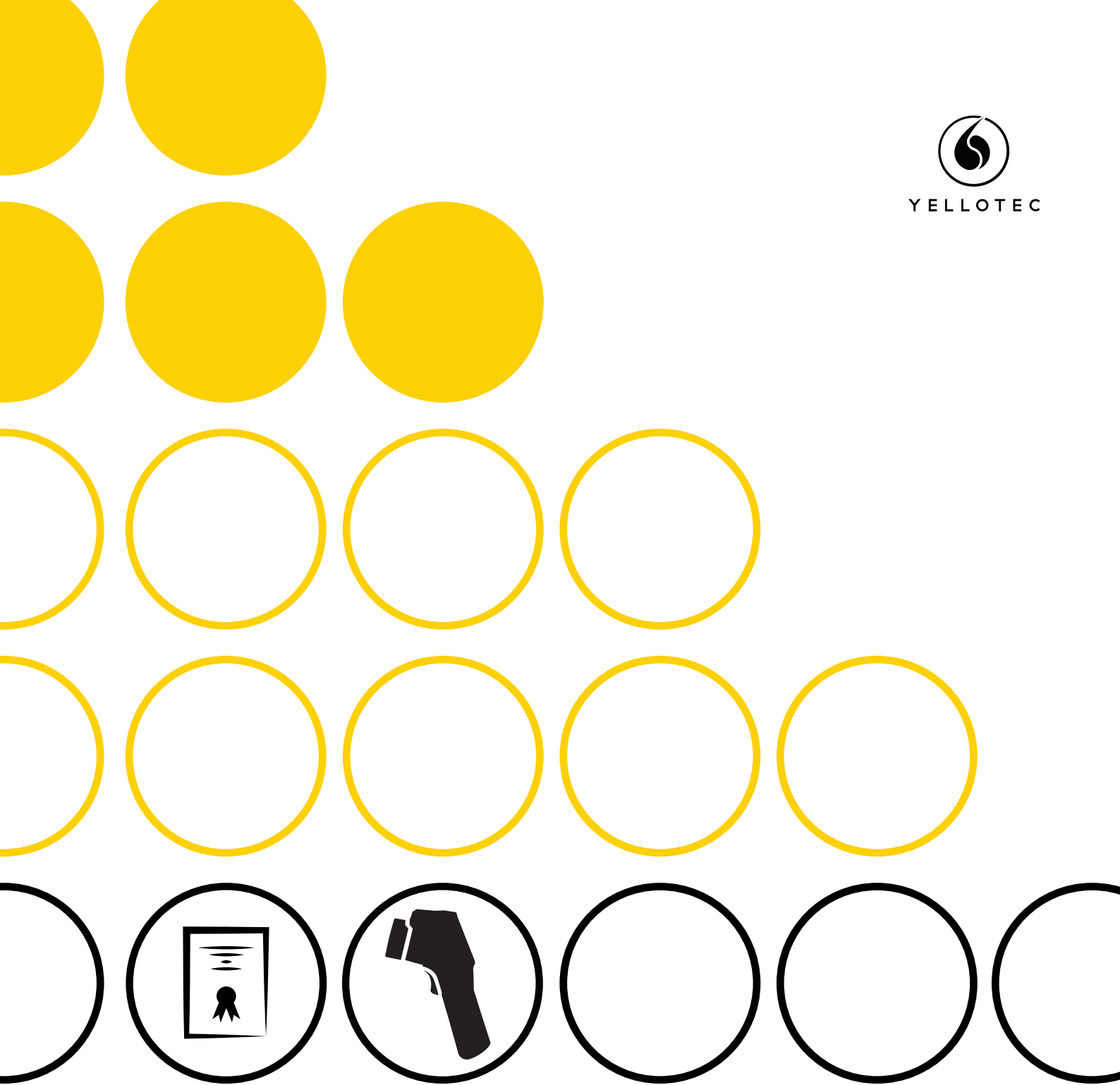




YELLOTEC



# Infrared Thermography

## CAT1A, Level 1-3

Advance your skills and knowledge in the field of infrared thermography

# Infrared Thermography Category 1A



Learn the 7 Measurement Rules© of Infrared Thermography.

IRT CAT 1A, The 7 Measurement Rules©, is the best introduction for any beginner Infrared Thermographer. For instance have you ever noticed that temperatures displayed by an infrared camera are sometimes obviously wrong? Do you understand the difference between radiation and temperature? That IR cameras measure radiation and calculates temperature? Based on a number of variables controlled by the thermographer? This course will teach you the basics of Infrared Thermography, giving delegates a good theoretical and practical foundation to kick-start their understanding and application of Infrared Thermography.

## Course Detail

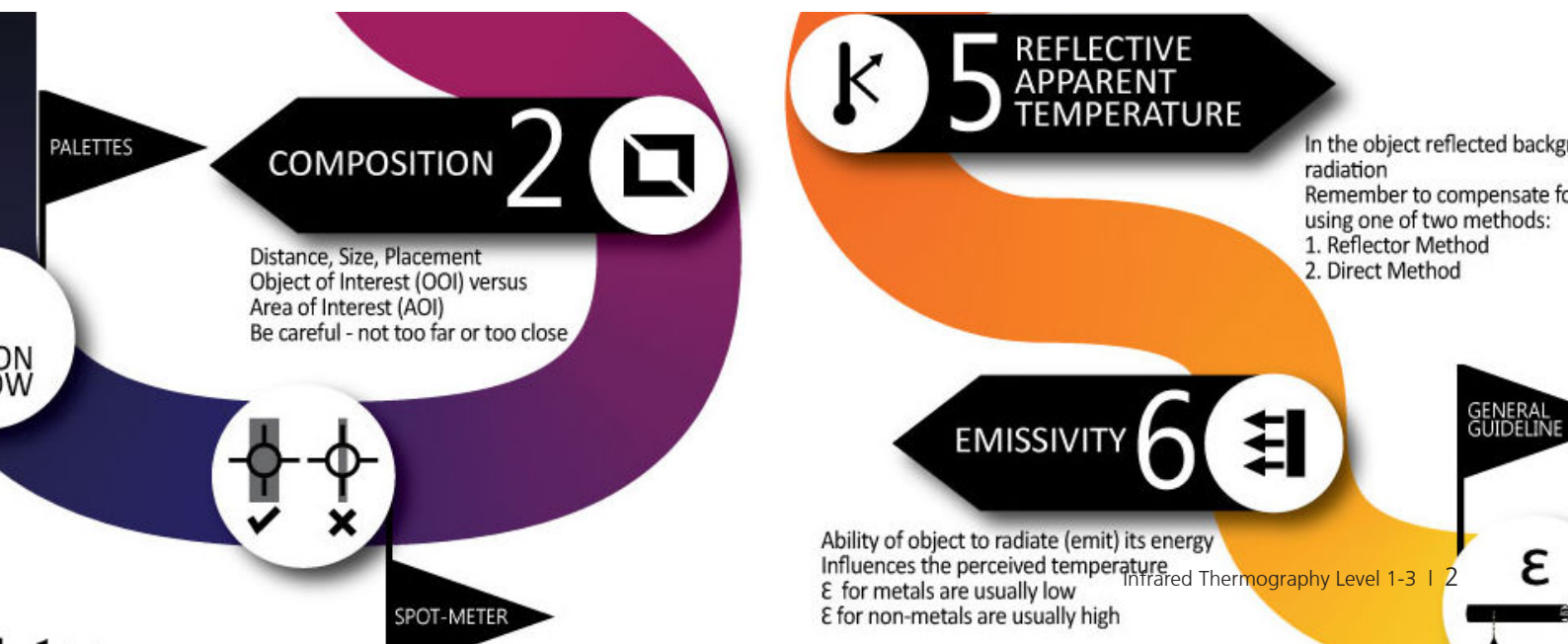
Tailored for the newcomer to the world of Thermography; the course focuses on the seven basic rules to be followed when using a thermal camera in practice to measure temperature accurately enough to base sound engineering decisions on the results. On the first day, you'll learn the essentials of using a thermal camera effectively. Day two focuses on using the camera practically, taking images of real life equipment measurement and including the creation of a thermal report from the images taken with your own camera using the supplied software.

## Who Should Attend This Course?

- First time Infrared Thermography Camera owners
- Basic training before attending Infrared Thermography Level 1 course

## Course Benefits

This course accelerates the user's ability to use the thermal camera and the software for the purpose it was bought for - quickly and without fuss. It will enable you to put an expensive instrument to immediate good use, minimising the start-up time to produce the first thermal report correctly and with confidence.



# 7 Measurement Rules©

## Course Outline

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*Bring your camera and your laptop and our experienced thermographers will get you, your camera and your software up and running in two wonderfully interesting and valuable days.*

### Day One (Theory)

Introduction to the peculiarities and applications of infrared thermography.

1. Focus - Learn the "How To" of a thermal camera, and understand why focussing sounds easier than it really is, i.e. realising the difference between IR and Visual.
2. Composition – Understand the concept of the identification of an Object of Interest (OOI) and an Area of Interest (AOI); as well as collecting and presenting the thermal data correctly.
3. Thermal Contrast – Understand that cameras are not intelligent and can only display what it sees, and that thermographers need to adjust every image to reveal the real thermal patterns.
4. Environment - Adjusting for, and understanding the importance of, the influences of the atmosphere on your measurements.

5. Reflected Apparent Temperature – Understand that everything always reflects something and that your target is mostly a mirror! Learn the importance of  $T_{refl}$  and how to estimate it correctly.
6. Emissivity – Learn the practical craft of measuring and estimating emissivity and the importance of getting it right (Plus a few practical tips for the field).
7. Data Capture – Learn the practicalities involved with saving and working with thermal data.

The remainder of the afternoon is spent discussing the interpretation and analysis of field case studies.

### Day Two (Practical)

1. Practice the measurement rules by performing thermal inspections.
2. Produce and prepare a report template in your software.
3. Managing thermal data and producing a thermal report.



# Infrared Thermography Level 1 (ITC)

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Become a Level 1 certified thermographer and gain a competitive advantage.

This course prepares you for qualification as a category 1 certified thermographer. You will learn about the basics of infrared, how to operate the camera under different conditions and for various purposes, how to do an appropriate judgement of the measurement situation in the field and identify potential error sources. You will be able to do IR inspections following written guidelines and to report the result of this inspection.

## Course Detail

After a short introduction to thermography you will have hands-on training. The theory sections on heat and infrared will provide you with the basic knowledge needed to use the IR camera in the field, and to recognize and interpret thermal patterns. Strong emphasis will be put on the IR measurement techniques and the influence of emissivity and reflectivity on the measurement results.

You will train the measurement on real-life lab equipment and you will also learn how and when to use qualitative and quantitative thermography. A short introduction to inspection routines and reporting principles will finalize the lecture. Now you will be well prepared to create a short case study which you will present in front of the class. The course ends with an exam including multiple choice questions and thermogram analysis.

The class includes exercises and our trainers work with images, sketches, and simple diagrams to illustrate the theoretical parts in a descriptive way.

## Who Should Attend This Course?

This course is designed for beginners in thermography with some experience in camera handling and limited IR knowledge, who want to take their first step to become a professional thermographer and want to qualify as a Level 1 certified thermographer.

## Course Benefits

- The ITC is an Accredited Training Organization in conformance to the British Institute of Non Destructive Testing (BINDT) BS EN ISO 9001:2000 with certificate issued 25 May 2006.
- The ITC Infrared Thermography Level 1 Course is validated against the BINDT requirements for the structured training of Condition Monitoring practitioners.
- Learn the basics of infrared camera care and handling.
- Introduction to thermal imaging and measurement systems for predictive maintenance applications.
- Benefit hugely from an extensive overview of practical applications of Infrared Thermography.
- Collect quality data; make accurate temperature measurements using the infrared camera, and account for external influencing effects such as atmospheric conditions; (ambient temperature, distance & humidity) as well as Reflected Apparent Temperature and Emissivity using infrared cameras.
- Interpret thermograms and make informed decisions using heat transfer concepts to analyse thermal patterns in thermal images.
- See and experience the latest in infrared inspection report generation and database software.
- Avoid costly mistakes - learn to distinguish between hot spots and reflections, direct vs. indirect readings and qualitative vs. quantitative thermography.
- Challenge yourself with field applications labs that closely simulate real-world infrared applications.
- Learn the practical pitfalls and receive tips for performing thermal inspections in the plant.

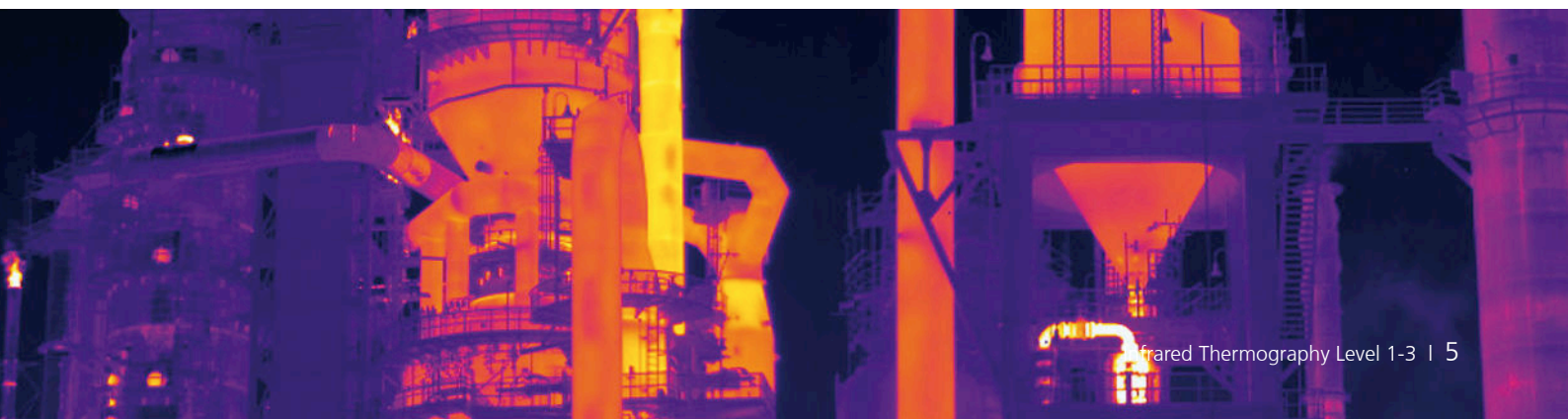
# Infrared Thermography Level 1 Course Outline

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*No prior certification or experience is necessary to attend this course, although ownership of an infrared camera, laptop and software would be beneficial (bring along if possible).*

*Typically the mornings are spent on theory lectures and the afternoons on practical exercises with cameras and props.*

1. Introduction to Thermography:
  - Introduction to infrared thermography
  - Why is temperature important?
  - Applications
2. IR Camera introduction:
  - Controlling the image
  - Measurement functions
  - Capturing an image
    - The "Big Three"
    - Temperature range
    - Optical focusing
    - Image composition
    - Storage devices
    - Practical tips
3. Basic Thermal Science:
  - Heat and temperature
  - Units for measuring temperature
  - Rules in thermal science
4. Basic Heat Transfer
  - Heat transfer modes
  - Conduction
  - Convection
  - Radiation heat transfer
5. The Electromagnetic Spectrum
  - Waves
  - The electromagnetic spectrum
6. Radiation Energy Exchange
  - Radiation energy exchange modes
  - Incident radiation
  - Exitant radiation
  - Blackbodies
7. Thermal Image Interpretation
  - Real life targets
  - Camera principle
  - Visual versus infrared
  - The thermal image
  - Apparent temperature and emissivity
8. Thermal Image Analysis Techniques
  - Thermal gradient
  - Camera tools for pattern enhancement
  - Thermal tuning
  - Image analysis – misleading patterns
9. Qualitative and Quantitative
  - Qualitative
  - Quantitative
  - Fault classification criteria
  - Baseline data
10. Infrared Measurement Techniques
  - Radiated energy and temperature
  - Calibration
  - Compensation for effects of the surroundings
  - Measurement conditions
11. Infrared Measurement Techniques
  - Radiated energy and temperature
  - Calibration
  - Compensation for effects of the surroundings
  - Measurement conditions
12. Thermography Guidelines



# Infrared Thermography Level 2 (ITC)

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Become a Level 2 certified thermographer and increase your IR knowledge.

This course prepares you for qualification as a category 2 certified thermographer. You will learn about topics in infrared thermography to both deepen and broaden your knowledge about infrared physics, heat science, infrared measurement equipment and its application. As a Level 2 thermographer you shall provide guidance to category 1 personnel in the areas of equipment selection, techniques, limitations, data analysis, corrective actions and reporting.

## Course Detail

After a short introduction to certification levels and procedures, and related standards, you will take an initial test. During the course you will repeat and learn more about thermal science and heat transfer as well as gain advanced knowledge on IR theory and IR equipment. The course ends with a multiple choice exam.

The course includes advanced practical exercises and discussions about the participants' professional experiences and cases from the field. Thermal and infrared science theory are taught by using formulas, diagrams, and graphs. The focus is on steady-state processes, but transient mechanisms are also included.

## Who Should Attend This Course?

This course is designed for thermographers holding a Level 1 certificate, who want to increase their knowledge about IR thermography and want to qualify as a Level 2 certified thermographer.

## In order to attend a Level 2 Thermography Course

- You will hold a valid Level 1 thermography certificate,
- You will have the recommended experience within thermography according to relevant standards,
- You will prepare a case study to be presented at the Level 2 course and submitted towards qualification at course closing.

## Course Benefits

- Reinforce Level I infrared training concepts with refresher material covering the latest infrared camera, technology and thermal imaging application developments.
- Expand your thermography knowledge with new, more in-depth concepts in infrared theory, heat transfer and spatial resolution.
- Learn the basics of predictive maintenance thermography and overall infrared inspection program development.
- Learn to calculate avoided costs with Excel-based application software (included).
- Refine your image analysis and interpretation proficiency with in-depth thermal imaging survey and measurement techniques for predictive maintenance applications.
- Learn to measure emissivity of common materials.
- Improve your thermal analysis skills with more challenging laboratory and infrared field applications labs.
- The training course and exam follows the ISO 18436-7 Category 2 standards, and the ASNT SNT-TC-1A Level II standard.
- The course not only prepares the thermographer to carry out advanced thermal analyses and compile professional reports, it is also structured to prepare the delegate for the final examination on day five.
- The course is vendor neutral and delegates are encouraged to attend with any thermal camera.

# Infrared Thermography Level 2

## Course Outline

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*Bring: Certified copy of valid Level 1 IRT Certificate, Scientific calculator, Thermal camera, laptop and software, Practical field assignment for presentation on day one.*

1. Principles of infrared thermography:
  - Fourier's Law, Newton's Law of Cooling
  - Atmospheric transmission, Radiation reference sources
  - Planck's Law, Wien's Law, Emissivity, and factors affecting emissivity
2. Equipment and data acquisition:
  - Infrared camera selection criteria, Spectral bands, Thermal sensitivity (NETD), Lens selection, Optical resolution, and Operation of equipment
  - Image composition, Emissivity determination, Error source recognition, prevention or control, Waveband selection criteria
  - Recognizing and dealing with radiation, convection, and conduction
  - Effects of incorrect emissivity, Camera calibration and Environmental and operational conditions
3. Image processing:
  - Temperature measurement, and Comparative quantitative and qualitative thermography
  - Camera measurement tools, Measurement tools, Distance (atmospheric) correction, Emissivity correction
  - Statistical analysis, Image subtraction, Image montage and Temperature trending
  - General image interpretation guidelines, and General guidelines for establishing thermal severity assessment criteria
4. General applications
5. Diagnostics and prognostics
6. Condition monitoring applications:
  - Machinery engineering principles (components and construction)
  - Typical machinery failure modes and mechanisms and their associated thermal signatures
  - Severity assessment and acceptance criteria (engineering codes and standards)
7. Corrective actions
8. Reporting and documentation (ISO International Standards)
9. Condition monitoring programme design
  - General principles, Technique selection, Measurement intervals
  - Reference temperatures, and Baseline temperatures
  - Procedure development
10. Condition monitoring programme implementation
11. Condition monitoring programme management
  - Safety, Equipment and Procedure management
  - Skills and competencies management
  - Database management
  - Managing corrective action implementation

# Infrared Thermography Level 3

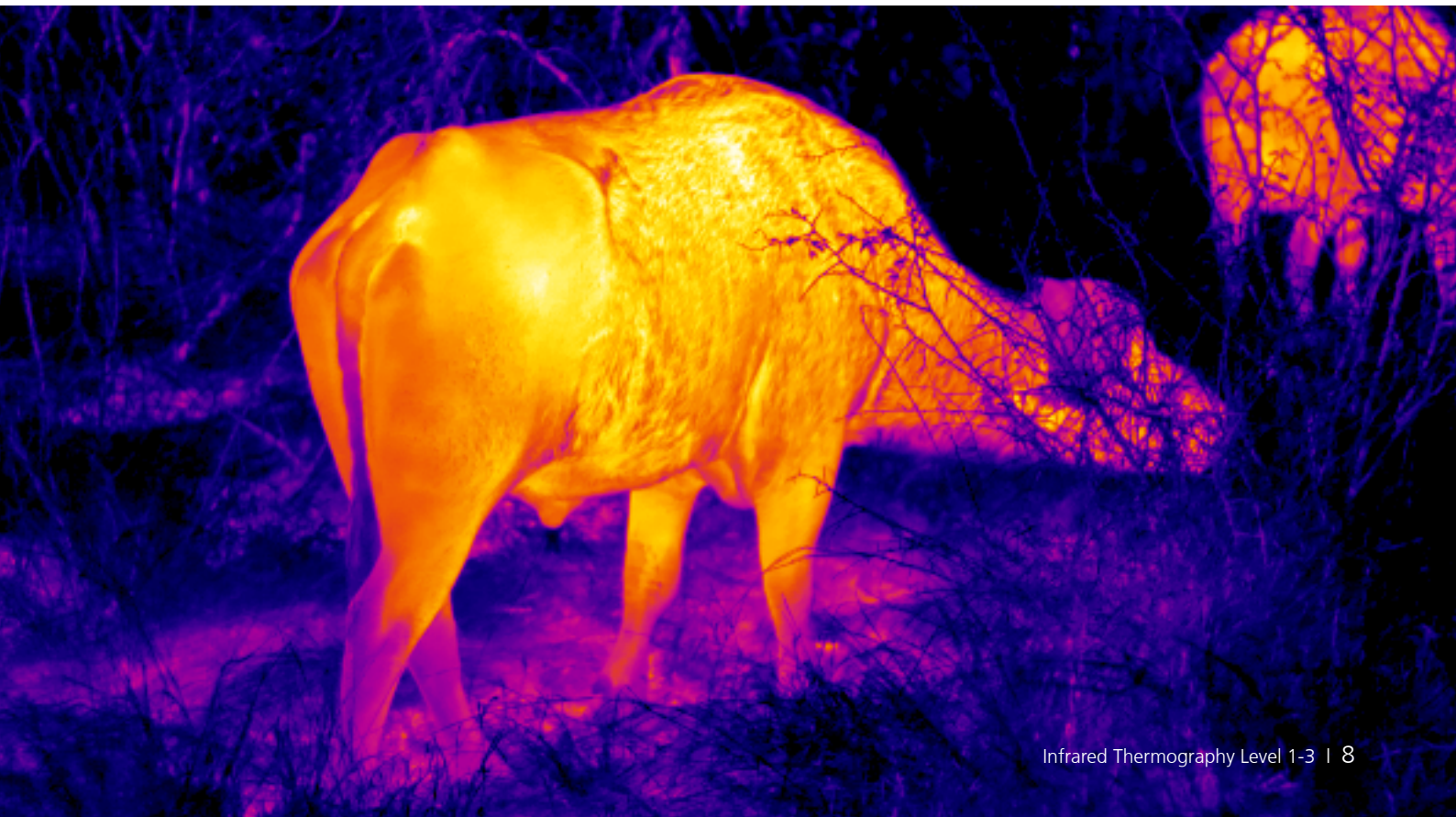
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Become a Level 3 certified thermographer with advanced IR skills and knowledge.

This course assumes the attending delegate to be an advanced, experienced user of thermal cameras, already familiar with all theoretical and practical aspects of the technology as taught in Levels 1 and 2. The delegate should preferably have in excess of two years practical IRT experience.

## Course Benefits

- The training course and exam follows the ISO 18436-7 Category 3 standard, and the ASNT SNT-TC-1A Level III standard.
- The course is unique in that it combines practical workshop sessions with the relevant theory required by ISO 18436-7. The level 3 demonstration kits that are included in the price of the course, allow delegates to conduct their own practical workshop exercises (without having to share with other delegates), and then take these kits back to their workplace and show off their newly acquired skills.
- The course not only prepares the thermographer to carry out advanced thermal analyses and compile professional reports, it is also structured to prepare the delegate for the final examination on day five.
- The course is vendor neutral and delegates are encouraged to attend with any thermal camera.





# Infrared Thermography Level 3 Course Outline

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*Please bring along:  
Valid Level 2 Certificate,  
Thermal camera, Laptop  
with installed reporting  
and analysis software,  
scientific calculator,  
open mind...*

The contents of this course closely follow the requirements of ISO 18436-7 and contain as minimum the following:

1. Principles of infrared thermography (IRT) :
  - Fourier's Law, Newton's Law of Cooling
  - Atmospheric transmission, Radiation reference sources
  - Planck's Law, Wien's Law, Stephan-Boltzmann Law, Emissivity and its influencing factors.
2. Equipment and data acquisition:
  - Infrared camera selection criteria, Spectral bands, Thermal sensitivity (NETD), Lens selection, Optical resolution, and Equipment Operation.
  - Image composition, Emissivity determination, Error source recognition, prevention and control, Wavelength selection criteria.
  - Recognizing and dealing with radiation, convection, and conduction.
  - Effects of incorrect emissivity settings, Camera calibration and Environmental and operational conditions.
3. Image processing:
  - Temperature measurement, Comparative quantitative and qualitative thermography techniques.
  - Camera measurement tools, Advanced Software Measurement tools, Distance (atmospheric) correction, Emissivity correction
  - Statistical analysis , Image subtraction, Image montage and Temperature trending
4. General applications
5. Diagnostics and prognostics
6. Condition monitoring applications:
  - Machinery engineering principles (components and construction)
  - Typical machinery failure modes and mechanisms and their associated thermal signatures
  - Severity assessment and acceptance criteria (engineering codes and standards)
7. Corrective actions
8. Reporting and documentation (ISO International Standards)
9. Condition monitoring programme design:
  - General principles, Technique selection, Measurement intervals
  - Reference temperatures, and Baseline temperatures
  - Procedure development
10. Condition monitoring programme implementation
11. Condition monitoring programme management:
  - Safety, Equipment and Procedure management
  - Skills and competencies management
  - Database management
  - Managing corrective action implementation

# Training Opportunities

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Yellotec offers a full complement of training courses in Condition Monitoring disciplines as well product and Reliability Engineering specific courses. Courses offered are either presented under license from International Certification Bodies or are in accordance with ISO requirements.

## Private Courses

All our public training courses can also be conducted as an in-house private courses. If you have 12 or more people attending, consider the benefits of an in-house session conducted in the privacy and conveniences of your facilities or a meeting site of your choice. Please contact us so that we can understand your requirements, explore the benefits and make it happen.

## All Courses Offered By Yellotec

Infrared Thermography (IRT)  
IRT Basics, Level 1, Level 2 and Level 3

Vibration Analysis (Mobius)  
Category 1, 2 and 3

Field Lubricant Analysis  
Noria Level 1, 2 and 3

Machinery Lubrication  
Noria Level 1 and 2

Oil Analysis Series  
Level 1, 2 and 3

Shaft Alignment  
Level 1

Ultrasound  
Level 1 and 2

Gearbox Maintenance

Failure Analysis

Condition Monitoring for Engineers

Plant Management – Dr. Mike Vorster

# Registration Form

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Please register each delegate by completing the details below and return by fax to 011 656 9112, or e-mail to [training@yellotec.com](mailto:training@yellotec.com). The company details are intended for accounting purposes and must reflect the details required for the completion and delivery of tax invoice.

## Invoice Details

Company \_\_\_\_\_  
VAT Number \_\_\_\_\_  
Postal Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Postal Code \_\_\_\_\_  
Person Responsible for Payment \_\_\_\_\_  
Contact Number \_\_\_\_\_  
E-Mail Address \_\_\_\_\_  
Fax Number \_\_\_\_\_  
Payment Method Purchase Order Number \_\_\_\_\_  
Cheque Number \_\_\_\_\_  
Electronic Transfer Ref Number \_\_\_\_\_

## Delegate Details

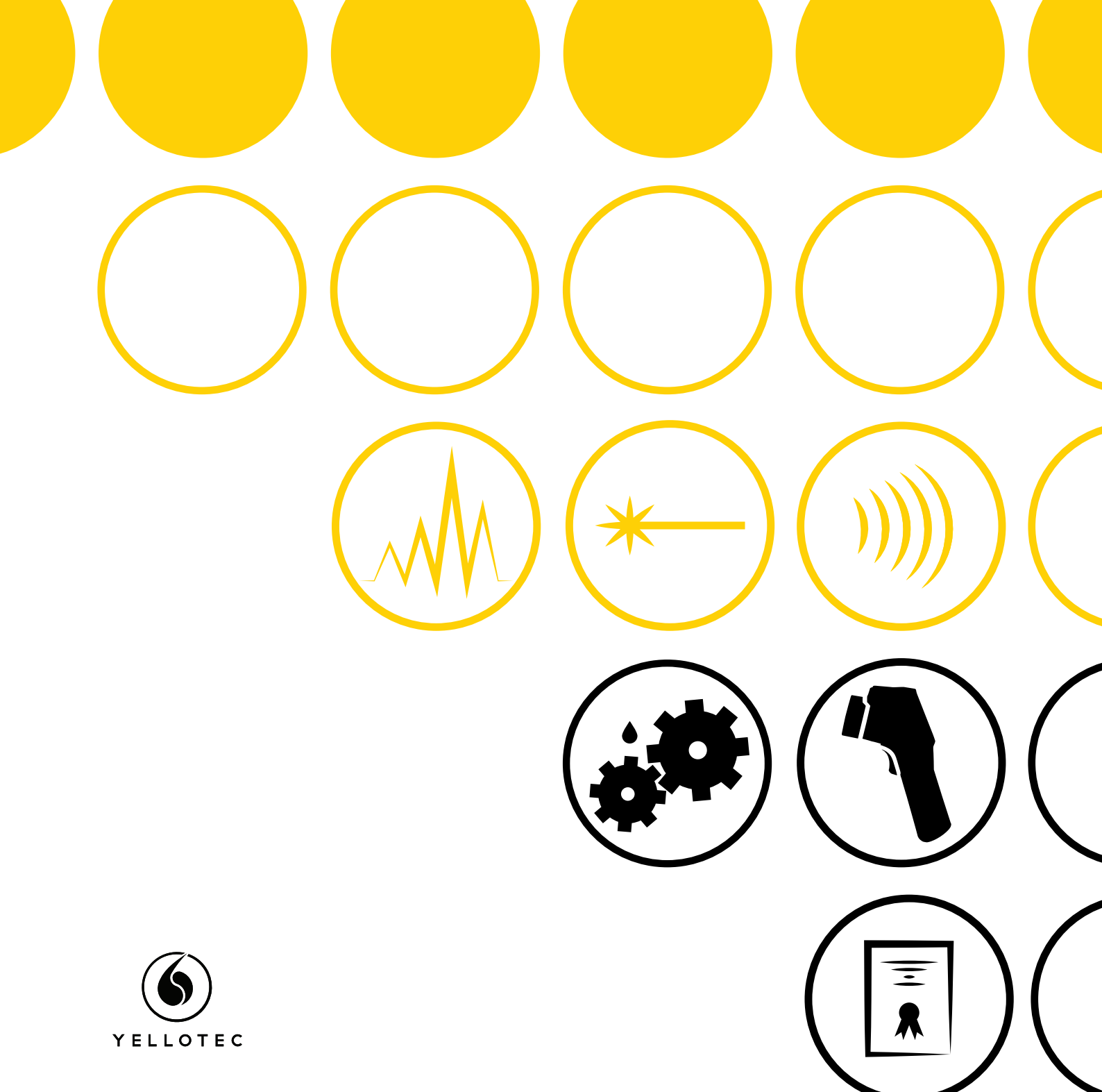
Delegate Name \_\_\_\_\_  
Contact Number \_\_\_\_\_  
Fax Number \_\_\_\_\_  
E-mail Address \_\_\_\_\_  
Do you have Halaal requirements? Yes  No

## Course Details

Course \_\_\_\_\_  
Dates \_\_\_\_\_  
Cost (Excl. VAT) \_\_\_\_\_

### Terms and Conditions

1. All course fees are payable upon confirmation of booking and an invoice will be sent as per the details indicated above. Bookings cannot be secured until payment of invoice or valid purchase order is received.
2. Only cancellations received in writing 10 days before the start of the course will be refunded in full.
3. There will be no charge if a substitute person wishes to replace the original delegate.
4. Yellotec reserves the right to cancel any course at any time without liability. In these circumstances, delegates will be offered an alternative date, or a full refund.
5. All Halaal requirements will be charged at an extra cost.
6. Delegate no shows, partial attendance or late cancellations will be liable for full cost.



**YELLOTEC**

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Yellotec is a products, service and training provider in the following specialist fields:

1. Complete solutions for the implementation and management of Condition Based Maintenance.
2. Remote Diagnosis of Vibration Analysis.
3. Full on-site CBM services, ranging from single individuals to complete department.
4. Oil Analysis Laboratory Services.
5. Vibration Analysis Services.
6. Thermographic Analysis Services.
7. Laser Alignment & Balancing Services.
8. Training in all specialist areas of Condition Based Maintenance
9. Direct agents for Flir Systems (Sweden) and Prüftechnik(Germany).