

**Infratherm**

# THERMOGRAPHIC SURVEY FINAL REPORT

Prepared for  
**Invensys PLC**

Site Inspected:  
**Invensys Controls South America**  
Br 116, Km 33  
Vacaria RS, Brasil

Inspection Date: June 18, 2010.  
Report Date: July 1st, 2010.

Survey By: **Fernando Castillo**  
Survey Provider: **Infratherm**  
Accompanied By: **Carlos Corassini**

Exit Interview With: **Carlos Corassini, EHS  
Technician and Marcelo Melo,  
Plant Manager.**

# Infratherm

## The Company

Infratherm brings over 15 years of experience utilizing infrared imaging in the areas of energy conservation and preventative/predictive maintenance. Our customer base is extremely diversified; it takes in manufacturing facilities, hospitals, governmental buildings, high-rise office buildings and hotels.

## Our objective

It is our objective not only to support a facilities energy conservation or preventative/ predictive maintenance program, but to enhance the program through infrared imaging.

## Our Business

We are in the business of inspecting electrical circuits, electrical machinery, steam traps and lines, insulation integrity, faculty roofs and any other potential problem that might occur. In inspecting these areas we look for problems such as electrical shorts, loose or dirty connections, corrosion, power overloads, uneven power distribution, excessive strain, poor insulation, roof leaks, refractory problems, bad bearings, cooling problems, clogged steam traps and lines, etc.

## Why utilize Infrared Thermographic survey?

There are 4 basic reasons why thermographic should be utilized as a trouble shooting device:

1. When equipment or objects are inaccessible or dangerous to touch
2. To identify areas of energy loss or gain
3. Map temperatures over large areas quickly and efficiently
4. Locate areas of concern quickly and accurately.

**It makes it possible to evaluate your facility easily and safely. It prevents costly breakdowns and unproductive man-hours, in short, it saves time and money.**

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## Report

Infratherm conducted this thermographic survey at the Invensys facility located at Vacaria, RS, Brasil, on June 18, 2010. The survey was conducted by Fernando Castillo, mechanical engineer and Level II thermographer.

The objective of the survey was to identify and reduced potential heat/fire source from electrical and/or mechanical systems. This is one of the key risk minimization elements of overall environmental, health, safety and sustainability program.

The survey was an on site inspection that included: thermographic imaging of major circuits, inspection of the conditions, and/or interview with employees. This survey was accompanied by:

Full Name	Title
<b>Carlos Corassini</b>	<b>EHS Technician</b>
<b>Santin de Paula Teixeira</b>	<b>Maintenance Electrician</b>

Initial survey results were reviewed with:

Full Name	Title
<b>Carlos Corassini</b>	<b>EHS Technician</b>
<b>Santin de Paula Teixeira</b>	<b>Maintenance Electrician</b>

\*\*This survey and report have been performed and prepared following the Invensys EHS-P012 “Thermographic Audit Program Process”.

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## Thermographer Certification



## Camera Calibration Certificate



## Infratherm [www.thermografia.com](http://www.thermografia.com)

### BRIEF DESCRIPTION OF THE INSPECTION:

Carry out thermographic survey throughout the whole site.

Survey all items on the site hazard heat fire source inventory and new add items.

Put labels on the items inspected.

### METHOD:

Thermographic Surveys will be carried out at a distance of 1 meter from the control panels and 2 - 3 meters from the Distribution boards.

The images & digital photos we take of buildings will be done at an appropriate & safe distance.

### EQUIPMENT REQUIRED:

Thermographic and Digital Camera / Digital thermometer / Digital volt and ampere meter.

**Personal Protective Equipment:** Arc flash clothing 8 cal/cm<sup>2</sup> minimum /electric arc face shield / dielectric gloves / non steel toe electrical hazard safety boots.

Tools: Cordless screwdriver and bits.



\*Safety equipment.

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## Risk Classification Table

<b>Risk Classification</b>	<b>Temperature Rise</b>	<b>Recommended action</b>	<b>Closure validation requirements</b>
<b>Minor</b>	< 10 °C	Repair as part of regular maintenance program.	One single regular inspection signed by Site leader.
<b>Low</b>	10 °C < 35 °C	Repair in the next 4-5 days. Monitor load or heat release and watch for changes.	3 regular inspections during the following month of the finding date. Signed by site leader.
<b>Moderate</b>	35 °C < 75 °C	Repair in the next 24 hrs. Inspect surrounding components for possible damage. Set periodic monitoring load or heat release and maintenance inspections until thermograph validation.	Thermograph validation is required during the following 4 days of the repair. Signed by Plant manager or B.U.
<b>High / Severe</b>	> 75° C	Repair immediately or Shut down. Set periodic monitoring load or heat release and maintenance inspections during the next 30 days after thermograph validation.	Thermograph validation is required immediately after the repair. And only will set for running until validation. Signed by B.U.

**Finding # 1**

Temperature Rise: 29.3 °C

Risk Classification: **Low**

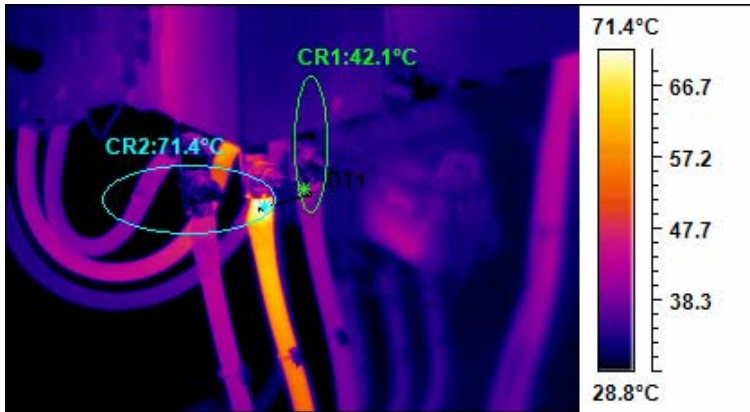
Location: Compressors room

Equipment Description: Air compressor CAC009

Observation: Hot spot on connection phase L2 main contactor.

Probable Cause: Loose connection.

**SEE RECOMENDATIONS BELOW**



Object Parameter	Value
DT1:Temp-A	41.3°C
DT1:Temp-B	70.6°C
<b>DT1:DeltaTemp</b>	<b>29.3°C</b>

Recommendation	Date Scheduled	Repaired by	Closure validation
Clean and tighten.	06-18-10	Santin D P.	Closed. Was reinspected by Infratherm 6/18/2010
Schedule in periodic maintenance program.	Annually	Elias Ocanha	Regular inspection signed by site leader.

SITE		PLANTA VACARIA		Date Inventory			By	Carlos Corassini					
THERMOGRAPH PROGRAM				Date Audited	6/18/2010		By	Fernando Castillo					
		Inventory data base for performance						Reporting data performance					
Location	Equipment Description	Nominal Volts / Amps (HEAT BTU)	Installed date	Date inspection	last	Risk classification	No.Findings / No. Closed	Date inspected	In operation YES/NO	Problem YES/NO	Risk Classification	No.Findings / No. Closed	Performance Rate. (Last year risk VS This year Risk)
Sala Geração Energia	GMG003 - Quadro Transferência	380VCA / 1250A						6/18/2010	YES				
Sala Geração Energia	Trafos - Quadro de Comando (Disjuntores) QGBT	380VCA		3/11/2009				6/18/2010	YES				
Sala Geração Energia	Quadro de Passagem Cabeamento (Subestação x Geração)	380VCA		3/11/2009				6/18/2010	YES				
Subestação	Banco Capacitores Subestação	380VCA		3/11/2009				6/18/2010	YES				
Subestação	Trafos - Média e Baixa Tensão	23.1KV		3/11/2009				6/18/2010	YES				
Sala Compressores	CAC006 - Comando e Força	380VCA		3/11/2009				6/18/2010	YES				
Sala Compressores	CAC009 - Comando e Força	380VCA		3/11/2009				6/18/2010	YES	YES	LOW		
Sala Compressores	CAC010 - Comando e Força	380VCA		3/11/2009				6/18/2010	NO				
Oficina Manutenção	QGBT - Fábrica	380VCA		3/11/2009				6/18/2010	YES				
Oficina Manutenção	Banco Capacitores Fábrica	380VCA		3/11/2009				6/18/2010	YES				
Fábrica	Barramento Principal	380VCA / 800A		3/11/2009				6/18/2010	YES				
Fábrica	Derivadas Elétricas Produção - 7	380VCA		3/11/2009				6/18/2010	YES				
Fábrica	CD Distribuição Prédio Escritório	380VCA		3/11/2009				6/18/2010	YES				
Célula 05	CD Cél.05	380VCA						6/18/2010	YES				
Célula 09	CD Cél.09	380VCA						6/18/2010	YES				
Célula 12	CD Cél.12	380VCA						6/18/2010	YES				
Célula 02	TME011	380VCA						6/18/2010	YES				
Célula 02	TME012	380VCA						6/18/2010	YES				
Célula 05	EEL005	380VCA						6/18/2010	YES				
Célula 05	EEL006	380VCA						6/18/2010	YES				
Célula 09	MDC008	380VCA		3/11/2009				6/18/2010	YES				
Célula 09	MDC010	380VCA		3/11/2009				6/18/2010	YES				
Célula 09	MDC004	380VCA						6/18/2010	YES				
Célula 09	MDC001	380VCA						6/18/2010	YES				
Célula 09	MDT006	380VCA		3/11/2009				6/18/2010	YES				
Célula 09	MDT007	380VCA		3/11/2009				6/18/2010	YES				
Célula 12	MDT013	380VCA		3/11/2009				6/18/2010	YES				
Célula 12	MDT004	380VCA						6/18/2010	YES				
Célula 12	MFC002	380VCA						6/18/2010	YES				
Célula 12	MFF002	380VCA						6/18/2010	YES				
Célula 12	MER002	380VCA						6/18/2010	YES				
Célula 12	MER007	380VCA						6/18/2010	YES				
Célula 14	MRP001	380VCA						6/18/2010	YES				
Célula 14	MRP003	380VCA						6/18/2010	YES				
Célula 14	MRP004	380VCA						6/18/2010	YES				
Célula 14	EEL007	380VCA						6/18/2010	YES				
Célula 14	PHA001	380VCA						6/18/2010	YES				
Célula 14	PHA002	380VCA						6/18/2010	YES				
Célula 14	TRV003	380VCA						6/18/2010	YES				
Célula 14	TRV008	380VCA						6/18/2010	YES				
Célula 14	TRV016	380VCA						6/18/2010	YES				
Célula 15	FRC001	380VCA						6/18/2010	YES				
Célula 15	FRC002	380VCA						6/18/2010	YES				
Célula 15	EEL002	380VCA						6/18/2010	YES				
Célula 15	TRF001	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	TRF006	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	TRF007	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	TRF008	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	TRF009	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	TRF010	380VCA		3/11/2009				6/18/2010	YES				
Célula 15	BEC001	380VCA						6/18/2010	YES				
Fábrica	NOB001	380VCA						6/18/2010	YES				
Ferramentaria	TME002	380VCA						6/18/2010	YES				
Cozinha	CD Cozinha	380VCA		3/11/2009				6/18/2010	YES				
Escritório	Ar Condicionado Central Escritório	380VCA						6/18/2010	YES				