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Road vehicles — Qualification and certification of technical personnel dealing with natural gas vehicles (NGVs)

Véhicules routiers — Qualification et certification du personnel technique chargé des véhicules au gaz naturel

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects of gaseous fuels*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The use of natural gas (NG) as compressed natural gas (CNG) or liquified natural gas (LNG) is considered risky because of how the fuel is stored on board of vehicles (compressed at pressure higher than 200 bar or cryogenic at a temperature of –160 °C). Furthermore, operations on systems subjected to very high pressure or very low temperature can seriously injure or cause the death of persons not competent in activities dealing with natural gas vehicles (NGVs). Also, users can be badly affected in the same manner as a consequence of activities conducted by not competent persons.

Since the effectiveness of any application depends upon the competence of the persons who perform or are responsible for the activities, a procedure has been developed to provide a means for qualifying the competence of personnel involved with different levels of liability in the NGVs operations as well as a certification scheme for those professional figures that are subjected to high risk activities.

Thus, this document, as well as other standards dealing with high risk activities associated with NGVs, also aim to provide to the certification bodies precise requirements for a certification scheme when certification is required to verify the competence of level 3 and 4 (see 5.3). On this matter, methods and techniques that should be adopted for a standardized competence assessment of technicians involved with the operations on NGVs are provided. This is to avoid discrepancies and different criteria in competence assessment. A synthetic scheme on how this document shall be applied in conjunction with other standards covering training and qualification of technical personnel dealing with natural gas vehicles is provided in Figure 1.

When certification of personnel working on NGVs is required in product standards, regulations, codes or specifications, it is important to certify the personnel in accordance with this document.

When there is no requirement by legislation, standards or in certification of NGVs personnel, it is upon employers of such personnel to decide how to assure themselves that they are competent to do the work assignments. Thus, they may employ people who are already certified or they may apply their own expertise so as to assure themselves that their employee has the necessary competence.

This document is mainly directed to:

— workshop personnel;

— CNG, LNG and L-CNG fuelling station owner/personnel;

— first responders;

— inspectors;

— training course providers;

— certification bodies;

— original equipment manufacturer (OEM);

— system manufacturer;

— workshop owner/personnel;

— CNG and L-CNG fuelling station owner/personnel.

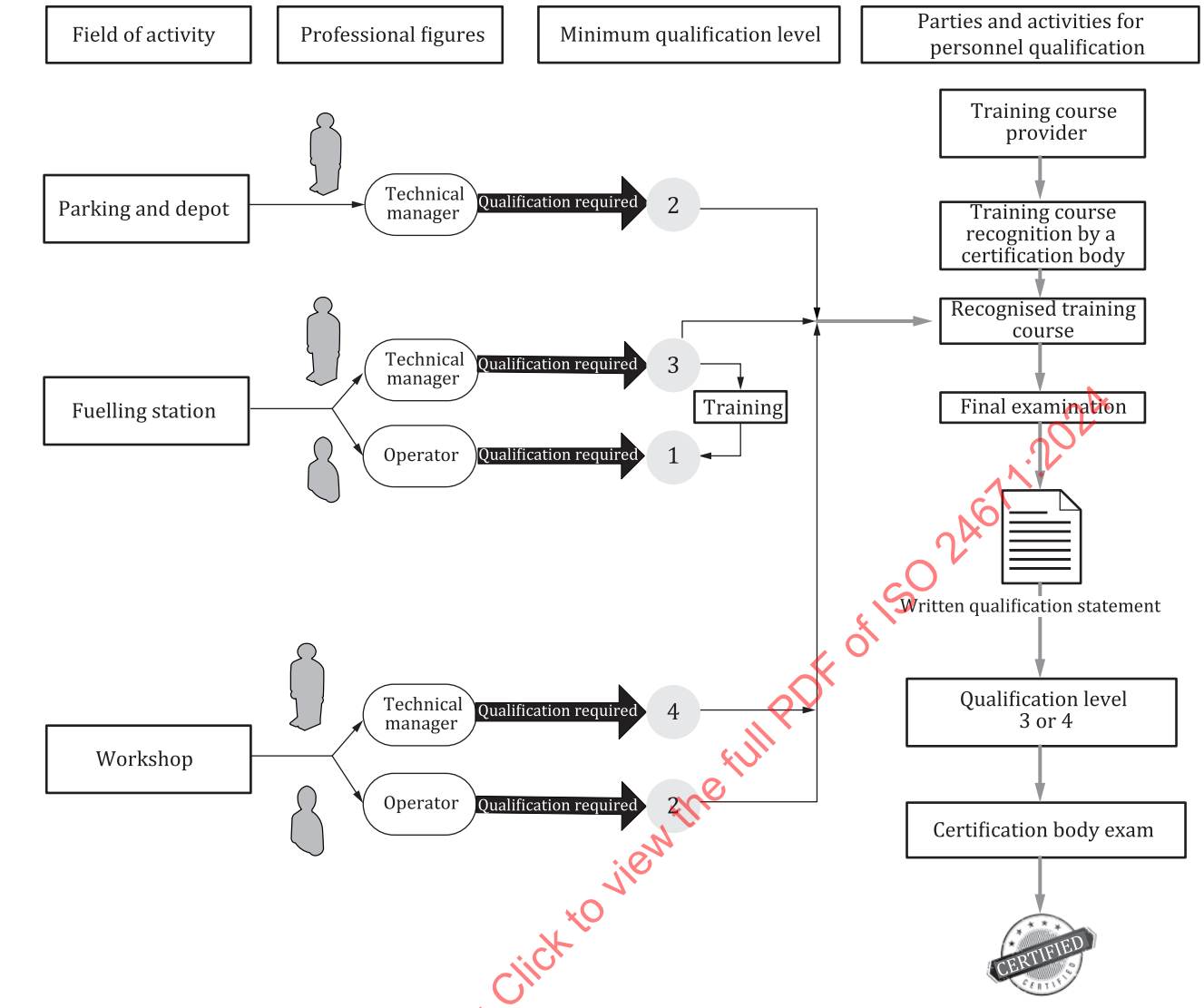

Figure 1 — Certification and qualification scheme of personnel dealing with NGVs activities

Road vehicles — Qualification and certification of technical personnel dealing with natural gas vehicles (NGVs)

1 Scope

This document specifies requirements for the qualification and certification of personnel who perform operations on NGVs, according to the level of safety required by the role and/or position.

NOTE 1 The certification is required for the level 3 and 4 of competence as defined in ISO 23684.

NOTE 2 This document specifies requirements for what are, in effect, third-party conformity assessment schemes. These requirements do not directly apply to conformity assessment by second or first parties, but relevant parts of this document can be referred to in such arrangements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17024, *Conformity assessment — General requirements for bodies operating certification of persons*

ISO 23684:2023, *Road vehicles — Technical personnel dealing with natural gas vehicles (NGVs) — Training and qualification*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
ability
capacity and human attribute to perform an activity

[SOURCE: ISO/IEC TS 17027:2014, 2.1]

3.2
applicant
person who has submitted an application to be admitted into the *certification process* (3.8)

[SOURCE: ISO/IEC 17024:2012, 3.13]

3.3
authorized qualification body
body, independent of the NGV workshop, authorized by the *certification body* (3.10) to prepare and administer qualification examinations

Note 1 to entry: Qualification examination is an activity administered by the *certification body* (3.10) or the authorized qualification body, which assesses the general, specific and practical knowledge and the *skill* (3.40) of the candidate.

Note 2 to entry: The training course provider of a recognised training course can also operate as an authorized qualification body if the requirements of impartiality are not compromised as well as the reduction of the assessment and certification requirements.

[SOURCE: ISO 9712:2021, 3.2, modified — Note 1 to entry and Note 2 to entry have been added, and "employer" has been changed to "NGV workshop".]

3.4
candidate
applicant (3.2) who has fulfilled specified prerequisites and has been admitted to the *certification process* (3.8)

3.5
certificate
document in the form of a letter, card or other medium (e.g. digital certificate) issued by a *certification body* (3.10) under the provisions of this document, indicating that the named person has fulfilled the *certification requirements* (3.9)

3.6
certification
third-party attestation related to products, processes, systems, or persons

3.7
certification cycle
maximum period of time permitted from the date of certification to the date of *recertification* (3.36) inclusive of the *renewal* (3.37) period

3.8
certification process
activities by which a *certification body* (3.10) determines that a person fulfils *certification requirements* (3.9), including application, assessment, decision on certification, *renewal* (3.37), *recertification* (3.36) and use of *certificates* (3.5) and logos/marks

3.9
certification requirement
set of specified requirements, including requirements of the scheme to be fulfilled in order to establish or maintain *certification* (3.6)

3.10
certification body
CB
third-party conformity assessment body operating *certification schemes* (3.12)

Note 1 to entry: A certification body can be non-governmental or governmental (with or without regulatory authority).

Note 2 to entry: A conformity assessment body is a body that performs conformity assessment activities and that can be the object of accreditation.

Note 3 to entry: Third-party conformity assessment is the conformity assessment activity that is performed by a person or body that is independent of the person being certified.

[SOURCE: ISO/IEC 17065:2012, 3.12, modified — Note 2 to entry and Note 3 to entry have been added.]

3.11
certified person
person whose competence is attested as the outcome of an assessment and validation process by a *certification body* (3.10)

3.12
certification scheme
specific *certification requirements* (3.9) related to specified categories of persons to which the same particular standards and rules, and the same procedures apply

3.13
competence
ability (3.1) to apply knowledge and skills to achieve intended results

[SOURCE: ISO/IEC 17024:2012, 3.6]

3.14
compressed natural gas
CNG
natural gas which has been compressed and stored for use as a vehicle fuel

[SOURCE: ISO 16923:2016, 3.12]

3.15
competence assessment
formal outcome of an evaluation process (e.g. examination) and validation by means of objective elements, obtained when a competent body states that the learning outcomes of a person meet given standards and safety regulations

3.16
competent person
person who has been assessed by means a *competence assessment* (3.15) and has been deemed to have the knowledge and skills for competent performance

3.17
CNG cylinder
any container used for the storage of compressed natural gas according to the following classifications:

— CNG-1: an all metal cylinder

— CNG-2: a hoop wrapped cylinder with a load sharing metal liner and composite reinforcement on the cylindrical part only

— CNG-3: a fully wrapped cylinder with a load sharing metal liner and composite reinforcement on both the cylindrical part and dome ends

— CNG-4: a fully wrapped cylinder with a non-load sharing non-metallic liner and composite reinforcement on both the cylindrical part and dome ends

3.18
employer
government, prime contractor, sub-contractor, supplier or outside agency employing or contracting the services of one or more individuals who perform activities on NGVs

Note 1 to entry: Self-employed individuals are included in this definition.

3.19
examination
mechanism that is part of the assessment which measures a *candidate's* (3.4) *competence* (3.13) by one or more means, such as written, oral, practical and observational, as defined in the *certification scheme* (3.12)

[SOURCE: ISO/IEC 17024:2012, 3.9]

3.20
examination centre
centre approved by the *certification body* (3.10) where *examinations* (3.19) are carried out

3.21
examination element
component of an *examination* (3.19)

3.22
examiner
person competent to conduct and score an *examination* (3.19), where the examination requires professional judgement

[SOURCE: ISO/IEC 17024:2012, 3.10]

3.23
fuelling station
facility at which vehicle fuels are dispensed

3.24
learning outcome
what a person is expected to know, understand or be able to do at the end of a training programme, course or module

[SOURCE: ISO/IEC TS 17027:2014, 2.57]

3.25
liquefied natural gas
LNG
natural gas which has been liquefied, after processing, for storage or transportation purposes

[SOURCE: ISO 16924:2016, 3.38]

3.26
multiple-choice examination question
wording of a question giving rise to potential replies, only one of which is correct, the remaining being incorrect or incomplete

3.27
natural gas
complex gaseous mixture of hydrocarbons, primarily methane, but that generally includes ethane, propane and higher hydrocarbons, and some non-combustible gases such as nitrogen and carbon dioxide

Note 1 to entry: The definition includes renewable natural gas (biogas, biomethane, etc.).

[SOURCE: ISO 14532:2014, 2.1.1.1, modified — Note 1 to entry has been replaced.]

3.28
NGV workshop
competent organization, appropriately equipped, that assumes technical responsibility for correct and safe service, inspection, repair and retrofit on CNG or LNG vehicles

3.29
qualification
demonstrated education, training and work experience, where applicable, required to properly perform the assigned task

[SOURCE: ISO/IEC 17024:2012, 3.7, modified — The following text has been added: "required to properly perform the assigned task".]

3.30
depot
building used for the storage and servicing of NGVs

3.31
knowledge
facts, information, truths, principles or understanding acquired through experience or education

Note 1 to entry: An example of knowledge is the *ability* (3.1) to describe the various parts of an information assurance standard.

[SOURCE: ISO/IEC TS 17027:2014, 2.56, modified — Note 1 to entry has been added, taken from ISO/IEC 19896-1:2018, 3.7]

3.32
natural gas vehicle
NGV
road vehicle powered by *natural gas* (3.27)

[SOURCE: ISO 15500-1:2015, 3.9]

3.33
operation
procedures to use or tasks performed to control, refuel, install, repair or replace part of the system

3.34
practical examination
assessment of practical skills, in which the *candidate* (3.4) demonstrates familiarity with, and the *ability* (3.1) to perform, the test

3.35
qualification examination
examination, administered by the *authorized qualification body* (3.3), which assesses the general outcome of the training

3.36
recertification
process for revalidation of a *certificate* (3.5) by *examination* (3.19) or by otherwise satisfying the *certification body* (3.10) that the published criteria for recertification have been met

3.37
renewal
process for revalidation of a certification at any time up to five years after success in an initial, supplementary or *recertification* (3.36) *examination* (3.19)

3.38
recognised training course
training course whose contents (for instance: *qualification* (3.29) of teachers, training procedures, documents, examination programme and procedures) are assessed against specific requirements established and approved by a *certification body* (3.10)

3.39
second-party conformity assessment
conformity assessment activity that is performed by a person or organization that has a user interest in the object

Note 1 to entry: Persons or organizations performing second-party conformity assessment activities include, for example, purchasers or users of products, or potential customers seeking to rely on a supplier's management system, or organizations representing those interests.

[SOURCE: ISO/IEC 17000:2020, 4.4, modified — The term was originally "second-party conformity assessment activity"; the example and Note 2 to entry were deleted.]

3.40
skill
ability (3.1) to perform a task or activity with a specific intended outcome acquired through education, training, experience or other means

[SOURCE: ISO/IEC/TS 17027:2014, 2.74]

3.41
significant interruption
absence or change of work activity which prevents the certified individual from practising the duties corresponding to the level in the method and the sector[s] within the certified scope, for either a continuous period in excess of one year, or two or more periods for a total time exceeding two years

Note 1 to entry: Legal holidays or periods of sickness or training courses of less than 30 days are not taken into account when calculating the interruption.

3.42
system manufacturer
company which can assume technical responsibility for the manufacturing or retrofitting of CNG system and can demonstrate that it possesses the features required and the necessary means to provide quality assessment and conformity of production of the CNG system

[SOURCE: Reference [11]]

3.43
technical manager
qualified person which takes responsibility for decisions relating to parking, fuelling, installation, maintenance and repair of an NGV system

[SOURCE: adapted from EN 13423:2021, 3.27.]

3.44
third-party conformity assessment
conformity assessment activity that is performed by a person or body that is independent of the person or organization that provides the object, and of user interests in that object

Note 1 to entry: Criteria for the independence of conformity assessment bodies and accreditation bodies are provided in the international standards and guides applicable to their activities.

[SOURCE: ISO/IEC 17000:2020, 4.5, modified — The term was originally "third-party conformity assessment activity" and Note 1 to entry was replaced.]

3.45
training
activities designed to facilitate the learning and development of *knowledge* (3.31), *skills* (3.40), and *abilities* (3.1), and to improve the performance of specific tasks or roles

[SOURCE: ISO 22398:2013, 3.23]

3.46
training course provider
organization competent to administer a programme to train personnel operating on *natural gas vehicles* (3.32) with specific courses

3.47
assessment
process that evaluates a person's fulfilment of the requirements of the *certification scheme* (3.12)

[SOURCE: ISO/IEC 17024:2012, 3.8]

3.48
code of conduct
document specifying the ethical or personal behaviour required by a *certification scheme* (3.12)

4 Responsibility

4.1 General

The qualification/certification system, which shall be controlled and administered by a certification body, includes all procedures necessary to demonstrate the qualification and the competence of an individual to carry out tasks in the NGV sector in leading to certification.

4.2 Certification body

4.2.1 The certification body shall fulfil the requirements of ISO/IEC 17024.

4.2.2 The certification body:

a) shall initiate, promote, maintain and administer the certification scheme according to ISO/IEC 17024 and this document;

b) shall be independent of any single interest;

c) shall publish information regarding the scope of the certification scheme and a general description of the certification process;

d) shall establish examination questionnaires and specimens to be used for personnel qualification for certification purposes;

e) shall provide information for training courses recognition as per ISO 23684:2023, 6.3.1;

f) shall conduct an initial audit and subsequent periodic surveillance audits of the authorized qualification body(ies) to ensure their conformity to the specifications;

g) shall monitor and be responsible, in accordance with a documented procedure, for all delegated functions;

h) shall bear full responsibilities for examinations conducted on temporary basis at external premises;

i) shall establish and/or approve examination questionnaires and specimens to be used for personnel qualification by an authorized qualification body;

j) shall be responsible for ensuring the security of all examination materials (question banks, examination papers, etc.) and shall ensure that these materials are not in use for training purposes;

k) shall be responsible for granting, extension, suspension, withdrawal or revalidation of certification;

l) shall establish an appropriate system for the maintenance of records, which shall be retained for at least one certification cycle;

m) shall require all candidates and certificate holders to give a signed or stamped undertaking to abide by a code of conduct which it shall develop for the purpose and publish;

n) shall approve training courses in accordance with ISO 23684;

o) may delegate, under its direct responsibility, the detailed administration of qualification to authorized qualification bodies, to which it shall issue specifications and/or procedures covering facilities, personnel, verification and control of equipment, examination materials, conduct of examinations, examination grading, records, etc.;

p) shall establish a process to authorize examiners ensuring that personnel do not serve as an examiner of a specific candidate they have trained until the certification body demonstrates it does not compromise impartiality;

q) to standardize the qualification/certification process of NGVs technicians shall verify that every training course meets the competence requirements defined in ISO 23684.

4.3 Authorized qualification body

Where established, the authorized qualification body shall:

a) work under the control of and apply the specifications issued by the certification body;

b) be independent of any single predominant interest;

c) ensure that it is impartial with respect to each candidate seeking qualification, bringing to the attention of the certification body any actual or potential threat to its impartiality;

d) apply a documented quality management system approved by the certification body;

e) have the resources and expertise necessary to establish, monitor and control examinations centres, including examinations and the verification and control of the equipment;

f) prepare, conduct and administer examinations under the responsibility of an examiner authorized by the certification body;

g) apply a documented quality procedure for examinations approved by the certification body;

h) shall establish a process to authorize examiners ensuring that personnel do not serve as an examiner of a specific candidate they have trained;

i) have adequate qualified staff, premises and equipment to ensure satisfactory examinations for the levels, methods, and sectors concerned;

NOTE The use of external premises is allowed.

j) prepare and conduct examinations under the responsibility of an examiner authorized by the certification body, using only examination questionnaires and specimens established or approved by the certification body for that purpose as per 4.2.2 (g);

k) use only specimens approved by the certification body;

l) maintain appropriate examination documents according to the requirements of the certification body;

m) when more than one examination is conducted at the same time, different approved questionnaires and examination specimens shall be used of comparable test difficulty and comparable test contents. Under no circumstances shall specimens be used for training purposes;

n) when the examination activities are conducted at an employer's premises, the certification body shall require controls to preserve impartiality and protect confidentiality of the examinations. The examinations shall be maintained under the control of an authorized representative of the certification body.

4.4 Training course provider

The training course provider shall:

a) submit every training course designed in accordance with ISO 23684 to a training course recognition by the certification body as per 7.2;

b) apply a documented quality procedure approved by the certification body;

c) have the resources needed to administer examinations;

d) have adequate qualified staff, premises and equipment to ensure satisfactory qualification examinations for the levels, methods, and sectors concerned;

e) designate a teaching manager whose competence has been previously ascertained by the certification institution. The qualification criteria adopted to establish his/her competence include:

   i) analysis of curriculum vitae (engineering degree, technical-scientific publications, reports held at conferences on course subjects, etc.)

   ii) at least three years verifiable experience in the field of NGV activities resulting in documented competence;

f) conform to the requirements of 4.3 when operating as an authorized qualification body.

4.5 Employer

4.5.1 The employer shall document the personnel information which shall include the declaration of education, training and industrial experience to determine the eligibility of the candidate. If the candidate is self-employed, the industrial experience shall be attested to by a referee.

4.5.2 All documentation obtained from the employer, as required by the appropriate qualification level, shall be verified by the certification body.

4.5.3 In respect of certified personnel under their control, the employer shall be responsible for:

a) all that concerns the authorization to operate, i.e. providing job—specific training (if necessary);

b) issuing the written authorization to operate;

c) maintaining documentary evidence confirming the continuous activity in the relevant sector without significant interruption, this action shall be done every 12 months;

d) ensuring that personnel hold valid certification relevant to their tasks within the organization;

e) maintaining appropriate records.

These responsibilities shall be described in a documented procedure.

4.5.4 A self-employed individual shall assume all responsibilities ascribed to the employer.

4.5.5 Certification to this document provides an attestation of general competence of the certified personnel. It does not represent an authorization to operate, since this remains the responsibility of the employer and the certified personnel may require additional specialized knowledge of parameters such as equipment, procedures, materials and products specific for the employer.

4.6 Applicant

An applicant shall:

a) provide documentary evidence of training in accordance with ISO 23684;

b) provide documentary evidence that the required experience has been gained;

c) provide other requisites requested by the certification body.

4.7 Certificate holders

Certificate holders shall:

a) abide by a code of conduct published by the certification body;

b) notify the certification body and the employer if the conditions of certification are not maintained in accordance with 18.11.2.

4.8 Examiners

4.8.1 Examiners shall:

— be authorized by the certification body to conduct, supervise and grade examinations;

— be qualified by the certification body in the product and/or industrial sector for which they are authorized.

The competence of the examiners shall be consistent with the topics covered.

The qualification criteria to establish the examiners' competence shall include, for example, (but not exhaustively):

— analysis of curriculum vitae (graduation, training process, scientific and technical publications, conference speeches on the subject, etc.);

— proven experience in professional and technical activities related to NGVs for at least five years.

4.8.2 An examiner shall not be permitted to examine any candidate:

— that they have trained for the examination for a period of two years from the date of the conclusion of the training in case of level 3 or higher certifications;

— who is working (permanently or temporarily) in the same facility as the examiner unless the certification body has established a documented confidentiality and impartiality management procedure for such a situation.

5 Figures and levels of qualification

5.1 Figures

The professional figures and the minimum qualification levels to which they are subjected to are indicated in ISO 23684.

5.2 Qualification levels

5.2.1 General

Level 1: The learning outcomes relevant to level 1 is basic general knowledge.

Level 2: The learning outcomes relevant to level 2 are: basic factual knowledge of a field of work or study.

For the provisions of this document the following requirements apply:

5.2.2 Level 1

An individual qualified to level 1 has demonstrated the competence to carry out activities according to written instructions and under the supervision of level 2 or level 3 or level 4 personnel. For example, within the scope of the competence defined on the certificate, level 1 personnel may be authorized by the employer to perform the following in accordance with instructions:

a) set up equipment;

b) perform the tests;

c) record and classify the results of the tests according to written criteria;

d) report the results.

Level 1 qualified personnel shall neither be responsible for the choice of test method or technique to be used for the conformity assessment, nor for the interpretation of test results.

5.2.3 Level 2

An individual qualified to level 2 has demonstrated competence to perform activity on NGVs according to given procedures. For example, within the scope of the competence defined on the qualification certificate, level 2 personnel are authorized by the employer to:

a) translate codes, standards, specifications and procedures into instructions adapted to the actual working conditions;

b) set up and verify equipment settings;

c) perform and supervise tests;

d) interpret and evaluate results according to applicable standards, codes, specifications or procedures;

e) carry out and supervise all tasks at or below level 2;

f) provide guidance for personnel at or below level 2;

g) report the results of conformity assessment activity.

5.3 Certifications levels

5.3.1 General

Level 3: The learning outcomes relevant to level 3 are: knowledge of facts, principles, processes and general concepts, in a field of work or study.

Level 4: The learning outcomes relevant to level 4 are: factual and theoretical knowledge in broad contexts within a field of work or study.

5.3.2 Level 3

An individual certified to level 3 has demonstrated competence to perform and direct operations on NGVs for which he/she is certified. These personnel have demonstrated:

a) skills and knowledge to interpret codes, standards, and other contractual documents that control the NGVs operation method(s) as used by the employer;

b) the competence to evaluate and interpret results in terms of existing standards, codes, and specifications;

c) sufficient practical knowledge of applicable materials, fabrication, process, system installation and repair and product technology to select conformity assessment methods, establish conformity assessment techniques, and assist in establishing acceptance criteria where none are otherwise available;

d) a general familiarity with system installation and repair, vehicle maintenance and conformity assessment methods.

Within the scope of the competence defined on the certificate, level 3 or level 4 personnel is authorized to:

1) assume full responsibility for NGV operational facility and staff;

2) prepare and verify the adequacy of procedures and work instructions;

3) establish, review for editorial and technical correctness, and validate instructions and procedures;

4) designate the particular test methods, procedures, and instructions to be used;

5) carry out and supervise all tasks at all levels;

6) provide guidance for personnel below level 3.

5.3.3 Level 4

An individual certified to level 4 has demonstrated competence to perform and direct operations on NGVs for which he/she is certified. These personnel have demonstrated:

a) skills and knowledge to interpret codes, standards and other contractual documents that control the NGVs operation method(s) as used by the employer;

b) the competence to evaluate and interpret results in terms of existing standards, codes and specifications;

c) sufficient practical knowledge of applicable materials, fabrication, process, system installation and repair and product technology to select conformity assessment methods, establish conformity assessment techniques, and assist in establishing acceptance criteria where none are otherwise available;

d) a general familiarity with system installation and repair, vehicle maintenance and conformity assessment methods;

e) a general knowledge of other operative methods and product manufacturing and inspection technologies used by the employer.

Within the scope of the competence defined on the certificate level 4 personnel is authorized to:

1) assume full responsibility for NGV operational facility and staff;

2) prepare and verify the adequacy of procedures and work instructions;

3) establish, review for editorial and technical correctness, and validate instructions and procedures;

4) designate the particular test methods, procedures, and instructions to be used;

5) carry out and supervise all tasks at all levels;

6) provide guidance for personnel below level 4;

7) when required by the written practice, audit outsourced product and service providing companies to ensure the requirements of the written practice are met;

8) take responsibility for completion of tasks in work or study and adapt own behaviour to circumstances in solving problems;

9) exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change. Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.

6 Eligibility

The candidate shall fulfil the minimum requirements of training prior to the examination and shall fulfil the minimum requirements for experience as per ISO 23684.

7 Training

7.1 General

All courses shall be recognized by a certification body in accordance with requirements of ISO 23684.

The definition of minimum level of competence required to NGV technician trough a theoretical and practical training shall comply with ISO 23684.

7.2 Training course recognition

The training courses shall be recognised in accordance with ISO 23684:2023, 6.2.1.

7.3 Validity of training course

The training for initial certification shall remain valid for a maximum period of ten years from the date of completion.

7.4 Evidence of training

The candidate shall provide documentary evidence, acceptable to the certification body, that he/she has satisfactorily completed training in accordance with ISO 23684 as well level for which the certification is sought.

7.5 Training formats

For all levels, theoretical training may be delivered in a face-to-face instructor-led format, distance learning format, or a combination of these formats. Practical training shall be delivered by a face-to-face instructor-led format only in compliance with ISO 23684:2023, 6.3.3.

7.6 Minimum duration of training

In order to provide adequate skill and competence to the technicians involved in operation on NGVs, an adequate training programme shall be established in terms of contents and duration. The minimum duration of training undertaken by the candidate to achieve the skills and knowledge for certification shall comply with the requirements given by ISO 23684.

8 Competence assessment and qualification achievement

Examinations to verify the technical qualifications of recognised training course attendees are conducted by the training course provider on the basis of the same scheme applied by the certification body (see Clauses 11 and 12) and shall consist of a specific theoretical and practical examination as applicable for each figure, with reference to ISO 23684 requirements.

In case of a successful final examination by the course attendee, the training course provider will provide a written qualification statement.

Attendees who do not reach the required mark in the formal examination shall be allowed to take a re-sit examination paper, after proper application, without the need to attending a full course, provided that the re-sit is attempted within 12 months of the initial course. Failure of a re-sit examination shall result in a candidate having to attend a complete course if wishing to continue with the pursuit of training.

9 Prerequisite for certification

9.1 Attendance to a training course

Candidates for certification to all levels shall satisfactorily complete a course of theoretical and practical training (with the exception given in 9.1.1) recognized by the certification body, to achieve knowledge and skills as defined in ISO 23684 and shall complete the minimum training hours programme as well.

9.1.1 Exception

Exception to the obligation to attend a training course is given to the technicians and responsible who can demonstrate the requisites stated by ISO 23684:2023, 6.2.

In this case they can move directly to competence assessment as indicated in Clause 11 or Clause 12. If they fail the competence assessment, then they shall undergo training as per ISO 23684, at least for the part in which they failed, before a second competence assessment.

9.2 Written qualification statement

For candidates wishing to receive a level 3 or level 4 certification, the written qualification statement provided by the training course provider after having successful passed the recognized training course final examination constitutes a prerequisite for admission to the certification examination.

10 Examination content and grading

10.1 General

The certification body shall apply ISO/IEC 17024:2012, 9.3.

All candidates for certification shall have successfully completed the qualification process as per Clause 9.

The certification body shall increase the number of tests and/or test questions in line with the evolving technology.

The design of examination requirements shall ensure the comparability of results of each single examination, both in content and difficulty, including the validity of the pass/fail decision as per the applicable parts of Clauses 11 and 12.

10.2 Basic examination element

The written examination shall assess the candidate's knowledge of the basic subjects using examination questions shall be selected in an unpredictable way from the certification body's or authorized qualification body's collection of basic examination element questions valid at the date of examination.

10.3 Examination requirements

In order to find common criteria for personnel qualification and to ascertain that all requisites of ISO 23684 concerning the knowledge, skill and ability of technicians are met for each level of liability, the certification exam shall consist of at least two written tests and one practical test with different weight in determination of the final result. The goal of the examination is to provide evidence that the basic concepts as stated by ISO 23684 are detained by the technician as well as the faculty to make decisions and to conduct all practical operations to minimize the risks that are concerned with his/her activity.

The three major aspects of competence required of technicians (i.e. theoretical, operational and practical) shall be taken into account during examination and the right weight shall be given to each to balance their importance in determining the competence. To standardize the evaluation of knowledge, skills and abilities, as comprehensively and objectively as possible, and to limit any possible discretion at any level, it is necessary to provide at least the methods outlined in 10.3.1 and 10.3.2.

10.3.1 Written theoretical examination

10.3.1.1 Written tests are aimed at verifying the candidates' skill and knowledge comply with ISO 23684 requirements.

10.3.1.2 The written examination consists of two tests (theoretical and operational cases) during which the candidate shall answer the number of multiple-choice examination questions applicable to the level of qualification as shown in Tables 4 to 6.

10.3.1.3 All selected questions shall by chosen by weighted subject matter by the certification body in a data base containing at least five times the number of questions (see 10.1).

10.3.1.4 Questions in the data base shall be periodically revised (at least once in the year) and renewed accordingly with revision of mandatory and voluntary applicable standards and ISO 23684 as well.

10.3.1.5 Examination questions shall be approved and validated by the certification body and the grading shall be done in accordance with procedures approved by the certification body.

10.3.1.6 When conventional pre-prepared paper-based examinations are used, an examiner shall be responsible for the grading of the examinations by comparing the replies given by the candidate against answer keys approved by the certification body.

10.3.2 Practical examination

10.3.2.1 General

The practical examination shall be conducted in operational situations carried out in an equipped environment. It consists practical interventions, chosen for the candidate, from time to time by the examination commission.

All questions on operational cases shall by chosen by the examination commission from a data base, made available by the certification body, covering all technical operations on NGVs that are concerned with vehicle safety.

10.3.2.2 The data base shall contain at least three times the number of questions available for practical examination.

10.3.2.3 Questions in the data base shall be periodically revised (at least once in the year) and renewed accordingly with revision of mandatory and voluntary applicable standards (see ISO 23684).

11 Examination content and grading for level 3

11.1 Topics for fuelling station technical manager certification

11.1.1 First test (theoretical): skill and knowledge

The candidate shall answer as a minimum 25 multiple choice questions (as shown in Table 1) randomly chosen by the CB among a number of cases available in the CB data base, concerning the following four theoretical modules identified in ISO 23684 namely:

— equipment of CNG, LNG and L-CNG fuelling stations;

— NG as automotive fuels;

— applicable national and international regulations and standards for the use of NG as a fuel;

— workplace safety.

Table 1 — First test – theoretical – skill and knowledge

Part	Subject	Numbers of questions	Marks scored for each correct answer	Max. marks
1	Equipment of CNG, LNG and L-CNG fuelling stations	25	1	25
2	CNG/LNG in automotive	25	1	25
3	CNG/LNG regulations	25	1	25
4	Safety in working areas	25	1	25

11.1.1.1 Details on first test

It is assumed that 40 min is a suitable time for the completion of the test.

The result of this part of test contributes for 40 % to exam outcome.

11.1.2 Second test (theoretical): Operational cases

This test is aimed to ascertain the personal attitude to problem solving. The test consists in finding solutions to some operational cases that can occur during daily activity in the fuelling stations. For this purpose, the candidate is requested to find the only four applicable right solutions, among a set of 10, given for each of a minimum of five case studies (as shown in Table 2) random chosen by the CB among a number of cases available in the CB data base concerned with safety of NGVs fuelling system in compliance with ISO 23684.

Table 2 — Second test – theoretical – operational cases

Part	Subject	Numbers of applicable answers	Marks scored for each correct answer	Max. marks
1	Safety in the fuelling station	10 (only 4 correct)	5	20
2	Customer relationship and satisfaction	10 (only 4 correct)	5	20
3	Safety of persons and vehicles during fuelling	10 (only 4 correct)	5	20
4	Risks management	10 (only 4 correct)	5	20
5	Application of emergency procedures	10 (only 4 correct)	5	20

11.1.2.1 Details on second test

It is assumed that 30 min is a suitable time for the completion of the test.

The result of this part of test contributes for 20 % to exam outcome.

11.1.3 Third test (practical): operations on fuelling system

The interventions shall cover activities on maintenance, diagnosis, emergency procedures, hazard management, testing and inspection, control and malfunctioning reactivation.

The questions chosen for the candidate at the time of examination by the examination commission shall cover the 10 parts of the aspects concerned with safety of NGVs fuelling system (shown in Table 3) in compliance with ISO 23684.

Table 3 — Third test – practical – operations on vehicles

Part	Subject	Marks scored for each correct action	Max. marks
1	Operations on fuelling systems	10	10
2	Maintenance and repair of system	10	10
3	Controls on fuelling system parts	10	10
4	Use of fixed/portable instrumentation for gas leak detection and minimization	10	10
5	Use of equipment and tools for testing	10	10
6	Identification of malfunctions of individual components of the whole system	10	10
7	Identification and minimization of hazards	10	10

Table 3 *(continued)*

Part	Subject	Marks scored for each correct action	Max. marks
8	Procedures for safe refuelling	10	10
9	Solution to restore compliance of the fuelling system	10	10
10	Knowledge and application of safety procedures	10	10

11.1.3.1 Details on third test

It is assumed that 60 min is a suitable time for the completion of the test.

The result of this part of test contributes for 40 % to exam outcome.

12 Examination content and grading for level 4

12.1 Topics for NGV technical manager certification

12.1.1 First test (theoretical): skill and knowledge

The candidate shall answer as a minimum 20 multiple choice questions (as shown in Table 4) randomly chosen by the CB among a number of cases available in the CB data base, concerning the following five theoretical modules whose contents are identified in ISO 23684:2023, 6.4.2 namely:

— internal combustion engines for automotive;

— NG as automotive fuels;

— applicable national and international regulations and standards for the use of NG as a fuel;

— workplace safety;

— applicable requisites of a quality management system based on ISO 9001.

Table 4 — First test – theoretical – skill and knowledge

Part	Subject	Numbers of questions	Marks scored for each correct answer	Max. marks
1	Vehicles engines and fuels	20	1	20
2	CNG/LNG in automotive	20	1	20
3	CNG/LNG regulations	20	1	20
4	Safety in working areas	20	1	20
5	Quality management	20	1	20

12.1.1.1 Details on first test:

It is assumed that 40 min is a suitable time for the completion of the test.

The result of this part of test contributes for 40 % to exam outcome.

12.1.2 Second test (theoretical): Operational cases

This test is aimed to ascertain the personal attitude to problem solving. The test consists in finding solutions to some operational cases that can occur during daily activity in a workshop. For this purpose, the candidate is requested to find the only four applicable right solutions, among a set of 10 (as shown in Table 5), given for

each of a minimum of five case studies randomly chosen by the CB among a number of cases available in the CB data base.

Table 5 — Second test – theoretical – operational cases

Part	Subject	Numbers of applicable answers	Marks scored for each correct answer	Max. marks
1	Safety in the working places	10 (only 4 correct)	5	20
2	Customer relationship and satisfaction	10 (only 4 correct)	5	20
3	Safety of vehicles	10 (only 4 correct)	5	20
4	Liability of technical manager	10 (only 4 correct)	5	20
5	Vehicle conformity assessment	10 (only 4 correct)	5	20

12.1.2.1 Details on second test

It is assumed that 30 min is a suitable time for the completion of the test.

The result of this part of test contributes for 20 % to exam outcome.

12.1.3 Third test (practical): operations on fuel system

The interventions shall cover activities of repair or installation/replacement of system parts or maintenance, activities of diagnosis, control and malfunctioning reactivation.

The questions chosen for the candidate at the time of examination by the examination commission shall cover the 10 parts of the aspects concerned with safety of NGVs system (shown in Table 6) in compliance with ISO 23684.

Table 6 — Third test – practical – operations on vehicles

Part	Subject	Marks scored for each correct action	Max. marks
1	Operations on retrofit systems	10	10
2	Maintenance and repair of system	10	10
3	Correct assembling of system parts	10	10
4	Use of fixed/portable instrumentation for gas leak detection	10	10
5	Use of diagnostic equipment for malfunctioning detection	10	10
6	Identification of malfunctions of individual components of the whole system	10	10
7	Treatment of on-board vehicle diagnosis equipment (OBD) information and visual inspection of CNG cylinders	10	10
8	Use of fixed/portable instrumentation for gas leak detection	10	10
9	Solution to restore compliance of the system, also through the use of diagnostic equipment and after cylinder inspection.	10	10
10	Knowledge and application of safety procedures	10	10

12.1.3.1 Details on third test

It is assumed that 90 min is a suitable time for the completion of the test.

The result of this part of test contributes for 40 % to exam outcome.

13 Assessment method for certification

Candidates shall be graded according to their examination marks as shown in Table 7.

To pass the exam, the candidate shall, therefore, obtain at least:

— 60 % total marks in each test,

— 60 % marks as total exam outcome.

Table 7 — Assessment method

Test	Subject	Maximum marks scored	Minimum score to pass the single test	Percentile weighting for examination elements	Maximum score to the exam out-come	Minimum score to the exam outcome
1 (theoretical)	Skill and Knowledge	100	60	40 %	40	24
2 (theoretical)	Operational cases	100	60	20 %	20	12
3 (practical)	operations on vehicles	100	60	40 %	40	24

14 Examination content and grading for recertification for level 3 and level 4

14.1 General

The recertification exam shall cover only the theoretical parts and:

— it shall be conducted on the same subjects of certification exams;

— the number of questions of the first test can be reduced but shall be a minimum of 50 % of that of the certification examination;

— the number of questions of the second is reduced to three operational cases;

— the suitable time for the completion of test shall be reduced accordingly with the number of questions.

14.2 Recertification for level 3

The exam for recertification for level 3 shall follow the criteria outlined in 11.1.1 and 11.1.2.

14.3 Recertification for level 4

The exam for recertification for level 4 shall follow the criteria outlined in 12.1.1 and 12.1.2.

15 Assessment method for recertification

Candidates shall be graded according to their examination marks as shown in Table 8.

To pass the exam, as shown in Table 8, the candidate shall, therefore, obtain at least:

— 60 % total marks in each test,

— 60 % marks as total exam outcome.