

COURSE OVERVIEW FE0986
Basic Thermography & Thermal Imaging Reports
(ASNT, SNT-TC-1A)

Course Title

Basic Thermography & Thermal Imaging Reports
 (ASNT, SNT-TC-1A)

Course Reference

FE0986

Course Duration/Credits

Five days (32 hours)/3.2 CEUs/32 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	May 13-17, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	August 04-08, 2024	Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA
3	November 03-07, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE



Course Description



This practical and highly-interactive course includes various practical sessions. Theory learned will be applied using thermal imaging infrared cameras.



This course will provide participants the advanced concepts and principles of Thermal/Infrared Testing (IR) as per the ASNT Recommended Practice No. SNT-TC-1A for Personnel Qualification and Certification in Nondestructive Testing.



Infrared thermography technique which is non-contact, nondestructive test method uses an infrared imaging to detect, display and record thermal patterns and temperature across the surface of an object.

Thermography can be applied to any situation where thermal profile and temperature will provide meaning data about a system or object. It is equipment which senses infrared radiation by converting it into temperature and displays image of temperature distribution.

This course is designed to provide participants with a detailed and up-to-date overview of the thermography and thermal imaging reports. It covers the nature of heat and temperature and how it is measured/expressed; the heat transfer modes covering the fundamentals of heat conduction, heat convection and heat radiation; the radiosity concepts comprising of reflectivity, transmissivity, absorptivity, emissivity, infrared radiometry, imaging, spatial resolution concepts and error potential in radiant measurements; and the basic thermal/infrared operating including the operation of infrared thermal imager and operation of support equipment for infrared surveys.

During this interactive course, participants will learn the checking of equipment calibration with blackbody references; the infrared image and documentation quality; supporting data collection and detecting thermal anomalies resulting from differences in thermal resistance (quasi-steadystate heat flow); detecting thermal anomalies resulting from differences in thermal capacitance, using system or environmental heat cycles; detecting thermal anomalies resulting from differences in physical state, fluid flow problems and friction; detecting thermal anomalies resulting from non-homogeneous exothermic or endothermic conditions; and the field quantification of point temperatures covering simple techniques for emissivity, typical high emissivity applications and special problem of low emissivity applications.

Sample Questions for general examinations are presented in the separate question booklets that can be obtained from ASNT International Service Center. Participants will further demonstrate familiarity with and ability to operate the necessary equipment for IR, record and analyse the resultant information to the degree required as well as test flawed specimen and component and analyse the results of NDT as part of the practical training.

At the completion of the course, participants will be appearing for a Level I exam. Each candidate will be a 'Certified ASNT NDT Level I in Thermal/Infrared Testing' upon successfully passing the examination with a minimum passing composite grade of at least 80 percent (%) which will be administered and graded by Haward Technology through its Certified ASNT Level-III instructors.

Course Objectives

Upon the successful completion of the course, each participant will be able to:-

- Get certified as an "Certified ASNT NDT Level I in Thermal/Infrared Testing"
- Discuss the nature of heat and temperature and how it is measured/expressed
- Identify heat transfer modes covering the fundamentals of heat conduction, heat convection and heat radiation
- Recognize radiosity concepts comprising of reflectivity, transmissivity, absorptivity, emissivity, infrared radiometry, imaging, spatial resolution concepts and error potential in radiant measurements
- Carryout basic thermal/infrared operating including the operation of infrared thermal imager and operation of support equipment for infrared surveys
- Check equipment calibration with blackbody references and discuss infrared image and documentation quality
- Support data collection and detect thermal anomalies resulting from differences in thermal resistance (quasi-steadystate heat flow)

- Detect thermal anomalies resulting from differences in thermal capacitance, using system or environmental heat cycles
- Detect thermal anomalies resulting from differences in physical state, fluid flow problems and friction
- Detect thermal anomalies resulting from non-homogeneous exothermic or endothermic conditions
- Discuss field quantification of point temperatures covering simple techniques for emissivity, typical high emissivity applications and special problem of low emissivity applications

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides a wide understanding and deeper appreciation of thermal infrared testing for facility integrity engineers, inspection engineers, inspectors, maintenance engineers, maintenance supervisors, mechanical engineers and maintenance technical staff.

Exam Eligibility & Structure

Exam candidates shall have the following minimum pre-requisites:-

Initial Training & Experience Levels			
Level	Training Hours	Minimum Hours in Method	Total Hours in NDT
I	32	210	400
II (Building Diagnostics)	34	1260	1800
II (Electrical and Mechanical)	34	1260	1800
II (Materials Testing)	34	1260	1800

Examinations Category & Criteria

Vision Examinations

- Near-Vision Acuity
 - This examination will ensure natural or corrected near-distance acuity in at least one eye such that the applicant is capable of reading a minimum of Jaeger Number 2 or equivalent type and size letter at the distance designated on the chart but not less than 12 inches (30.5 cm) or a standard Jaeger test chart. The ability to perceive an Ortho-Rater minimum of 8 or similar test pattern is also acceptable. This examination shall be administered annually.

- Color Contrast Differentiation
 - This examination will demonstrate the capability of distinguishing and differentiating contrast among colors or shades of gray used in the method as determined by the employer. This shall be conducted upon initial certification and at five-year intervals thereafter

General (Written)

- This examination will address the basic principles of the applicable method
- The NDT Level III will provide appropriate questions covering the applicable method to the degree required by the employer's written practice
- The minimum number of examination questions that will be given is 40

Specific (Written)

- This examination will address the equipment, operating procedures and NDT techniques that the individual may encounter during specific assignments to the degree required by the employer's written practice
- The specific examination will also cover the specifications or codes and acceptance criteria used in the employer's NDT procedures
- The minimum number of examination questions that will be given is 20

Practical

- The candidate shall demonstrate familiarity with and ability to operate the necessary NDT equipment, record and analyse the resultant information to the degree required
- At least one flawed specimen or component shall be tested and the results of the NDT analysed by the candidate
- The description of the specimen, the NDT procedure including check points and the results of the examination shall be documented
- Proficiency shall be demonstrated in performing the applicable NDT technique on one or more specimens or machine problems approved by the NDT Level III and in evaluating the results to the degree of responsibility as described in the employer's written practice. At least ten (10) different checkpoints requiring an understanding of test variables and the employer's procedural requirements will be included. The candidate shall detect all discontinuities and conditions specified by the NDT Level III

Note: While it is normal to score the practical on a percentile basis, practical examinations will contain check points that failure to successfully complete will result in failure of the examination

Additional Criteria

All written examinations will be closed-book except that necessary data such as graphs, tables, specifications, procedures, codes, etc., may be provided during the examination. All questions are approved by the responsible NDT Level III.

Course Certificate(s)

(1) Internationally recognized Qualification Certificates will be issued to participants who have successfully completed the course and passed the exam at the end of the course. Successful candidate will be certified as a “Certified ASNT NDT Level-I Thermography Inspector”. Qualification Certificate is valid for 5 years.

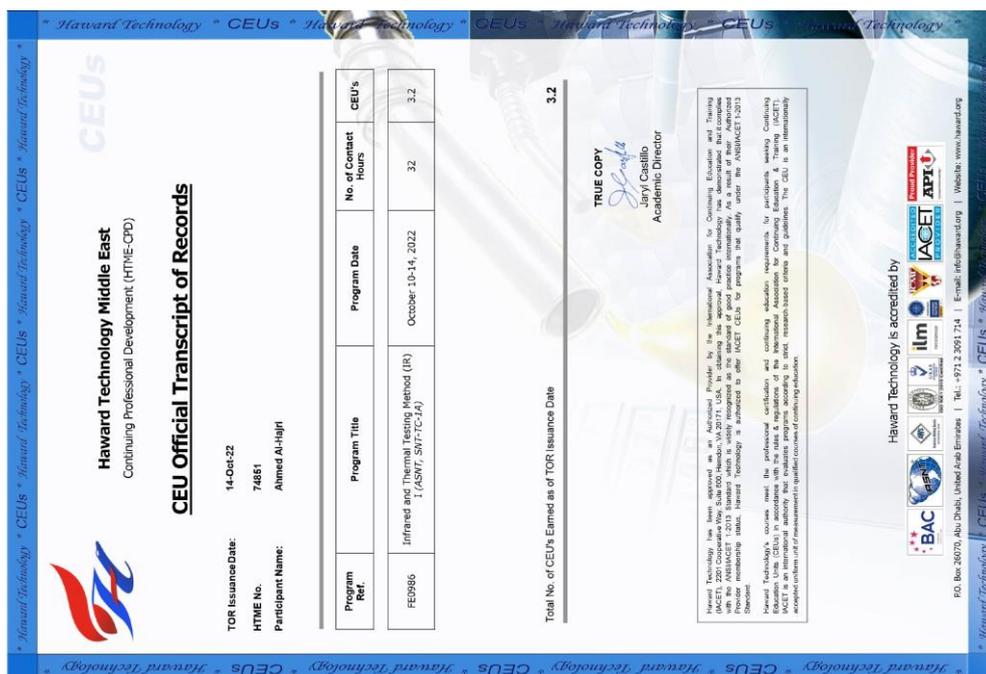
Recertification is FOC for a Lifetime.

Sample of Certificates

The following are samples of the certificates that will be awarded to course participants:-



(2) Official Transcript of Records will be provided to the successful delegates with the equivalent number of ANSI/IACET accredited Continuing Education Units (CEUs) earned during the course



Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- 
The American Society for Nondestructive Testing (ASNT)

Haward Technology has certain instructors who are certified by **The American Society for Nondestructive Testing (ASNT)** and are authorized to conduct ASNT's certification programs for specific NDT methods. ASNT is the world's largest technical society for nondestructive testing (NDT) that provides a forum for exchange of NDT technical information, NDT educational materials and programs, and standards and services for the qualification and certification of NDT personnel.

- 
The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.2 CEUs** (Continuing Education Units) or **32 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- 
British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Training Methodology

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Workshops & Work Presentations
- 30% Case Studies & Practical Exercises
- 20% Software, Simulators & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Abu Dhabi	US\$ 6,000 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Al Khobar	US\$ 6,000 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	US\$ 6,000 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Luis Lopez is a **Senior Inspection Engineer** with extensive experience within the **Oil & Gas, Petrochemical and Refinery** industries. His expertise widely covers in the areas of **Thermography, Thermal Infrared Testing, Radiographic Film Interpretation, Visual Testing, Phased Array Ultrasonic Testing, Ultrasonic Testing, Magnetic Particle Testing, Liquid Penetrant Testing, Non-destructive Testing, NDT Methods & Applications, Electromagnetic Testing, Hydrostatic Leak Testing, Eddy Current Testing, Valve Inspection & Testing, Codes & Standards Interpretation, Corrosion Engineering, Corrosion & Metallurgy, Welding & Corrosion Engineering, Welding Metrology, International Welding Codes, Practical Welding Technology, Plastic Pipe Welding, Welding Inspection, Welding Defects Analysis, Welding Joints & Coating Inspection, Post Weld Heat Treatment, Hardness Testing, Welding Electrodes Monitoring & Control, Pipe Testing, Piping System, Steel Structures, Metals Casting, Crane Functional Testing & Load Testing, Hydrotesting, Pressure Testing Procedure, Pressure Equipment Calibration, Stream Inspection, Corrosion Evaluation, Casting Products Inspection and Raw Materials Inspection.** He is currently the **Senior NDT Instructor** of **SETE** wherein he is deeply involved in thermography, NDT qualification and certification of personnel.

During his career life, Mr. Lopez gained his practical and field experience through his various significant positions and dedication as the **Technical Manager, NDT Instructor, NDT Manager & Instructor, NDT Inspector, NDT Offshore Inspector & Quality Control, Phased Array Ultrasonic Technician and Radiographic Testing Technician** for various international companies such as the JP Inspections, Nova Inspection, NSD Services, Cotemar, UNISPEC Inspection and Ruiver.

Mr. Lopez holds a **Diploma in Professional Mechanical & Electrical Technician**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management (ILM)**, a **Certified ASNT-NDT Level III Inspector** in Infrared & Thermal Testing (IR), Liquid Penetrant Testing (PT), Magnetic Particle Testing (MT), Ultrasonic Testing (UT), Visual Testing (VT), Radiography Testing (RT), Leak Testing (LT), Electromagnetic Testing (ET), **Certified Welding Inspection & Metallurgy Professional (API 577)** and a **Certified AWS-CWI Welding Inspector**. He has further delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	The Nature of Heat - What is it & How is it Measured/Expressed? Instrumentation • Scales & Conversions
0930 – 0945	Break
0945 – 1200	Temperature - What is it & How is it Measured/Expressed? Instrumentation • Scales & Conversions
1200 – 1300	Lunch
1300 – 1500	Heat Transfer Modes Familiarization Heat Conduction Fundamentals • Heat Convection Fundamentals • Heat Radiation Fundamentals
1500 – 1515	Break
1515 – 1615	Radiosity Concepts Familiarization Reflectivity • Transmissivity • Absorptivity • Emissivity • Infrared Radiometry & Imaging • Spatial Resolution Concepts • Error Potential in Radiant Measurements (an Overview)
1615 – 1630	Recap
1630	End of Day One

Day 2

0730 – 0930	Basic Thermal/Infrared Operating Thermography Defined • How Infrared Imagers Work • Differences Among Imagers & Alternative Equipment
0930 – 0945	Break
0945 – 1200	Basic Thermal/Infrared Operating (cont'd) Operation of Infrared Thermal Imager • Operation of Support Equipment for Infrared Surveys
1200 – 1300	Lunch
1300 – 1500	Checking Equipment Calibration with Blackbody References
1500 – 1515	Break
1515 – 1615	Infrared Image & Documentation Quality Elements of A Good Infrared Image • Recording
1615 – 1630	Recap
1630	End of Day Two

Day 3

0730 – 0930	Support Data Collection Environmental Data • Emissivity • Surface Reference Temperatures • Identification & Other
0930 – 0945	Break
0945 – 1200	Detecting Thermal Anomalies Resulting from Differences in Thermal Resistance (Quasi-Steadystate Heat Flow) Large Surface-to Ambient Temperature Difference
1200 – 1300	Lunch
1300 – 1500	Detecting Thermal Anomalies Resulting from Differences in Thermal Resistance (Quasi-Steadystate Heat Flow) (cont'd) Small Surface-to Ambient Temperature Difference
1500 – 1515	Break
1515 – 1615	Detecting Thermal Anomalies Resulting from Differences in Thermal Capacitance, Using System or Environmental Heat Cycles
1615 – 1630	Recap
1630	End of Day Three

Day 4

0730 – 0930	Detecting Thermal Anomalies Resulting from Differences in Physical State
0930 – 0945	Break
0945 – 1200	Detecting Thermal Anomalies Resulting from Fluid Flow Problems
1200 – 1300	Lunch
1300 – 1500	Detecting Thermal Anomalies Resulting from Friction
1500 – 1515	Break
1515 – 1615	Detecting Thermal Anomalies Resulting from Non-Homogeneous Exothermic or Endothermic Conditions
1615 – 1630	Recap
1630	End of Day Four

Day 5

0730 – 0930	Field Quantification of Point Temperatures Simple Techniques for Emissivity
0930 – 0945	Break
0945 – 1030	Field Quantification of Point Temperatures (cont'd) Typical (High Emissivity) Applications
1030 – 1100	Field Quantification of Point Temperatures (cont'd) Special Problem of Low Emissivity Applications
1100 – 1200	Theoretical Examination
1200 – 1300	Lunch
1300 – 1500	Theoretical Examination (cont'd)
1500 – 1515	Break
1515 – 1600	Practical Examination
1600 – 1615	Course Conclusion
1615 – 1630	Presentation of Course Certificate
1630	End of Course

Practical Sessions/Site Visit

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will carryout NDT inspection using our “MSX Thermal Imaging Camera”.



FLIR E4, E5, E6, E8 with MSX® Enhancement

FLIR E4, E5, E6, E8 with MSX® Enhancement

- Display: 3" color LCD
- On-board 640 x 480 Digital Camera
- Easy-to-use, weighs only 1.2lbs
- 2% accuracy
- File format: Radiometric jpg
- Swappable Li-ion Battery with 4 hour life
- Spot Measurement mode
- Simultaneous storage of IR/Visual/MSX images
- Picture in Picture image (E6 and E8)
- Area Box Measurement mode (E5, E6 and E8)

Each includes power supply/charger with four plugs, rechargeable battery, FLIR Tools software, USB cable, and hard transport case. E8 also includes extra battery and external battery charger.

FLIR E4

- 4,800 pixels (80 x 60)

FLIR E5

- 10,800 pixels (120 x 90)

FLIR E6

- 19,200 pixels (160 x 120)

FLIR E8

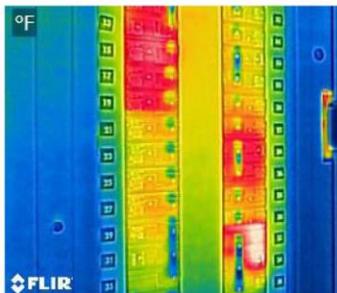
- 76,800 pixels (320 x 240)



New Exclusive MSX Thermal Imaging Technology Made Affordable for Everyday Use

What is MSX?

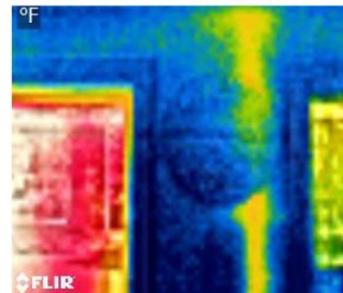
Multi-Spectral Dynamic Imaging (MSX) for easier interpretation of an image - adds visible spectrum definition to IR images by detecting the edges of objects and including that detail in the thermal image. Text becomes clearly visible so that you can read a label or identifier within the IR image. This exclusive function provides extraordinary thermal detail that instantly highlights and orients problem locations and eliminates the need to refer back to a visual image for detail.



Breaker Panel
E8 with MSX



Missing Insulation - Summer Day
E6 with MSX



Warm Drain Pipe in Wall
E4 with MSX

Imaging Specifications

FEATURES	FLIR E4	FLIR E5	FLIR E6	FLIR E8
IR Pixel Resolution	4,800 (80 x 60)	10,800 (120 x 90)	19,200 (160 x 120)	76,800 (320 x 240)
Thermal Sensitivity	<0.15°C	<0.10°C	<0.06°C	<0.06°C
Temperature Range	-4 to 482°F (-20 to 250°C)			
Measurement modes	Centerspot	Centerspot, Area Box, Auto Hot/Cold detection	Centerspot, Area Box, Auto Hot/Cold detection	Centerspot, Area Box, Auto Hot/Cold detection
Frame Rate	9Hz			
Field of View	45° x 34°			
Focus	Focus free			
Auto Hot/Cold Detection	No	Auto min/max markers within area	Auto min/max markers within area	Auto min/max markers within area



Included in All Models



Additional Accessories Included with E8



Optional Accessories

Ordering Information

63901-0101 FLIR E4 Compact Thermal Imaging Infrared Camera with MSX® Enhancement (80x60)
 63901-0101-NIST FLIR E4 with Certificate Traceable to NIST
 63905-0501 FLIR E5 Compact Thermal Imaging Infrared Camera with MSX® Enhancement (120x90)
 63905-0501-NIST FLIR E5 with Certificate Traceable to NIST
 63902-0202 FLIR E6 Compact Thermal Imaging Infrared Camera with MSX® Enhancement (160x120)
 63902-0202-NIST FLIR E6 with Certificate Traceable to NIST
 63903-0303 FLIR E8 Compact Thermal Imaging Infrared Camera with MSX® Enhancement (320x240)
 63903-0303-NIST FLIR E8 with Certificate Traceable to NIST

ACCESSORIES
 T198529 Pouch
 T198530 Replacement battery
 T198531 External battery charger
 T198532 Car Charger
 T198534 Power supply/charger with EU, UK, US and AU plugs
 T198533 USB cable
 T198528 Hard Transport Case



10-Year Detector Protection
 5-Year Battery
 2-Year Parts & Labor

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org