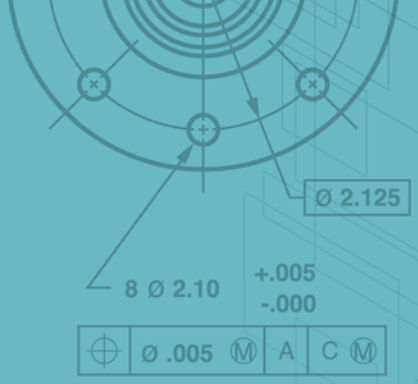
GO.ASME.ORG/GDTP



ASME Y14.5M-1994 Geometric Dimensioning and Tolerancing Professional™ Certification

Applicant Information Handbook

The American Society of Mechanical Engineers®
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SETTING THE STANDARD

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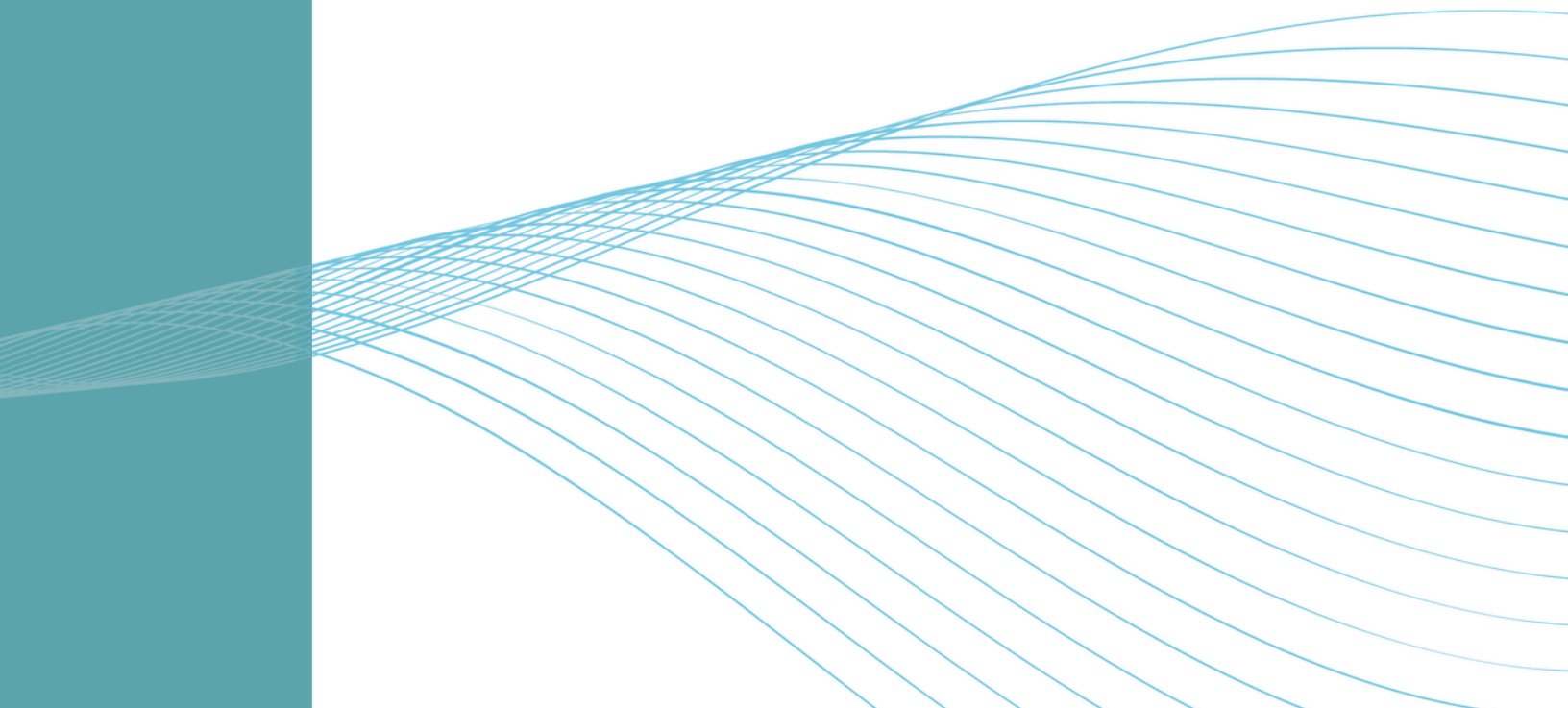

GDTP™ CERTIFICATION OVERVIEW

This handbook defines the requirements and qualifications for GDTP certification. These requirements recognize the knowledge, training, and experience necessary to understand, apply, and teach the principles defined in ASME Y14.5M-1994.

The American Society of Mechanical Engineers (ASME) established the Y14.5.2 Subcommittee on Certification in October 1988 to address the need for standardized qualifications for professionals who use the ASME Y14.5 Standard. The Subcommittee was tasked with developing a standard to serve as the foundation for an ASME certification program in Geometric Dimensioning and Tolerancing (GD&T).

The GDTP certification program provides a means to evaluate proficiency in the understanding and application of geometric dimensioning and tolerancing principles as defined in ASME Y14.5M-1994. These principles form a fundamental element of the engineering language used to communicate design intent.

The program offers two levels of certification. The first level, Technologist, measures an individual's ability to read, interpret, and understand engineering drawings prepared using the language of geometric dimensioning and tolerancing as defined in the ASME Y14.5M Standard. Technologist certification is intended for individuals whose responsibilities involve interpreting dimensioning and tolerancing requirements.

The second level, Senior, measures an individual's ability to select, apply, and generate appropriate geometric controls on engineering drawings. Senior certification is intended for individuals responsible for the development and application of dimensioning and tolerancing requirements and reflects a deeper level of technical knowledge and practical application.

GDTP CERTIFICATION

WHAT IS ASME GDTP?

GDTP CERTIFICATION – OVERVIEW

The GDTP Certification Program recognizes professional proficiency in the understanding and application of geometric dimensioning and tolerancing principles as defined in the ASME Y14.5M Dimensioning and Tolerancing Standard.

The program offers two levels of certification: Technologist GDTP and Senior GDTP, which assess an individual's ability to interpret, apply, and generate dimensioning and tolerancing requirements in accordance with the ASME Y14.5M Standard.

Individuals holding GDTP certification may be employed in a wide range of engineering and technical roles, including but not limited to design engineer; manufacturing or production engineer; process engineer; quality engineer; tool or gage engineer; engineering manager; CAD, CAM, or CAE software user, programmer, or developer; drafter or checker; engineering consultant; educator; inspector; contract engineer; project engineer; and technical specialist.

Certification is based on the principles, practices, and applicable appendices of the ASME Y14.5M-1994 edition of the Dimensioning and Tolerancing Standard, as specified in this handbook. A GDTP certificate is issued to applicants who meet the qualifications described herein and is valid for a period of three years from the date of issuance.

Why Obtain ASME GDTP Certification?

GDTP CERTIFICATION – BENEFITS

Corporate and Engineering Management

1. Verify the GD&T competency of your design, manufacturing, and inspection personnel.

2. Promote consistent interpretation of engineering drawings and documentation across the organization.

3. Improve technical communication among internal teams, suppliers, and customers.

4. Reduce manufacturing and inspection costs through proper application of tolerancing practices.

Engineering and Technical Professionals in Design, Drafting, Inspection, Quality, and CAD/CAM

1. The certification provides an industry-recognized way to demonstrate required GD&T knowledge.

2. Enhance your credentials and increase professional recognition among your peers.

3. Confirm your knowledge to work more confidently in advisory and cross-functional roles.

4. Demonstrate your readiness for increased responsibility and career advancement.

CERTIFICATION LEVELS

TECHNOLOGIST LEVEL

Technologist GDTP certification indicates that an individual has demonstrated the knowledge and skills required to understand and interpret engineering drawings that apply Geometric Dimensioning and Tolerancing (GD&T) in accordance with the ASME Y14.5M Standard. This includes demonstrated proficiency in recognizing GD&T symbols and modifiers, understanding their relationships, and applying GD&T principles for accurate interpretation of technical documentation.

SENIOR LEVEL

Senior GDTP certification indicates that an individual has demonstrated advanced competence in the application of Geometric Dimensioning and Tolerancing (GD&T) in accordance with the ASME Y14.5M Standard. This includes the ability to select and apply appropriate GD&T symbols, modifiers, and datum reference frames to document product design intent; perform GD&T-related calculations to determine geometric requirements; and apply GD&T principles in support of manufacturing, quality control, verification, and functional gaging activities associated with engineering drawings and related documentation.

CERTIFICATION PROCESS

How to Apply

1. Submit Payment

The payment for the examination must be submitted prior to submitting an application. Payment by credit card may be submitted on ASME.org or via phone. Please follow the instructions below to pay by phone.

ASME Customer Care, 8:30 a.m.-5:00 p.m. EDT: 1.800.843.2763 (U.S./Canada) 1.646.616.3100 (outside U.S./Canada)

Please be prepared to provide the following information:

- Contact information including: name, title, organization, mailing address, email address, and phone number
- Preferred GDTP certification level (Technologist or Senior) and applicable ASME Y14.5M 1994 edition
- Credit card information

You will receive a payment confirmation email shortly after submitting the fee. **If you are not paying by credit card, please click here for more payment options.**

2. Submit Application

After completing a GDTP purchase, applicants:

- Will receive an email confirmation within 24 hours containing instructions for accessing ASME-PC Connect, ASME's online system for submitting applications
- Should refer to the ASME-PC Connect GDTP User's Guide for detailed instructions on completing and submitting an online application

Applicants **must complete and submit their application within one year of purchase**. Failure to submit an application within this time period will result in forfeiture of eligibility, although a partial refund may be granted upon request.

All information supplied on this application is subject to verification. Certification may be revoked by ASME for reasons of falsifying or providing inaccurate information during the certification process.

3. Schedule Exam

Once an application has been accepted, candidates:

- Will receive an email with instructions for scheduling the examination at a Prometric Testing Center
- **Must schedule the examination within 180 days** of acceptance
- Forfeit all fees if an examination appointment is not scheduled within the eligibility period
- May request a one-time 180-day extension prior to the expiration of the original eligibility period, subject to payment of the applicable fee
- Will be subject to a reinstatement fee if Prometric cancellation or rescheduling policies are not followed, resulting in a new eligibility period beginning on the date the fee is processed

Exam Results

Notification of results:

- Will include the percentage of correct answers within each part
- Will be mailed to the applicant within 24-48 hours after the exam
- Grades will **not** be given over the phone

NOTE: Candidates may attempt the exam up to two times within a six-month period. After a second unsuccessful attempt, candidates must wait 180 days before they are eligible to retake the exam. A retake fee applies once the waiting period has passed.

Exam Feedback and Inquiries

Send to: GDTP@asme.org

Do send:

- General feedback about your testing experience (process, scheduling, technical or administrative issues), without including any exam content.
- If you do not pass and would like your results reviewed: make your intentions known in writing, to be received within 30 days of the date of the notification letter, and include the technical reason(s) upon which the review is based. Submit your request to GDTP@asme.org.

Don't send

- Any exam content, including remembered questions, answer options, drawings, exhibits, symbols, or reconstructed item details.
- Requests to review, explain, confirm, or debate specific items or scoring outside the formal reconsideration process.
- Personal or proprietary materials as evidence, such as employer drawings, screenshots, or confidential work products.

CERTIFICATION POLICIES

Certification

Applicants who pass the GDTP examination will:

- Be issued a GDTP certificate
- Receive a certificate that identifies the specific revision of the ASME Y14.5M Standard on which the certification is based
- Receive a certificate that identifies the level of certification achieved
- Receive a certificate that expires three years from the date of issuance
- Be listed as a certificate holder on the ASME-PC Connect website

Please note:
Successfully passing the ASME Y14.5M-1994 examination confers certification only to the ASME Y14.5-1994 Standard and does not confer certification to any earlier standard (e.g., ASME Y14.5-2009 or Y14.5-2018)

Maintenance of Certification

Certification may be attained without examination for applicants who:

- Provide a detailed description of relevant professional experience with GD&T over a period of 24 months

ASME will notify certificate holders at least six months prior to the expiration date listed on their certificate. To maintain certification, certificate holders must:

- Log in to ASME-PC Connect
- Pay the applicable recertification fee
- Document and submit their GD&T experience for verification

Accomodations

ASME is committed to compliance with Title III of the Americans with Disabilities Act (ADA), as amended. In support of this policy:

- ASME offers examinations in locations and formats that are accessible to individuals with qualifying disabilities, or provides alternative accessible arrangements where feasible
- ASME may provide auxiliary aids and services and/or make reasonable modifications to examination procedures for candidates who timely request testing accommodations due to a qualifying disability
- All requested accommodations must not fundamentally alter the skills or knowledge being assessed, must not be unduly burdensome, and must not compromise the integrity or security of the examination

Accomodations Continued

- All accommodation requests must be submitted in advance of the examination date and include supporting documentation sufficient for ASME to determine eligibility under its Policy Manual
- Accommodation requests are evaluated on a case-by-case basis

Confidentiality

ASME is committed to protecting confidential and proprietary information related to its certification activities. This confidentiality policy includes the following provisions:

- Confidential and proprietary information includes information related to applicants, candidates, certificate holders, and the examination development, maintenance, and administration process
- The confidentiality policy applies to all ASME staff, Management Committee members, committee members, consultants, psychometric consultants, and any other individuals authorized to access confidential information
- Candidate information and examination results are released only to the candidate, unless a written authorization is provided by the candidate or disclosure is required by law

ASME considers certification status to be public information. Accordingly:

- ASME will confirm an individual's certification status upon request
- Certification verification is available via the internet
- Published verification information includes the individual's name, current certification status, credential(s) held, and the city and state of residence

CERTIFICATION POLICIES

Errors or Distruptions in Exam Administration

Candidates who believe that testing conditions or other examination issues adversely affected their ability to take or complete an examination must report the issue promptly. The following provisions apply:

- Candidates should notify test center personnel at the time of the examination or contact ASME as soon as possible after the examination
- Examples of qualifying issues may include, but are not limited to, power failures, hardware or software malfunctions, or weather-related disruptions affecting the examination process

If ASME determines, in its sole discretion, that an issue compromised the integrity of the examination results:

- ASME will provide the candidate with an opportunity for reexamination
- Reexamination shall be the sole remedy available to the candidate
- Requests to cancel examination results after results have been released will not be considered

ASME shall not be liable for inconvenience, expense, or other damages arising from examination administration issues, including delays in score reporting or the need for retesting. In no circumstance will ASME reduce or alter its certification standards as a means of addressing examination administration problems.

Code of Ethics

All individuals involved in the certification process and all Certificate Holders are required to adhere to established ethical and professional standards. These requirements include the following:

- Individuals involved in the development, administration, and oversight of the certification program, including examination developers and program staff, adhere to the ASME Code of Ethics of Engineers and the ASME Conflict of Interest Policy
- Candidates and Certificate Holders are expected to conduct themselves ethically throughout the certification process and for the duration of time they remain certified
- Candidates and Certificate Holders agree that their professional qualifications and fitness for ASME certification—including professionalism, ethics, integrity, and competence in engineering skills—may be evaluated by ASME, and that ASME's good-faith judgment in such matters shall be final
- Candidates and Certificate Holders are responsible for providing accurate information during application and renewal processes and for complying with all ASME policies throughout the certification period
- Failure by a Candidate or Certificate Holder to comply with the ASME Code of Ethics of Engineers or the ASME Conflict of Interest Policy, as determined by ASME in its sole discretion, may result in invalidation of examination results, suspension or revocation of certification, or exclusion from future examination

All ASME examination materials are strictly confidential and protected under federal copyright law. Accordingly:

- Examination materials include, but are not limited to, examination questions, answers, and candidate performance data
- All ASME examinations are protected by the federal Copyright Act, 17 U.S.C. § 101 et seq.
- Access to ASME examinations is conditioned upon a candidate's agreement to comply with ASME examination policies

Candidates who take ASME examinations have a continuing obligation to maintain examination confidentiality. Candidates agree that they will:

- Not copy, reproduce, adapt, disclose, or transmit examination content, in whole or in part, before or after taking an examination, by any means now known or hereafter invented
- Not reconstruct examination content from memory or by any other means
- Not discuss examination or assessment content with others

Candidates acknowledge that disclosure or misuse of examination content constitutes a violation of ASME policies and may result in disciplinary sanctions, including but not limited to invalidation of examination results, exclusion from future examinations, suspension or revocation of certification, and other appropriate sanctions.

To protect the integrity of the certification process:

- Test administrators are required to report any observed irregular or improper behavior by a candidate during an examination to ASME
- Irregular or improper behavior identified during an examination, through data forensics or statistical analysis, or by other means constitutes a violation of the certification process
- Such violations may result in invalidation of examination results and disciplinary sanctions, including withholding or revocation of certification or eligibility to participate in the certification program
- ASME investigates all reports of irregular or improper activity
- Failure to fully cooperate with an ASME investigation is considered unprofessional conduct and constitutes grounds for disciplinary action

TEST REQUIREMENTS

Y14.5M-1994 TECHNOLOGIST EXAMINATION

Y14.5M-1994 TECHNOLOGIST LEVEL EXAMINATION

This certification indicates that the individual has demonstrated proficiency in reading and interpreting an engineering drawing that conforms to ASME Y14.5M-1994.

The ASME Y14.5M-1994 Technologist Level examination consists of:

- 150 scored multiple-choice questions
- Maximum duration of 6 hours
- Is closed book
- Evaluates the applicant's knowledge of GD&T principles and practices in accordance with the ASME Y14.5M-1994Standard.

The topics covered on the examination, the approximate distribution of questions by topic, and the minimum passing requirements are described below:

- Candidates **must achieve an overall score of at least 75%**
- A **minimum score of 50% in each section below**.

In order to be certified as a Technologist GDTP, applicants must successfully pass the Technologist GDTP Examination

ASME Y14.5M-1994 Technologist Examination by Sections:

(a) 10% on Scope, Definitions, and General Dimensioning
(b) 10% on General Tolerancing and Related Principles.; Knowledge of former practices included in Appendix D of Y14.5M-1994
(c) 5% on Symbology
(d) 15% on Datum Referencing
(e) 30% on Tolerances of Location
(f) 30% on Tolerances of Form, Profile, Orientation, and Runout

BODY OF KNOWLEDGE

Y14.5M-1994 TECHNOLOGIST EXAMINATION

This body of knowledge forms the basis of the ASME Y14.5M-1994 Technologist Level certification examination.

Domain 1: SCOPE, DEFINITIONS, AND GENERAL DIMENSIONING
Knowledge/skill in:

(a) General
1. what ASME Y14.5M-1994 covers
2. reference to this Standard
3. reference to gaging

(b) Definitions
1. datum
2. datum feature
3. datum target
4. dimension
5. basic dimension
6. reference dimension
7. feature
8. feature of size
9. full indicator movement (FIM)
10. least material condition (LMC)
11. maximum material condition (MMC)
12. regardless of feature size (RFS)
13. actual size
14. limits of size
15. tolerance
16. bilateral tolerance
17. geometric tolerance
18. unilateral tolerance
19. true position
20. virtual condition

(c) Fundamental rules
1. dimensioning
2. implied 90-deg angle
3. basic 90-deg angle

(d) Units of measurement
1. identification of linear units
2. angular units

(e) Types of dimensioning
1. millimeter dimensioning
2. decimal-inch dimensioning

(f) Application of dimensions
1. dimension lines
2. extension (projection) lines
3. limited length or area indication
4. leaders (leader lines)
5. reading direction
6. reference dimensions
7. overall dimensions
8. dimensioning within the outline of a view

(g) Dimensioning features
1. diameters
2. radii
3. chords, arcs, and angles
4. rounded ends
5. rounded corners
6. outlines consisting of arcs
7. irregular outlines
8. symmetrical outlines
9. round holes
10. slotted holes
11. counterbored holes
12. countersunk and counter-drilled holes
13. spotfaces
14. chamfers
15. keyseats
16. rods and tubing details

(h) Location of features
1. rectangular coordinate dimensioning
2. rectangular coordinate dimensioning without dimension lines
3. tabular dimensioning
4. polar coordinate dimensioning
5. repetitive features or dimensions
6. use of “X” to indicate “BY” or “NUMBER OF PLACES”

Domain 2: GENERAL TOLERANCING AND RELATED PRINCIPLES, AND FORMER PRACTICES
Knowledge/skill in:

(a) Application of tolerances
1. directly applied tolerances
2. geometric tolerances
3. application by note
4. specified in reference documents
5. general tolerance block

(b) Tolerance expression
1. metric tolerances
2. inch tolerances
3. angle tolerances
4. interpretation of limits
5. plated and coated parts

(c) Single limits

BODY OF KNOWLEDGE

Y14.5M-1994 TECHNOLOGIST EXAMINATION

This body of knowledge forms the basis of the ASME Y14.5M-1994 Technologist Level certification examination.

(f) Tolerance accumulation
   1. chain dimension
   2. baseline dimensioning
   3. direct dimensioning
(g) Limits of size
   1. individual feature of size (Rule 1)
   2. exceptions to Rule 1
(h) Relationship between features
(i) Applicability of RFS, MMC, LMC
   1. effect of RFS
   2. effect of MMC
   3. effect of LMC
   4. effect of zero tolerance at MMC and LMC
(j) Geometric tolerance application to screw threads
   1. default feature
   2. specified feature
(k) Geometric tolerance application to gears and splines
(l) Virtual/resultant condition
   1. LMC
   2. MMC
(m) Datum features at virtual condition
(n) Angular surfaces
   1. parallel planes
   2. nonparallel planes
(o) Conical tapers
(p) Flat tapers
(q) Radii
   1. radius (R)
   2. controlled radius (CR)
(r) Statistical tolerancing identification
(s) Former practices (ASME Y14.5M-1994, Appendix D)
   1. general
   2. definition for feature of size
   3. applicability of RFS, MMC, and LMC
   4. tangent radii
   5. datum feature symbol
   6. projected tolerance zone

Domain 3: SYMBOLOGY
Knowledge/skill in:
(a) Geometric characteristic symbols
   1. straightness
   2. flatness
   3. circularity
   4. cylindricity
   5. profile of line
   6. profile of surface
   7. angularity
   8. perpendicularity
   9. parallelism
   10. position
   11. concentricity
   12. symmetry
   13. circular runout
   14. total runout
(b) Datum feature symbol
   1. datum identifying letters
   2. method of relating symbol frame to datum
   3. feature
(c) Datum target symbol
   1. indicating size of target area
   2. indicating targets on hidden side of view
(d) Basic dimension symbols
(e) Material condition symbols
   1. maximum material condition
   2. least material condition
   3. restrictions on use of symbols
(f) Projected tolerance zone symbol: use and restrictions
(g) Diameter and radius
(h) Reference symbol
(i) Arc length symbol
(j) Statistical tolerance symbol
(k) Between symbol
(l) Counterbore or spotface symbol
(m) Countersink symbol
(n) Depth symbol
(o) Square symbol
(p) Dimension origin symbol
(q) Taper and slope symbol
(r) All-around symbol
(s) Free state symbol
(t) Tangent plane symbol
(u) Geometric tolerance symbols
   1. Feature control frame
   2. Feature control frame incorporating one datum reference
   3. Composite feature control frame
   4. Two single-segment feature control frames
   5. Combined feature control frame and datum
   6. feature symbol
   7. Feature control frame with a projected tolerance zone
(v) Tolerance zone identification

BODY OF KNOWLEDGE

Y14.5M-1994 TECHNOLOGIST EXAMINATION

This body of knowledge forms the basis of the ASME Y14.5M-1994 Technologist Level certification examination.

Domain 4: DATUM REFERENCING
Knowledge/skill in:
(a) Definitions
1. datum simulator
2. datum reference frame

(b) Immobilization of part
1. purpose — measurable relationships
2. true geometric counterparts
3. application
4. datum reference frame

(c) Datum feature identification
(d) Datum feature controls
(e) Datum feature order of precedence
(f) Establishing datums from datum features
1. datum features not subject to size variations
2. datum features subject to size variations
3. multiple datum features
4. pattern of features
5. screw threads, gears, and splines
6. partial surface as datum features
7. mathematically defined surface
8. multiple datum reference frames
9. simultaneous versus separate requirements
10. simultaneous requirements and composite feature control

(g) Datum targets
1. purpose/applications
2. datum target symbol
3. datum target points
4. datum target lines
5. datum target areas
6. datum target dimensions
7. datum planes established by datum targets
8. methods of establishing a primary datum axis
9. equalizing datums
10. datums established from complex or irregular surfaces

Domain 5: TOLERANCES OF LOCATION
Knowledge/skill in:
(a) General
1. types of location tolerances
2. relationships controlled

(b) Position tolerancing
1. features applicable to
2. basic dimensions
3. use of feature control frame
4. application to baseline and chain dimensioning
5. effect of material condition
   (-a) RFS (implied)
   (-b) MMC
   (-c) LMC
6. zero positional tolerancing at MMC
7. multiple patterns of features located by basic
8. dimensions relative to common datums
9. simultaneous requirements — RFS
10. simultaneous requirements — MMC

(c) Feature pattern location
1. definitions
   (-a) feature — relating tolerance zone framework (FRTZF)
   (-b) pattern — locating tolerance zone framework (PLTZF)
1. composite positional tolerancing
2. projected tolerance zone
3. nonparallel holes
4. counterbored holes
5. closer control at one end of a feature

(d) Bidirectional positional tolerancing of features
(e) Noncircular features
(f) Coaxiality controls
1. definition
2. position tolerance control

(g) Concentricity
1. definition
2. differences between coaxiality controls and concentricity

(h) Positional tollerancing for systemmetrical relattionships
(i) Symmetry tolerancing
1. definition
2. material condition basis

(j) Spherical features

Domain 6: TOLERANCES OF FORM, PROFILE, ORIENTATION, AND RUNOUT
Knowledge/skill in:
(a) Form tolerance
1. straightness
2. flatness
3. circularity
4. cylindricity

(b) Orientation
1. angularity
2. parallelism
3. perpendicularity

(c) Profile
1. profile of a line
2. profile of a surface

(d) Runout
1. circular
2. total

TEST REQUIREMENTS

Y14.5M-1994 SENIOR EXAMINATION

Y14.5M-1994 SENIOR LEVEL EXAMINATION

Applicants for the Senior GDTP examination must demonstrate a **minimum of 3 years** of relevant GD&T professional experience. The description must include work personally performed by the applicant within the last 3 years and demonstrate independent application of GD&T principles. It is not required to be a certified GDTP Technologist to qualify for Senior Level certification. ASME membership is not an exam requirement.

The exam competencies include, but are not limited to, the following:

1. Understanding the meaning of the symbols, modifiers, and relationships of GD&T as applied to engineering drawings and related documentation that conform to ASME Y14.5M-1994
2. Making the proper selection, with consideration for the function and relationship of part features, of geometric controls to document the product design intent
3. Applying the appropriate geometric control
4. symbols, modifiers, and datum references to the engineering drawings and related documentation
5. Applying the principles of GD&T to the operations of manufacturing, quality control, and verification processes associated with engineering drawings and related documentation
6. Applying the principles of GD&T to the establishment of functional gaging activities

The ASME Y14.5M-1994 Senior Level examination consists of:

- 150 scored multiple-choice questions
- Maximum duration of 6 hours
- Is closed book
- Evaluates the applicant's knowledge of GD&T principles and practices in accordance with the ASME Y14.5-1994Standard.

In order to be certified as a Senior GDTP, applicants must successfully pass the Senior GDTP Examination.

The topics covered on the examination, the approximate distribution of questions by topic, and the minimum passing requirements are described below:

- candidates **must achieve an overall score of at least 80%**
- A **minimum score of 50% in each section below**.

ASME Y14.5M-1994 Senior Examination by Sections:

(a) 10% on topics from the Technologist's Level examination
(b) 20% on Datum Selection
(c) 40% on General Tolerancing and Related Principles, Tolerance
Calculation and Appendices
(d) 15% on Application of Modifiers in Feature Control Frames
(e) 15% on Composite Positional Tolerancing

BODY OF KNOWLEDGE

Y14.5M-1994 SENIOR EXAMINATION

This body of knowledge forms the basis of the ASME Y14.5M-2009 Senior Level certification examination.

Domain 1: TOPICS FROM TECHNOLOGIST LEVEL BODY OF KNOWLEDGE

Domain 2: DATUM SELECTION
Knowledge/skill in:

(a) Immobilization of part
1. purpose — measurable relationships
2. true geometric counterparts
   (-a) a plane
   (-b) maximum material conditions (MMC) boundary
   (-c) least material condition (LMC) boundary
   (-d) virtual condition boundary
   (-e) actual mating envelope
   (-f) mathematically defined contour

(b) Application
1. measurement origin
2. examples of simulated datums
3. surface extremities establish datums

c) Datum reference frame
1. purpose
   (-a) relate features
   (-b) restrict motion of part
2. multiple datum reference frames
   (-a) functional requirements
   (-b) requires different datum simulation methods

(d) Datum feature selection criteria

(e) Datum feature symbol placement

(f) Datum feature controls
1. to account for datum feature variations
2. datum targets used alternatively

(g) Selection of datum feature order of precedence
1. design requirements
2. functional requirements
3. process requirements
4. verification requirements/principles

(h) Establishing datums from datum features
1. datum features not subject to size variations
   (-a) unstable
   (-b) restrained
2. datum features subject to size variations
   (-a) diameters and widths
   (-b) datum features regardless of feature size (RFS)
      (-1) primary datum feature — diameters or width RFS
      (-2) secondary datum feature — diameter or width RFS
      (-3) tertiary datum feature — diameter or width RFS
   (-c) datum features at MMC
      (-1) size of a primary or single datum feature
      (-2) size of a secondary or tertiary datum feature
   (-d) datum features at LMC
   (-e) effects of datum precedence and material condition
      (-1) cylindrical feature at RFS primary
      (-2) cylindrical feature at MMC secondary
3. multiple datum features
   (-a) simulation of a single datum plane (coplanar)
   (-b) single axis of two coaxial features
1. pattern of features
2. screw threads, gears, and splines
3. partial surface as datum features
4. mathematically defined surface
5. multiple datum reference frames
6. simultaneous versus separate requirements
7. simultaneous requirements and composite feature control

(i) Datum targets
1. purpose/applications
2. datum target area dimensions
3. datum planes established by datum targets
   (-a) primary, secondary, and tertiary datums
   (-b) stepped surfaces
4. methods of establishing a primary datum axis
5. secondary datum axis
6. equalizing datums
7. datums established from complex or irregular surfaces

BODY OF KNOWLEDGE Y14.5M-1994 SENIOR EXAMINATION

This body of knowledge forms the basis of the ASME Y14.5M-2009 Senior Level certification examination.

Domain 3: GEOMETRIC TOLERANCING AND RELATED PRINCIPLES; TOLERANCE CALCULATION AND APPENDICES
Knowledge/skill in:

(a) General need for expressing tolerances
(b) Application
  1. means of expressing tolerances
  2. controlling features of size
  3. controlling other features
(c) Direct tolerancing methods
  1. general
    (-a) limit dimensioning
    (-b) plus-and-minus tolerancing
  2. metric limits and fits
  3. limits and tolerance symbols
  4. tolerance symbols and limits
  5. millimeter tolerancing
    (-a) unilateral tolerancing
    (-b) bilateral tolerancing
    (-c) limit dimensioning
    (-d) with basic dimensions
  6. inch tolerances
    (-a) unilateral tolerancing
    (-b) bilateral tolerancing
    (-c) limit dimensioning
    (-d) with basic dimensions
  7. angle tolerances
  8. plated or coated parts
  9. single limits
  10. tolerance accumulation
    (-a) chain dimensioning
    (-b) baseline dimensioning
    (-c) direct dimensioning
  11. dimensional limits related to an origin
(d) Limits of size
  1. individual feature of size (Rule 1)
    (-a) when form control does not apply
    (-b) indicating that perfect form at MMC not required
  2. relationship between individual features
    (-a) no relationship unless otherwise specified
    (-b) zero tolerance of orientation
    (-c) zero tolerance of position
    (-d) control with general note
    (-e) relate dimensions to a datum reference frame-work with a general note
(e) Applicability of RFS, MMC, and LMC
  1. appropriate applications
  2. all applicable geometric tolerances (Rule 2)
  3. alternate practice for position control
  4. effect of RFS
  5. effect of MMC
  6. effect of zero tolerance at MMC
  7. effect of LMC
  8. effect of zero tolerance at LMC
(f) Screw threads
  1. feature
  2. modifier
(g) Gears and splines
(h) Virtual/resultant condition
  1. determining the appropriateness of MMC and LMC
  2. virtual condition determination
  3. resultant condition determination
  4. datum features at virtual condition
  5. calculating inner and outer locus
(i) Angular surfaces
(j) Conical tapers
(k) Klat tapers
(l) Radius
(m) Statistical tolerancing
  1. application to assemblies
  2. identification
(n) Tolerances of location
  1. utilization of modifiers
    (-a) effects of RFS (implied)
    (-b) effects of MMC
    (-c) effects of LMC
  2. displacement allowed by datum features at MMC
  3. calculating positional tolerance
  4. zero positional tolerance at MMC
  5. simultaneous requirements
  6. separate requirements
  7. projected tolerance zone
  8. nonparallel holes
  9. counterbored holes
  10. closer control at one end of a feature
  11. bidirectional positional tolerancing
  12. noncircular features
  13. coaxial controls
  14. concentricity
  15. symmetry
(o) Form
  1. straightness
    (-a) surface
    (-b) axis
    (-c) center plane
    (-d) applied on a unit basis

BODY OF KNOWLEDGE

Y14.5M-1994 SENIOR EXAMINATION

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2. flatness
   (-a) surface
   (-b) applied on a unit basis
3. circularity
4. cylindricity

(p) Profile
1. profile of a line
2. profile of a surface
3. coplanarity
4. for plane surfaces
5. on conical features

(q) Qrientation tolerances
1. angularity
   (-a) of a surface
   (-b) applied to features of size
2. parallelism
   (-a) of a surface
   (-b) applied to features of size
3. perpendicularity
   (-a) of a surface
   (-b) applied to features of size

(r) Runout tolerances
(1) circular
(2) total

(s) ASME Y14.5M-1994 Appendices
1. Appendix A, Principal Changes and improvements
   (-a) figures
   (-b) scope, definitions, and general dimensioning
   (-c) general tolerancing and related principles
   (-d) symbology
   (-e) datum referencing
   (-f) tolerances of location
   (-g) tolerances of form, profile, orientation, and runout
   (-h) principal changes and improvements
   (-i) formulas for positional tolerancing
   (-j) form, proportion, and comparison of symbols
   (-k) former practices
   (-l) decision diagrams for geometric control
2. Appendix B, Formulas for Positional Tolerancing
   (-a) general
   (-b) formula symbols
   (-c) floating fastener case
   (-d) fixed fastener case
   (-e) provision for out-of-squareness when projected tolerance zone is not used
   (-f) coaxial features
   (-g) limits and fits
3. Appendix C, Form, Proportion, and Comparison of Symbols
   (-a) general
   (-b) form and proportion
   (-c) comparison
4. Appendix D, Former Practices
   (-a) general
   (-b) definition for feature of size
   (-c) applicability of RFS, MMC, and LMC
   (-d) tangent radii
   (-e) datum feature symbol
   (-f) projected tolerance zone
5. Appendix E, Decision Diagrams for Geometric Control
   (-a) purpose
   (-b) functional requirements
   (-c) reference to standard
   (-d) geometric controls
   (-e) choosing other controls
   (-f) use of modifiers
   (-g) datums
      (-1) datum modifiers
      (-2) multiple datums

Domain 4: APPLICATION OF MODIFIERS IN FEATURE CONTROL FRAMES
Knowledge/skill in:

(a) Types of modifiers
1. RFS
2. MMC
3. LMC

(b) Application
1. to the toleranced feature
2. to datums
3. when applicable
   (-a) to geometric tolerances
   (-b) to datums
4. zero tolerance at MMC
5. results of datum features modified
   (-a) RFS (implied)
   (-b) MMC
   (-c) LMC
6. results of pattern of features modified
   (-a) RFS (implied)
   (-b) MMC
   (-c) LMC
7. simultaneous requirements

BODY OF KNOWLEDGE

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Domain 5: COMPOSITE TOLERANCING
Knowledge/skill in:

(a) Location of a pattern of features
1. location of a pattern of features
2. interrelationship of individual features within a pattern
3. multiple patterns of features; separate requirements

(b) Composite profile tolerancing

(c) Part verification methods
1. functional gaging
2. graphical analysis
3. mathematical analysis

(d) Application of composite positional tolerancing versus two single-segment tolerancing

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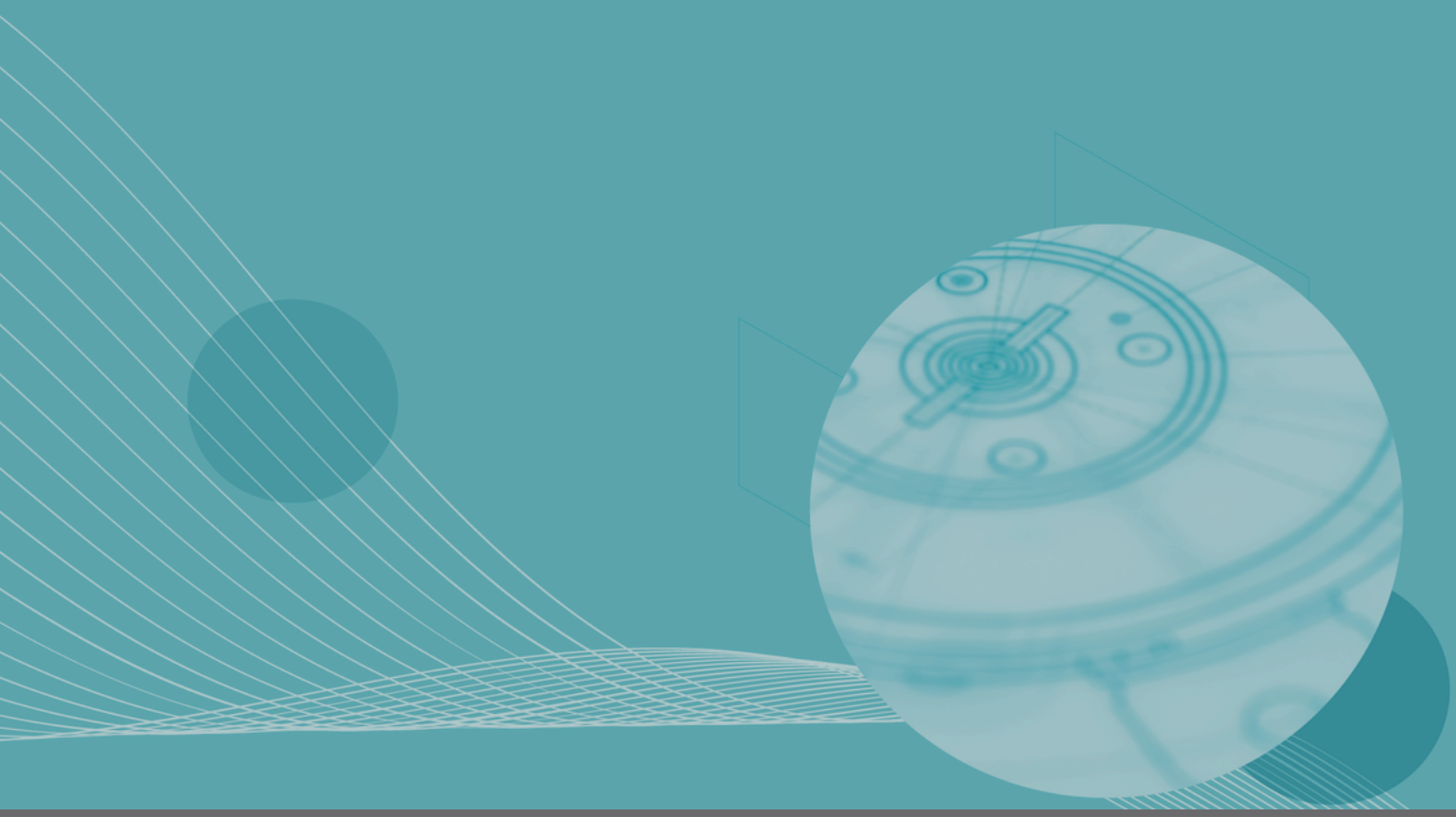

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