

DIMENSIONAL CHECK (DIM)

RINA issues certificates to NDT operators for the DIM method in accordance with the UNI EN ISO 9712 standard, considering the requirements indicated in the following specific standards:

- ISO 1101 Geometrical product specifications (GPS)- Geometrical tolerancing- Tolerances of form, orientation location and run out
- ISO 10360 series Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS)
- ISO 14253 series Geometrical product specifications (GPS) - Inspection by measurement of workpieces and measuring equipment
- ISO 14638 Geometrical product specifications (GPS) - "Matrix model"
- ISO 15530 series Geometrical product specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement
- ASME Y14.5 Dimensioning and Tolerancing. Engineering Product Definition and Related Documentation Practices

This type of certificate refers to the "Pre-service and in-service testing of equipment, plants and structures" sector, which includes the "manufacture" sector and covers one or more sectors of those listed here below and identified with [A], [B], [C] and [D]:

Pre-service and in-service testing of equipment, plants and structures	<p>Qualification applications: this method applies to all components of machines, equipment and plants which must be subject to a dimensional check requiring verification of the following quantities:</p> <ul style="list-style-type: none"> - dimensions - dimensional tolerances - form and position tolerances - roughness. <p>The dimensional check can be carried out both during production (pre-service) and during operation (in-service). Measurement activities shall be carried out by bench-top measurement instruments, roughness testers, coordinate measuring machines, optical machines, etc..</p>
- Bench-top measurement instruments [A]	Measurement activities shall be carried out using traditional bench-top instruments (gauges, micrometers, dial gauges, etc.), gauges (P/NP) and roughness meters, for measuring dimensions, form and position geometrical characteristics and roughness.
- Optical instruments [B]	Measurement activities shall be carried out using optical machines such as profile projectors, microscopes, etc.
- Coordinate measuring machines (CMM) [C]	Measurement activities shall be carried out using coordinate machines.
- Form measuring machines [D]	Measurement activities shall be carried out using roundness measuring machines.

NOTE:

- 1) sector [A] is considered as the BASIC sector and is a pre-requisite for the achievement of the qualification in any other sector [B], [C], [D].
- 2) Level 3 includes all sectors ([A]+[B]+[C]+[D])

Minimum training requirements

Level 1 [h]	Level 2 [h]	Level 3 [h]
40	32	24
<ul style="list-style-type: none"> • Training hours include both practical and theory courses. • Direct access to level 2 requires the sum of the training hours expected for Level 1 and Level 2. • Direct access to Level 3 requires the sum of the training hours expected for each Level, 1, 2 and 3. • Training duration may be reduced as a function of experience, education levels, application sectors and of whatever is defined by the standard, as listed here below. In any case, the total training duration cannot be less than 50% of the expected hours. 		

Expected training reductions for Level 1:

- **[A] + [B] + [C] + [D]** Training for Level 1 operators, pre-service and in-service industrial sector, about the use of bench-top instruments, optical instruments, coordinate measuring machines and form measuring instruments. Training hours for candidates who have graduated from technical college or university or have completed at least two years of engineering or science study at college or university: 32 hours.
- **[A]** Training for Level 1 operators, pre-service and in-service industrial sector, limited to bench-top instruments, BASIC method. Training hours: 28 h.
- **[B]** Training for Level 1 operators, pre-service and in-service industrial sector, limited to optical instruments. Training hours: 30 h.
- **[C]** Training for Level 1 operators, pre-service and in-service industrial sector, limited to coordinate optical instruments. Training hours: 36 h.
- **[D]** Training for Level 1 operators, pre-service and in-service industrial sector, limited to form measuring instruments. Training hours: 30 h.

Expected training reductions for Level 2:

- **[A] + [B] + [C] + [D]** Training for Level 2 operators, pre-service and in-service industrial sector, about the use of bench-top instruments, optical instruments, coordinate measuring machines and form measuring instruments. Training hours for candidates who have graduated from technical college or university or have completed at least two years of engineering or science study at college or university: 30 hours.
- **[A]** Training for Level 2 operators, pre-service and in-service industrial sector, limited to bench-top instruments, BASIC method. Training hours: 24 h.
- **[B]** Training for Level 2 operators, pre-service and in-service industrial sector, limited to optical instruments. Training hours: 24 h.
- **[C]** Training for Level 2 operators, pre-service and in-service industrial sector, limited to coordinate optical instruments. Training hours: 32 h.
- **[D]** Training for Level 2 operators, pre-service and in-service industrial sector, limited to form measuring instruments. Training hours: 24 h.
- Certification extension to one sector: at least 8 hours of training for each sector to be added.

Minimum required industrial experience

Level 1 [months]	Level 2 [months]	Level 3 [months]
4	12	18
- Industrial experience in months is based on a nominal 40 h working week or the legal week of work. When an individual is working in excess of 40 hours/week, he/she may be credited with experience based on the total hours, but he/she may be required to produce evidence of this experience.		

Conduction of Level 1 and 2 examinations

General examination

Level 1	Level 2
40 questions	40 questions

Specific examination

Level 1	Level 2
40 questions (for certification in all sectors [A] + [B] + [C] + [D])	40 questions (for certification in all sectors [A] + [B] + [C] + [D])
20 questions (for Basic sector [A])	20 questions (for Basic sector [A])
10 questions (for each additional sector [B] , [C] , [D])	10 questions (for each additional sector [B] , [C] , [D])

Practical examination

The practical examination shall involve performing the test on prescribed specimens, recording (and for Level 2 candidates, interpreting) the resulting information to the degree required and reporting the results in the required format. With regard to qualification in sector [A] + [B] + [C] + [D] , at least 4 tests must be conducted with different instruments, one for each sector. With regard to qualification in only one sector, 2 tests must be conducted with different instruments. Furthermore, Level 2 candidates shall draft a written instruction suitable for Level 1 candidate.

Conduction of Level 3 examinations

Basic examination:

Before accessing the method examination, a candidate must pass the basic examination in accordance with the ISO 9712 standard. The basic examination is not required for candidates with a level 3 ISO 9712 valid certificate in one NDT method.

Main-method examination:

30 questions	Level 3 knowledge of the dimensional check method (physical principles, equipment, control techniques)
20 questions	Application of the method, codes, standards, specific test applications, applicable specifications and procedures
Drafting of a dimensional testing procedure	Drafting of a specific procedure. Standards and codes are available to the candidates

The practical test shall be conducted only in case of direct access to Level 3 qualification and shall consist of 4 tests using different instruments, one for each sector (**[A]** + **[B]** + **[C]** + **[D]**).

For any information not provided above reference shall be made to the requirements of the UNI EN ISO 9712:2012 standard.

Contents of the training course

- 0 – Introduction to the course
- 1 – International System of Units
- 2 – Technical specifications:
 - Mandatory, explicit, intrinsic
 - Reference standards
- 3 – Technical drawing:
 - Terms
 - General principles and definitions
 - Representation systems
 - Dimensioning systems
- 4 – Machining tolerances:
 - ISO System
 - Couplings
- 5 – Micro-geometrical errors:
 - Roughness
- 6 – Macro-geometrical errors:
 - form and position tolerances
- 7 – Reading a drawing
 - Drills
- 8 – Fundamentals of statistics
 - Statistic parameters
 - Distribution, Gauss, standard deviation
- 9 – Statistics applied to production:
 - Batch validation
 - 6-sigma system
- 10 – Statistics applied to metrology
 - Measurement error, measurement uncertainty
- 11 – Measurement theory
 - Metrological characteristic
 - Measuring range
 - Unit of format
 - Repeatability resolution
 - Measurement uncertainty, contributions
- 12 – Measuring instruments:
 - General principles, terms and definitions
 - Fixed-zero and moving-zero instruments
 - Bench-top instruments
 - P/NP gauges
- 13 – Check and management of instruments as per ISO
 - Applicable and contractual requirements
 - Metrological confirmation
- 14 – Designing a control system
 - Specific analyses to be checked
 - Definition of acceptable limits
 - Identification of the measuring system
 - Drills
- 15 – Quality control plan
 - Controls upon acceptance
 - Controls during working cycle
 - Final testing
 - Controls during operation
 - Instruction for Level 1 operators
- 16 – Coordinate measuring instruments:
 - CMM measuring machines
 - Optical machines
 - Roundness meters and profilometers
 - Drills