Thermographic testing (TT) — Levels 1, 2 and 3

The thermographic testing training shall be in accordance with Tables 17 and 18.

Table 17 — General content

Content	Level 1 (% of total duration)	Level 2 (% of total duration)	Level 3 (% of total duration)
13.1 Introduction to terminology and history of thermographic testing (TT)	1	1	1
13.2 Physical principles of the method and associated knowledge	1	2	1
13.3 Product knowledge and capabilities of the method and its derived techniques	3	0	2
13.4 Equipment	15	9	13
13.5 Information prior to testing	1	11	13
13.6 Testing	30	26	18
13.7 Evaluation and reporting	10	7	11
13.8 Assessment	0	5	6
13.9 Quality aspects	1	4	7
13.10 Developments	0	1	5

Table 18 — Thermographic testing (TT) — Levels 1, 2 and 3

Content			Level 1	Level 2	Level 3
13.1 Introduction to terminology and history of thermographic testing (TT)	History		X	X	X
	Purpose of NDT	What is testing?	X	X	X
		W	X	X	X
		A p	X	X	X
		H	X	X	X
		V	X	X	X
		M	X	X	X
	Purpose of thermographic testing (TT)	D	X	X	X
		A	X	X	X
	Terminology		X	X	X
13.2 Physical principles and associated knowledge	Heat transfer	H	X	X	
		T	X	X	
		P	X	X	
		—	X	X	
		—	X	X	
		— Gas	X	X	
		Variations of temperature scale	X	X	

		Heat conduction fundamentals	X	X	
		— Fourier's law	X	X	
		Heat convection fundamentals	X	X	
		— Newton's law of cooling	X	X	
		Heat radiation fundamentals	X	X	
		— Plank's law	X	X	
		— Wien's law	X	X	
		—	X	X	
			X	X	
			X		
				X	
	Infrared engineering		X		
			X		
			X		
			X		
			X		
			X		
			X		
			X		
				X	
			X		
			X		
			X		
			X		
			X		
			X	X	X
				X	X
				X	X
				X	X
				X	X
				X	X
				X	X
					X
				X	X
				X	X
				X	X
					X
					X
					X
13.3 Product knowledge and related capability of the method and derived techniques	Principles of thermography		X	X	
			X	X	
		— Adiabatic temperature field	X	X	
		— Delamination/crack	X	X	
		— Self-heating	X	X	
		— Cavity radiation effect	X	X	
		— Active metho d	X	X	
		— Passive method	X	X	
		— Qualitative thermography	X	X	

		— Quantitative thermography	X	X	
		Selection criteria of technique		X	X
		Other temperature measurement equipment and their measurement principles			X
		Adjustment	X	X	X
	Thermoelastic stress measuring method	T		X	X
		P		X	X
		I			X
		T i			X
		T n			X
		S			X
		I			X
	Various flaws and their cause	F c d	X	X	
		M	X	X	
		P	X	X	
		E	X	X	
		M	X	X	
		I n s			X
		C			X
		C (v)			X
13.4 Equipment	Thermographic instrument	E f	X		
		C	X		
		–	X		
		–	X		
		F	X		
		M d	X	X	
		–	X		
		–	X		
		M t (		X	X
		M t (		X	X
		Ultraviolet (UV)	X		
		Knowledge of Image processing	X		
		— Color palettes	X		
		— Frame averaging	X	X	
		— Pixel correction	X		
		Signal process flow in instruments		X	

		Mechanism and principle of sensors		X	
		Selection criteria of sensors		X	
		— Bolometer		X	
		— Thermocouple		X	
		— Thermopile		X	
		— Pyroelectric sensor		X	
		S		X	
		M b		X	
		–		X	
		–		X	
		S n b		X	
		N d		X	
		N		X	
		E		X	
		D			X
		S			X
	Accessories	F	X		
		– f	X		
		–		X	
		V l	X		
		– l		X	
		–			X
		–			X
		–			X
		V a	X		
		– a		X	
		– i		X	
		–		X	
		– w a			X
		D c			X
	Thermal loading device	V	X		
		— Contact thermal heating	X		
		— Radiation heating	X		
		— Flash lamp heating/ step heating	X		
		— Electricity heating	X		
		— Other thermal loading devices	X		

		Selection criteria of thermal loading device		X	
		Thermoelastic stress measuring method		X	
		Efficiency			X
		Uniformity			X
		Reproducibility			X
		S			X
13.5 Information prior to test	Information about the test object	I n	X	X	X
		–	X	X	X
		–	X	X	X
		–		X	X
		–	X	X	X
	Test conditions and application of standard	A		X	X
		I			X
		P		X	X
		A		X	X
		S s b			X
		S o		X	X
		R p		X	X
		A			X
	Technique and sequence of performing test	S		X	
		S		X	
		P		X	
	Instructions	P p			X
		P i		X	
		P a i	X		
		I			X
		P c			X
13.6 Testing	Test condition	F	X		
		R	X		
		F		X	
		–	X	X	
		–	X	X	
		I o		X	
		Automated testing in production line scanner			X
		Control and adjustment of production process			X
		FEM simulation for parameter expansion, prediction of results and reconstruction			X

	Operation of infrared instruments	Setting of emissivity	X		
		Knowledge of sensor correction	X		
		Understanding of spatial resolution	X		
		Face angle dependence of emissivity		X	
		–	X		
		T e		X	
		– r	X		
		– a n	X		
		S	X		
		I n	X		
		A	X		
		F	X		
		M	X	X	
		V e	X	X	
		S e o	X	X	
		C d	X	X	
		F y	X	X	
	Special cases	T (			X
		T n			X
		F s			X
		M			X
		C			X
	Various flaws and their cause	F	X	X	
		F	X	X	
		M	X	X	
		P	X	X	
		F	X	X	
		M	X	X	
13.7 Evaluation and reporting	Data processing	V	X		
		T		X	
		A		X	
		F		X	
		S		X	
		I		X	
		Motion compensation		X	
		Trend processing		X	
		Selection criteria of data processing flow		X	
	Recording	Requirements	X	X	
	Reporting	Requirements	X	X	
		Characterization		X	

		Interpretation of indications		X	
		Evaluation of indications		X	
	Use of complimentary ND T methods	Interpretation of relevant standards and codes			X
		Evaluation (conventional approach, validated metho d			X
		D			X
		A			X
		I			X
		S			X
13.8 Assessment	Evaluation and confirmation of test reports	A		X	
		– s p		X	
		– c			X
		– d			X
		– a			X
13.9 Quality aspects	Personnel qualification	I	X	X	X
		C c			X
	Documentation	F p			X
		C p			X
		A i p			X
		D		X	
		V i	X		
		T		X	X
		R		X	X
	Knowledge of applicable NDT application and product standards	C		X	
		U		X	
		N		X	X
		J	X	X	X
		E	X	X	X
13.10 Developments	General information			X	
	Newest developments	Industrial applications			X
		Scientific applications			X