lengths, dimension Bn.
3. A Module heater is made up of 2 to 5 individual, single or double layer heaters connected together in series by means of wires of length Hn welded to each individual heater's connection pads. All individual heaters in a single Module heater shall either be single layer or double layer. Each individual heater of the Module heater may have any geometric shape (i.e. not limited to rectangular shapes) with different dimensions An and Bn, where An and Bn represent the overall dimensions of each individual heater.
4. Whichever is greater.
5. As applicable depending on the quantity of individual heaters in the Strip or Module heater.
6. The sum of all the individual dimensions Bn of a Module Heater shall not exceed 1500mm.
7. Terminal lead spacing shall be measured at the terminal lead connection area. Terminal leads may exit the terminal lead connection area at any angle. The terminal leads may be located on any side of the heater. There may be more than 2 terminal leads (for multiple resistive element and double layer heaters).
8. Peripheral margin dimension.
9. Perforated holes in the peripheral margin are allowed provided that the distance between the edge of the hole and the heater resistive element or connection pad is equal to, or greater than, dimension F.
10. The total length of the Strip heater.
11. In any case, the final feasibility of a particular heater design is established according to the limiting characteristics of the materials used and the production process, and shall be decided on by the Manufacturer; not all the configurations are possible.

TYPE 4009/004: PHYSICAL DIMENSIONS AND HEATER OUTLINE

The maximum weight of the heaters, excluding the weight of the terminal leads, shall be:

- Single layer heaters: 75mg/cm2
- Double layer heaters: 125mg/cm2
- Add 30 mg/cm² for heater backing
- Add 10 mg/cm² for pressure sensitive tape

The weight of the terminal leads shall be as specified in the applicable wire ESCC Detail Specification.

Heater Thickness

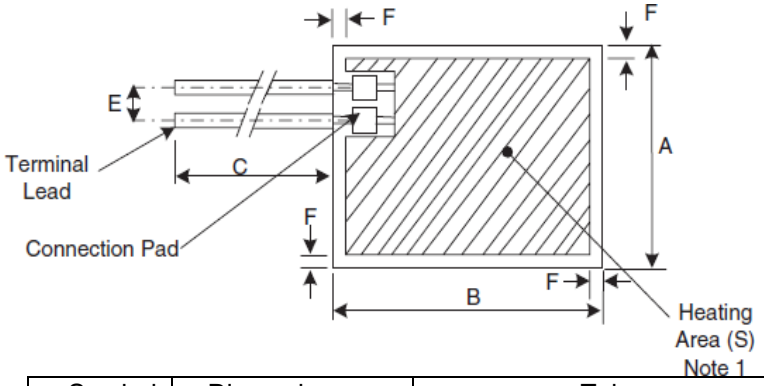
The maximum thicknesses for single layer and double layer heaters are as follows:

- 0.35mm maximum for single layer heaters.
- 0.55mm maximum for double layer heaters.

These maximum limits do not apply over the terminal lead and/or bridging tab connection area.

The general physical dimensions and heater layout shall be as follows. The heater type, construction, physical dimensions and heater layout applicable to a specific heater will be specified in the Heater Design Drawing held by the Manufacturer.

INDIVIDUAL HEATER



Symbol	Dimensions mm		Tolerance	Remarks
	Min	Max		
A	6	590	0.5mm or (Note 7) ±0.5%	Note 1
B	8	600	0.5mm or (Note 7) ±0.5%	Note 1
C	300	-	Note 2	
E	2	-	Note 3	Note 4
F	0.4	-	-	Notes 5, 6

NOTES:

1. The Heating Area, S, is defined as the total area of the heater excluding the peripheral margin and the terminal lead area.
   The acceptable limits of S are specified in Para. 1.4.2.
2. The tolerance shall be ±10% on the required dimension.

3. The tolerance shall be ±0.5mm on the required dimension.
4. Terminal lead spacing shall be measured at the terminal lead connection area. Terminal leads may exit the terminal lead connection area at any angle. The terminal leads may be located on any side of the heater.
   There may be more than 2 terminal leads (for multiple resistive element and double layer heaters).
5. Peripheral margin dimension.
6. Perforated holes in the peripheral margin are allowed provided that the distance between the edge of the hole and the heater resistive element or connection pad is equal to, or greater than, dimension F.
7. Whichever is greater.

5.3.2.3 Technology Flow Abstract

GENERAL FEATURES

RICA, according to ESCC 4009/002 and 4009/004, manufactures two standard types of heaters:

- Single Layer
- Double Layer

The additional following heater types can be manufactured as well:

- "Magnetically Compensated Heater" (double layer) (4009/002 and 4009/004)
- RICA Strips Heaters (single layer) (4009/002)
- RICA Modules Heater (single or double layer) (4009/002)

The cables' sealing area can be manufactured as follows:

- RICA patch (4009/002)
- Nicolitch patch (4009/002)
- RICA Acrylic patch (WA) (4009/004)

Technology Flow	Scope	Site
Orders Management and Design	1) Customer request reception 2) Technical feasibility check vs. ESCC applicable specifications 3) Commercial offer emission 4) Order reception 5) Design phase: see 1.1.1.5 6) Customer technical drawing approval	I.R.C.A. S.p.A RICA division Via Podgora, 26 31029 Vittorio Veneto (TV) Italy
Fabrication	Materials' cut and coupling (insulation and metal foil) First lamination Photoprinting Developing Etching Materials' cut and coupling (coverlay) Second lamination Singularization Cable cut and stripping	As above
Assembly	Cables' welding Cable connection area's sealing Elements marking Biadhesive (PSA) and/or Aluminum backing coupling (optional) Packing	As above
Test	Chart F2, F3 and F4 Periodic Testing	As above

BASIC INFORMATION

The heater resistive element is made of flexible nickel/chromium/iron alloy (76/16/8 Inconel).

Heater resistive elements, terminal leads connections and, for Strip heaters, bridging tabs connections are completely coated with:

- 4009/002: Polyimide Polymer/FEP in accordance with MIL-P-46112
- 4009/004: Polyimide Film/Acrylic Adhesive in accordance with IPC4203/1

Terminal leads are electrically welded to the heater resistive element. Terminal leads are made of multi-strand silver-plated copper in accordance with ESCC Generic Specification No. 3901.

COMPONENT TYPES
The available formats are defined in the variants table reported above

5.3.2.4 Technology Flow definition

1) Design

The design manuals covers the design rules and limits:

Company procedures

- Q.MARK 101
- Q.DESIGN 201
- Q.DESIGN 210

Design steps:

- customer requirements analysis and verification of ESCC4009/002 and ESCC4009/004 applicability
- track sizing according to the "CALCOLO_PISTE_EF" file
- material selection according to the "Flexible Heater - Product handbook" and related ESCC4009/00x
- Definition of documents in Athena
- Design of production equipment and product drawing on Cad system
- Technical approval
- Customer approval
- See ESCC4009/002 or ESCC4009/004

2) Fabrication/Assembly

The manufacturing flows and procedures are described in section 6 of IRCA S.p.A. PID.

3) Test

Complete test sequence as detailed in ESCC Generic 4009 and the relevant Detail Specifications is conducted by IRCA S.p.A.

4) Radiation Characteristics

The heaters covered in this technology domain are considered insensitive to radiation effects.