



Distinguishing Characteristics:

This is the beginning metrologist level. Typical assignments usually consist of unrelated specific tasks that are selected with a view toward orienting the incumbent in the practical application of theory and basic principles; toward ascertaining his interests and aptitudes; and toward relieving experienced metrologists of detailed and simple engineering work. The Metrologist I is expected to know and apply basic principles, elementary theories and readily available data in the field. Assignments are not complicated technically by conflicting ideas, principles or theories; they can be solved readily by application of basic principles and practices. Incumbents of positions at this level work from detailed technical manuals, directives and criteria that are directly applicable to the assignment. Original thinking is not required by the assignment at this level. Positions at this level receive specific instructions as to what is required and the results expected. Information is furnished in connection with reports to be used, measurements to be taken, probable results, and the end item desired. Work is checked in progress and upon completion is reviewed for accuracy and validity. Decisions are limited to a simple choice of known techniques to be applied.

Examples of Duties:

1. Accompany journeyman level inspectors into the field to observe performance to develop contacts and working relationships and to increase understanding of the Weights and Measures program responsibility to the consumer and the producer; perform inspections as directed;
2. Learn pertinent laws, rules, regulations, policies, directives, etc.; develop familiarity with National Bureau of Standards' Publications Handbook 44 (Specifications, Tolerances Commercial Weighing Equipment), Handbook 67 (Checking Pre-packaged Commodities) and Handbook 97 (Testing Procedures); develop understanding of the program objectives, direction and internal/external relationships; develop understanding of other regulatory and inspectional requirements, including the marketing, processing, handling, transporting, etc., of all commodities subject to weights and measures inspection and regulation;
3. Assist higher-level metrologists in the testing and calibration of field standards, inspection of devices and equipment; checking of engineering design and specifications, checking of new and improved standards and testing techniques; review of engineering developments and outlook in weights and measures; review of metrology laboratory procedures and techniques;

4. Perform special studies on the cost to the owner and to the consumer resulting from inefficient equipment, process, procedure, etc.; collect data in the field and from various sources as directed; check engineering detail of equipment involved to properly determine the cause of inefficiency or error; review findings against technical literature on such equipment; prepare technical report for the laboratory metrologist in charge or for the branch chief;
5. Assist in developing exhibits for weights and measures instruction as well as programming surveys, special investigations and studies;
6. Collect and analyze data regarding specific aspects of legislative proposals, program expansions, consumer's needs, program evaluation, compilation of engineering data for specific purpose;
7. Learn the operation and capabilities of a variety of weighing and measuring devices and equipment; review pertinent literature, specifications and evaluation reports; develop a working knowledge of their engineering details and functions; keep abreast of improvements, new equipment and other data; inform laboratory metrologist or branch chief of unusual data; and
8. Make minor designs; prepare or alter detailed drawings for electrical or other weights and measures equipment standard devices; prepare parts of specifications and cost estimates; set up equipment; make test of installation of small devices and make compilation; make calculations or check computations by others for accuracy; read blueprints; make measurements; and in other ways procure, assemble and prepare reports.

Knowledge and Abilities Required:

General knowledge of the basic principles, theories and practices in the branch of engineering such as may be acquired through the completion of a full four-year engineering curriculum leading to the bachelor's degree in an accredited college or university, or through equivalent experience and education. Ability to carry out under close supervision simple or routine tasks in support of higher-level professional work.

METROLOGIST II

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Duties Summary:

Using prescribed methods, performs work on specific and somewhat limited work assignments or projects normally forming minor phases of a broader assignment which is the responsibility of a higher-grade metrologist.

Distinguishing Characteristics:

Assignments are typically screened to eliminate difficult or unusual problems. Familiarity with and use of a number of standard engineering principles, methods and practices are necessary in order to adapt practices and techniques to specific situations, to adjust and correlate data, to recognize discrepancies and deviations in results and to follow an operation through a series of related detailed steps or processes in carrying out the work assignments. II level metrologists make tentative and preliminary selections and adaptations of engineering alternatives and, after approval by the supervisor, carry out the sequence of details. Although guides are detailed and directly applicable as described at the preceding level, some judgment is required in selecting the most appropriate guides. Some resourcefulness and initiative are required in planning independently the details to accomplish assignments governed by established, specifically applicable procedures. Supervisory control is the same as the preceding level on new assignments. Works under general supervision on repetitive assignments. Detailed calculations, findings and recommendations on repetitive assignments are generally accepted as technically accurate, but may be checked or verified. Reports, designs and specifications are reviewed in detail for technical accuracy of conclusions, clarity and format of presentation. Contacts are with employees within the organization to obtain and present factual information.

Examples of Duties:

1. Perform special tests and studies requiring knowledge of the construction, character, maintenance, capabilities and sensitivity to external factors of all types of commercial weighing and measuring equipment. (Examples of equipment are: computing scales, precision and analytical balances, heavy duty platform scales, liquid measuring equipment and linear measuring equipment.) Develop reports as required, involving the review of pertinent technical material, interview of users and operators, contact with other laboratory facilities, etc.

2. Collect and analyze data regarding specific legislative proposals, program expansion, consumer's needs, program evaluation and compile engineering data for specific purposes.
3. Observe different types of commercial establishments that require weights and measures supervision and inspection; study the controlling regulations, particularly those relating to tables of tolerances governing the acceptability of equipment from the standpoint of allowable deviation from standard; demonstrate ability to detect suspicious actions of dealers in the more common type of commercial establishment; assist in the definition and correction of external factors affecting accuracy.
4. Apply the Weights and Measures Law to the sales of various types of commodities; clarify or interpret regulations, procedures and instruct in the use of equipment.
5. Review design of commercial equipment for conformity with National Bureau of Standards' Handbook 44 (Specifications, Tolerances Commercial Weighing Equipment); check computations and prepare upper control limits and lower control limits for consumer/producer.
6. Visit metrology laboratories, government institutions and other laboratories to inventory the weighing and measuring equipment and devices used; observe and report on the techniques, procedures, standards and processes employed; interview operators of such equipment and devices; search out and study pertinent literature; determine laboratory objectives and missions; collect such data as may be needed to support, reconcile or complete the assignment; analyze and evaluate data; develop recommendations.
7. Assist in the performance of special tests, calibrations and cross-check of precisions standards; assist in the maintenance, improvement or development of laboratory equipment; assist in the inspection of devices for objectionable features of design, workmanship or material; review pertinent technical literature to keep abreast of engineering improvements and developments in weights and measures and of metrology laboratory processes, etc.; and
8. Make technical calculations for equipment or compile designed parts of project specifications by reviewing drawings, engineer's notes and basis for design; determine materials, equipment and installation methods to be specified; select and assemble guides and specifications to be used; review or write descriptions of materials and methods not covered in standards or

guide specifications; make on-sight investigations and inspections in engineering features of special equipment to assure compliance with plans and specifications; report discrepancies and deficiencies to supervisor; develop detailed designs; prepare detailed drawings including mechanical calculations to determine size of special parts for installations of simple and conventional power transmission systems; check working plans prepared by outside contractors for conformance of contract plans and specifications; conduct standard tests on new or experimental equipment to determine whether it is satisfactory for intended use or to determine operating characteristics; supervise or assist with the installation of such equipment to be tested.

#### Knowledge and Abilities Required

In addition to the knowledge and other qualities described at the I level, a sufficient working knowledge of the principles and practices of the engineering field to perform a variety of repetitive tasks without detailed and specific instructions. A general knowledge of regulatory and procedural issuances applicable to the assignments at this level. Ability to select and apply standard guides, methods and techniques within the area to assignment.

#### METROLOGIST III

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#### Duties Summary:

Performs assignments in which complex features which require the solution of difficult or unusual problems occur infrequently or in isolated, single units. Assignments are similar to those previously performed by the organization and can be performed without substantial adaptation or modification of precedents except for minor deviations such as sizes, dimensions, relationships of details, etc., which can be resolved by engineering calculations typical of the specialization or area of assignment.

Plans and conducts research or development work characterized by clear and specified objectives, investigation of a limited number of variables and self-directed work in planning and carrying out experiments in accordance with approaches which have been structured by others. Plans project details on the basis of precedents established in related projects and devises and recommends alternative methods of standardized analysis as a basis for solving problems. Well-established methods and techniques require only minor adaptation or modification.

Distinguishing Characteristics:

Assignments are given in terms of specific objectives with instructions as to possible complex features and the means of their solution. Standard technical methods, computations and details are seldom reviewed by supervisor. Detailed instructions and review are provided with regard to complex features. Completed work is reviewed for soundness of technical engineering judgment and to insure the overall completion of assignments. Where there is serious consequence of error, a complete independent check may be made of drawings, computations, etc.

Planning phases are accomplished through close collaboration with the supervisor and others. The fact-finding, tests, observations, etc., are performed independently without close or extensive supervision. At this level metrologists recognize significant variations or deviations in data or experimental conditions and report them to the supervisor, together with recommendations as to the probable reasons for their occurrence and possible means of solution.

Guidelines include standard instructions, literature, precedents and practices in the area of assignments or specialization. Originality is confined largely to alertness in independently selecting, evaluating and applying guides, with minor adaptation or modification. Guidelines for research and development assignments are the same as those above and, in addition, include a broader scope of scientific literature in the area of research or development being undertaken. Originality is similar to that indicated above for positions at this level.

Office positions engaged in such functions as design, specifications, development, cost estimating analyses, etc., are generally limited to the exchange of factual technical information with co-workers who are performing related work.

Field positions and positions concerned with cooperative programs with the public may involve contacts with State and municipal engineers and inspectors, contractors, property owners, utility company representatives and employees in other organizations to give and receive factual information.

Example of Duties:

1. Perform special tests, calibration and cross-check of precision standards submitted by quality control laboratories, consumer/producer laboratories and other governmental activities. These instruments include weighing kits consisting of load cells, digital indicators and printers, load cell electronic calibration systems, proving rings, dynamometers, etc.;

2. Observe, record and analyze results of findings and prepare complete and accurate calibration and/or special test reports. Also prepare stability and performance history records on submitted standards;
3. Perform electronic and mechanical repairs and modifications, as required to weighing kits and associated instrumentation to constantly improve measurement capabilities of weights and measures program; evaluate and perform research of present and future systems requirements; assist in the design and development of improved apparatus for the measurement system, which requirement varies from the complete design of accessory apparatus to assistance in the development of state-of-the-art force loading apparatus; and
4. Inspect devices for objectionable features of design, poor workmanship, or faulty materials; examine equipment having complex problems and requiring knowledge of advanced industrial material processes on intricate or specially designed preservation and packaging techniques or knowledge of inherent characteristics of a device, instrument or material to determine hidden interior defects by evaluating exterior indicators; determine variations from the standards resulting from environmental conditions or external factors; and recommend corrective action.

Knowledge and Abilities Required:

Good knowledge of standard guides, precedents, methods and techniques in the specialization or area of assignments; a working knowledge of established methods and procedures used in related areas of specialization. A sound working knowledge of the applicable regulatory material, established procedures, and policies of the agency and of sources of information useful in developing work assigned such as is supplied by manufacturers of equipment and material or other establishments working in the same field. Ability to recognize interrelationships with related engineering assignments in the organization. Ability to locate, evaluate, select and apply standard guides, precedents, methods and techniques.

METROLOGIST IV

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Duties Summary:

Performs a variety of assignments in which complex features occur on a regular and recurring basis. Typical assignments usually contain a few (e.g., two to five) complex features, but the work is sufficiently limited in scope that the assistance of

other metrologists is not required in undertaking those portions of work characterized by the presence of complex features. IV level metrologists are recognized as fully operating specialists in all of the conventional aspects of their subject-matter or functional area of assignment.

Plans and conducts research, development or other work for which precedent data, criteria, methods or techniques are inadequate in some aspects, or contain narrow gaps. The purpose of the work is to improve, extend, or validate currently known precedents, data, methods or techniques rather than to develop completely new ones.

Distinguishing Characteristics:

Assignments are given with instructions as to the purpose of the work and possible complex features. The actual means of resolving complex features are the responsibility of IV level metrologists who independently develop approaches and solutions to complex features. Work is usually carried through to completion with little guidance from the supervisor except in cases of controversial complex features and policy questions. Completed work is reviewed for overall technical adequacy and conformance with the objectives of the assignment.

Technical correctness of methods and techniques used in calculations, analyses and other operations is normally accepted by the supervisor. In dealing with the public and outside agencies, IV level metrologists make commitments on routine matters covered by precedents, agency regulations, policies and accepted engineering practices. Where there is serious consequences of error, a complete independent check may be made of drawings, computations, etc.

Assignments in research or development work are given with a statement of the objectives, limits of the assignment, suggested overall plan of work and type of results expected. Critical or unusual methods, techniques and procedures are reviewed during the progress of the work, and the supervisor makes specific suggestions concerning them. Completed work in the form of written recommendations, reports and test data is reviewed for validity of results and controversial or novel findings and recommendations are closely scrutinized for correctness of assumptions, detailed methods and techniques and applicability to the work.

Recommendations and findings are often used as a basis for action by others. Technical correctness of standard calculations, analyses, methods and techniques is accepted by the supervisor.

Guidelines include all those indicated at the previous levels. However, since complex features normally occur in assignments at this level, IV level metrologists must

apply experienced judgment in modifying, adapting or making compromises with standard guidelines. Originality is required in the application of standard engineering practices to new situations and in relating new work situations to precedent ones.

In addition to those indicated at the previous level, guidance used in R & D assignments include scientific literature from universities, laboratories, industry and research foundations which have performed related work. Originality is required in the planning of assignments, in the development and modification of methods, techniques and procedures, in discerning new patterns of phenomena and in correlating and substantiating already developed hypotheses.

Work relationships within the agency are for the purpose of exchanging ideas or information concerning assignments and to assure that assigned work will tie in properly with related work of others. Field positions and positions concerned with cooperative programs affecting the public frequently involve contacts with other agencies, contractors, private industry and public groups to explain and interpret the laws, regulations and procedures of the agency.

IV level metrologists engaged in R & D work often participate in meetings or conferences within the agency to plan cooperative activities and to devise concerted approaches to problems. They make factual reports and discuss technical problems of approach and analysis in such meetings. Visits are occasionally made to other government establishments, universities and industrial companies to obtain technical information relating to their assignments.

Examples of Duties:

1. Perform special tests, calibration and cross-check of precision standards submitted by Quality Control Laboratories, consumer/producer laboratories and other governmental activities. These instruments include weighing kits, volumetric standards, load cells (pneumatic, electronic, hydraulic) digital indicators and printers, load cell electronic calibration systems, proving rings, dynamometers, etc.;
2. Observe, record and analyze results of findings and prepare complete and accurate calibration and special test reports. Also prepare stability and performance history records on submitted standards.
3. Perform electronic, mechanical hydraulic or pneumatic repairs and modifications, as required to weighing kits and associated instrumentation to constantly improve measurement capabilities of weights and measures program. Evaluation of present and future systems requirements. Perform

literature research of **N.B.S., I.S.A.**, professional society and other technical publications to assure knowledge of the state-of-the-art in the field of metrology.

4. Perform design and development of improved measurement systems. This requirement varies from a complete design of accessory apparatus to the development of a state-of-the-art measurement system.
5. Determine, evaluate and provide recommendations on improved measurement techniques, including data handling, presentation and reporting.

Knowledge and Abilities Required:

Thorough knowledge of standard guides, precedents, methods and techniques in the specialization or area of assignment; a good working knowledge of established methods and procedures used in related specialized areas. Thorough knowledge of the applicable regulatory material, established procedures and policies of the agency and sources of information both in and out of Government useful in developing work assigned.

Ability to function independently, under only general supervision, in performing normal work assignments in the specialization or area of assignment. Ability to modify, adapt and make compromises with standard guides, precedents, methods and techniques. Ability to develop effective coordination and secure cooperation. Ability to plan and develop complete and comprehensive engineering reports. Such traits as ingenuity, creativity and decisiveness.

METROLOGIST V

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Duties Summary:

Develops, coordinates and carries through to completion blocks of work of large scope containing many phases of which two or more phases each obtain several complex features. A great many of the individual duties are concerned with planning and coordinating the various phases as performed by other technical personnel of the organization or contractor personnel, reviewing each phase as completed and maintaining liaison with organizations performing related work.

Plans and conducts research, development or other work for which precedent

data, criteria, methods or techniques are significantly inadequate, are controversial or contain critical gaps. At this level, metrologists develop or originate completely new features, in addition to improving, extending, or validating currently known precedents, data, methods or techniques.

Characteristics of the Class:

Assignments are given in terms of broad, general objectives and relative priority for completion of work. At this level, metrologists then work with considerable freedom from technical control in selecting and establishing the proper methods for attacking and resolving complex features and otherwise carrying assignments through to completion. Controversial policy questions are resolved by joint consideration with the supervisor. Completed work is reviewed for adequacy in terms of the broad objectives of the work and for compliance with agency policies and regulations.

Decisions and recommendations based upon the application of standard engineering practices are rarely changed by higher authority, except for reasons of policy, public relations, or budgetary considerations. Technical decisions and recommendations usually involve the expenditure of large sums of money.

Research and development assignments are given in terms of broad, general objectives, suggested general approaches and the boundaries of the program or project. The V level metrologists decide where and how the end results will be used and plan specific objectives for the program, including required innovations and improvisations. Work is reviewed largely for adequacy of results, to correlate it with that of specialists in other fields, and to determine conformance with administrative policies and procedures. Their conclusions in the form of theoretical investigations, experimental designs and laboratory evaluations provide the basis for effective and practical technical exhibits covering development programs for improved techniques and methods for equipment, products and processes. They may also recommend the need and desirability of collaborative or supplemental work to be performed by other organizational segments, laboratories or agencies.

Guides are the same as the previous level, but the V level metrologists must adapt, modify and make compromises with guides more frequently as this level is characterized by the occurrence of many complex features. Originality is necessary in planning and organizing work, devising short-cut procedures and evaluating and making compromises with a number of alternate solutions.

Guides for research and development assignments include all those indicated at the previous level; however, since they are often significantly inadequate, are controversial, or contain critical gaps, positions at this level require the use of initiative,

ingenuity and judgment in devising new schemes of attack or novel methods and techniques.

Positions at this level normally have more frequent and wider contacts than those at the preceding level. In view of the larger scope of work for which they are responsible, the V level metrologists must coordinate and maintain liaison with organizational segments having related assignments, other agencies, contractors, utility companies, State and local governments' authorities and the general public. Such duties generally constitute a substantial portion of the work of positions of this type at this level.

On research and development assignments, in addition to contacts indicated at the preceding level, metrologists at this level contact research and development workers performing related or basic work in other agencies, universities, foundations and industry; to discuss and obtain information concerning their understanding of controversial or little-known theories and techniques.

Examples of Duties:

1. Develop, plan and coordinate the operations of the State's Metrology Laboratory in such a manner to meet the requirements of consumer/producer/government. Schedule submission of standards and vary the work assignments to each measurement area by making the most efficient use of skills available. Provide engineering direction and assistance in complex measurement problems, measurement system design and development projects, development of measurement techniques and other engineering projects.
2. Develop and apply the formulation, review and verification of all measurement techniques developed and/or utilized by the Branch. Summarize such data from an engineering and statistical point of view in order to determine adequacy and acceptability.
3. Initiate design concepts and plan engineering studies to improve economy in operational techniques, characteristics and/or accuracies of the measurement standards and systems utilized by the Branch. Plan design and development of measurement techniques and systems in an effort to assure laboratory capabilities for current and future systems calibration requirements. This task can vary from the design and development of component standards to development of a unique configuration of a measurement system to enable state-of-the-art measurements for specialized system calibration requirements.

4. Plan, develop and conduct training courses related to metrology. Perform training for other Weights and Measures program participants as well as laboratory personnel. This training includes indoctrination, measurement techniques, data handling and recording and proper system utilization for various specialized measurement tasks.
5. Provide engineering consultant services on measurement systems and/or techniques to other government, producer/consumer and weights and measures activities.
6. Plan and schedule workload, both for calibration services and engineering studies, to maintain priority schedules for certification of field standards of Weights and Measures Branch, consumer/producer or other government activities.

Knowledge and Abilities Required:

Thorough and extensive knowledge of standard guides, precedents, methods and techniques in the specialization or area of assignment; a good knowledge of the principles, practices, methods and techniques of the branch of engineering and/or other specific fields as they relate to the area of specialization. Familiarity with work in the specialization being performed by other groups.

Ability to plan and organize large-scale assignments containing many problems and variables. Ability to develop new lines of approach and new or improved techniques and to solve problems where critical gaps occur in data or precedents. Ability to provide engineering advice on complex or unusual engineering problems and to analyze and evaluate proposals and ideas submitted by others. Ability to develop sources of information and to promote assistance from and cooperation of others. Ability to present technical matters effectively in conferences as a representative of the organizational segment. Mature technical judgment.