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Methodology for Examining Testing Laboratories for Manufactured Building

One and Two Family Dwelling Systems and Components

J. O. Bryson, A. A. Camacho, F. M. Gavan,
J. L. Heldenbrand, M. A. Robinson, B. M. Vogel

Project LEAP
Office of Building Standards and Codes Services
Center for Building Technology, IAT
National Bureau of Standards
Washington, D. C. 20234

January 1973

Preliminary Report

Prepared for
National Conference of States on Building Codes and Standards

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This report is to be superseded by a future publication which will receive general distribution and should be cited as a reference. Please consult the NBS Office of Technical Information and Publications to obtain the paper citation.

Prepared for
National Conference of States on Building Codes and Standards

U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary

NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

FOREWORD

The methodology presented in this document consists of procedures for examining the capabilities of laboratories to perform physical testing on industrialized building. Tests required in ANSI A119.1-1969 and in the Laboratory Evaluation and Accreditation Program (LEAP) "Criteria for Testing Laboratories"* form the basis for the examination of technical resources. Therefore, this report on Methodology is a companion document to the LEAP report on "Criteria for Testing Laboratories."

A Laboratory Examining Agency is envisioned, acting at the convenience of the State Accrediting Authorities, within a relationship described herein under sections entitled "This is LEAP" and "General Information for Laboratories Applying for Accreditation Under the LEAP Program for Industrialized Building Including Mobile Homes". Both of these descriptions form a part of the Advance Information Package which is included under the chapter "Initial Communications".

*Also referred to in this document as Criteria

METHODOLOGY FOR EXAMINING TESTING LABORATORIES
FOR MANUFACTURED BUILDING

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INTRODUCTION

This document deals with the collection of technical information about laboratories. A two step process* is presented: (1) study of advance information supplied by the laboratory and (2) on-site examination of laboratory resources. Figure 1 illustrates the sequence of events from initial communications to final report.

Initial Communications -- Briefly, the flow of events shown in Figure 1 begins with the Initial Communications Phase when a laboratory applies to a specific state for accreditation under that state's LEAP regulations. The state then notifies the proposed Laboratory Examining Agency to initiate an examination of the laboratory's technical capabilities. The Laboratory Examining Agency does this by sending an Advance Information Package to the laboratory. The package includes orientation information, the Criteria for Testing Laboratories and an examination application form. After reviewing this material, the laboratory completes the application form and returns it to the Laboratory Examining Agency.

Advance Preparation -- Upon receipt of the laboratory application, the Laboratory Examining Agency then notifies the state that an application for examination has been received. This event starts the Advance Preparation Phase. The state proceeds with its own appraisal of the laboratories business operations and the Laboratory Examining Agency initiates a thorough study of the technical information furnished on the application.

After the examining agency has completed the study of the technical information and determined that there are no critical deficiencies in the laboratory resources or gaps of information in the application, and has approved the proposed set up for the test demonstration, an on-site visit is scheduled.

On-Site Visit -- During the On-Site Visit an examiner collects information in two ways. First he completes a questionnaire, obtaining the needed information through visual inspection and by direct questioning of the laboratory staff. Secondly, the examiner observes the demonstration of an actual test as proposed by the laboratory. The examiner may also photograph non-proprietary facilities and test set ups. At the close of the on-site visit, highlights of the collected information are reviewed with a person designated by the laboratory.

*Possible approach that the states may use to facilitate reciprocity among themselves.

LABORATORY EXAMINATION

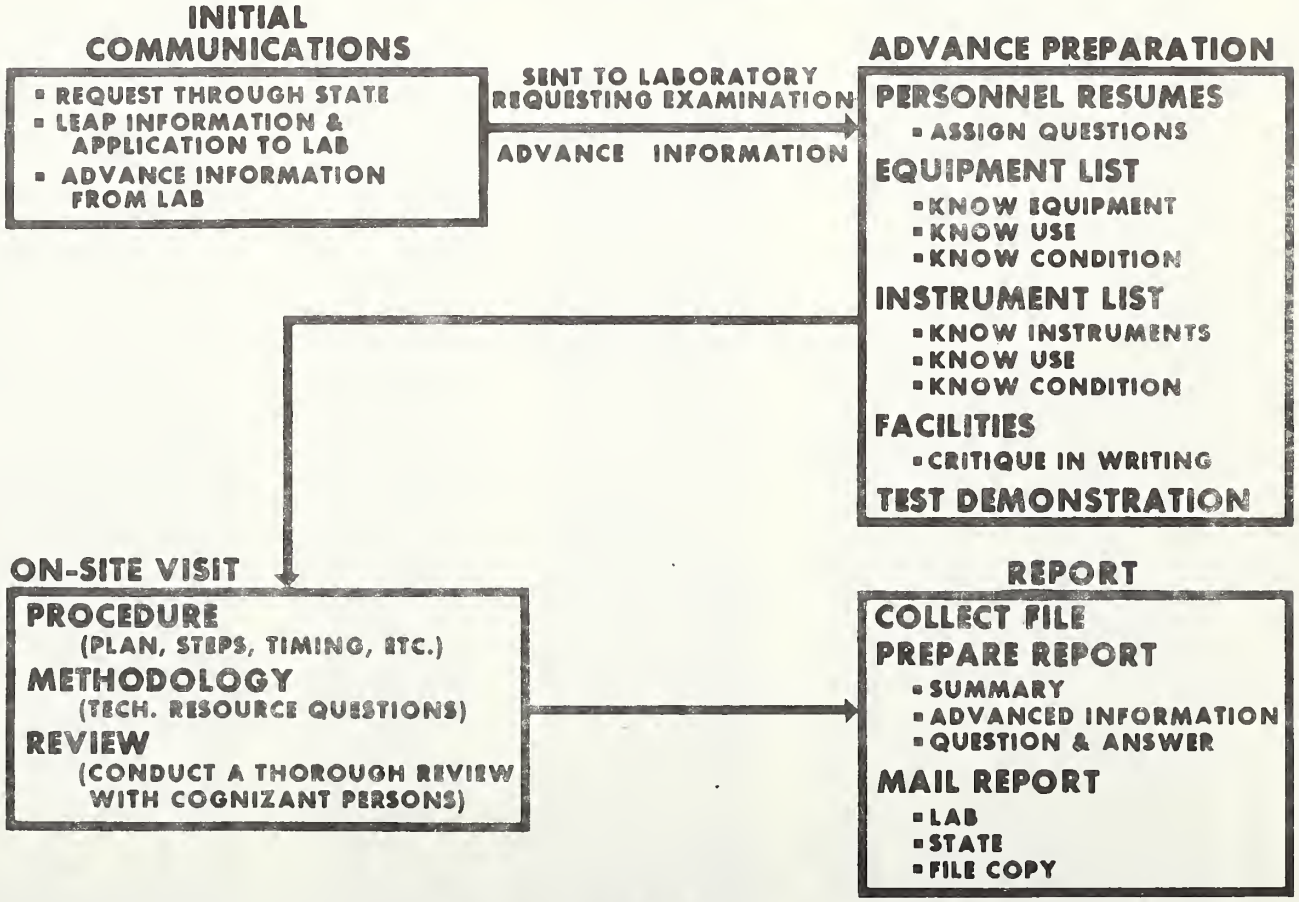

Figure 1

Report -- The Laboratory Examining Agency prepares a technical report consisting of a compilation and summary of information gathered during the Advance Preparation and On-Site Visit Phases. Copies are mailed to the candidate laboratory and the State Accreditating Authority. If, within a reasonable period of time,* the laboratory seeks accreditation in other states, a copy of the technical report will be furnished to those states in lieu of repeating the laboratory examination.

The following is a more detailed outline of procedures used to collect the technical information -- a part of the total information to be evaluated by the state as a basis for granting accreditation to a testing laboratory. Included are certain procedures and recommended forms felt to be expedient and necessary to the work of the proposed Laboratory Examining Agency and the State Accrediting Authority(s).

*To be determined by the National Conference of States on Building Codes and Standards.

INITIAL COMMUNICATIONS

The objectives of the Initial Communications Phase are to convey to interested laboratories the objectives and requirements of the Laboratory Evaluation and Accreditation Program, and to receive from candidate laboratories preliminary information on technical resources.

The initial communication phase begins when a laboratory, that wishes to be accredited notifies a particular state that it is as capable of performing physical testing on mobile homes and other industrialized structures. Under authority established by state regulations for the Laboratory Evaluation and Accreditation Program, the State Accrediting Authority then requests that the Laboratory Examining Agency start the technical examination process.

This process is initiated by sending four documents (see page 4) to the laboratory. These four documents make up the Advance Information Package. One of the four, the Criteria for Testing Laboratories, is published under separate cover. Suggested models for the other three items and for a sample cover letter are presented in this section.

One of the documents included in the Advance Information Package is the "Application Form for Laboratory Applying to State for Accreditation Under LEAP Program." Submittal of the completed application form to the Laboratory Examining Agency marks the end of the Initial Communications Phase.

SAMPLE COVER LETTER
FOR
ADVANCE INFORMATION PACKAGE

Mr. John Doe
Technical Director
XYZ Laboratory, Inc.
Anywhere, USA 12345

Dear Mr. Doe:

Your request for information on the procedures for obtaining laboratory accreditation under the Laboratory Evaluation and Accreditation Program (LEAP) has been forwarded to us by the State of _____. In response, we are enclosing the following documents:

Descriptive brochure "This Is LEAP"

Information sheet "General Information for Laboratories Applying for Accreditation Under the LEAP Program for Industrialized Building Including Mobile Homes"

"Application Form for Laboratory Applying to State for Accreditation Under LEAP Program"

"Criteria for Testing Laboratories"

The information sheet provides instruction and information needed to fill out the application form. Should you have any questions, I will be happy to try to answer them for you. My phone number is _____.

Sincerely,

Joe Smith
Laboratory Examining Agency

Enclosures

FOREWORD*

The sample brochure "This Is LEAP" was prepared by the Center for Building Technology, National Bureau of Standards, for the National Conference of States on Building Codes and Standards (NCSBCS). The subject of the brochure is that the state is answering inquiries from interested parties regarding a recently passed law establishing a state Laboratory Evaluation and Accreditation Program (LEAP).

The states have expressed urgent need for development of a program providing for state recognition of institutions that are competent to evaluate industrialized buildings and/or building components. The program should also provide the states with a basis for informal reciprocity of laboratory accreditation findings and the results of laboratory evaluations of building systems.

To allow the earliest possible initiation of the process, NCSBCS has suggested that a pilot program be initiated using the North Carolina regulations for industrialized buildings, which adopts by reference the only existing national consensus standard for a complete building system, ANSI A119.1-1969 Standard for Mobile Homes. These regulations allow A119.1 to be used as a reference for building modular dwelling units and other factory built structures, as well as mobile homes.

Using the pilot program as a foundation, the brochure "This Is LEAP" explains how the laboratory accreditation program works. The brochure references the A119.1 standard. While the content of A119.1 applies specifically to mobile homes, the program outlined in "This Is LEAP" describes procedures for accrediting laboratories that can later be applied to all industrialized building systems by making appropriate changes in the requirements and criteria. A119.1 is being used only to build a system for evaluating laboratories. No implied endorsement of the A119.1-1969 Standard is intended by NBS.

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*This foreword to be deleted from draft of any state sponsored document.

INTRODUCTION

Building technology is changing rapidly and we are witnessing increasing industrialized production of a wide range of complex construction components and assemblies. Designers and builders want to take advantage of these technical and economic advances and this demands more technically difficult evaluations by code officials. Such evaluations would also entail trips to distant factories and the need for regular follow-up inspections.

Because industrialized building systems may be manufactured outside the state borders and often times will involve innovative processes about which little field experience has been gained, the State of _____*_____ has established regulations for recognizing competent, building-evaluation institutions. Interested laboratories may apply for accreditation under the ____*_____ regulations entitled "Laboratory Evaluation and Accreditation Program" (LEAP).

WHAT DOES IT ALL MEAN?

FOR THE LABORATORIES -- Accreditation by the State of _____*_____ means that the work of a laboratory will be accepted by _____*_____, whether or not the housing system producer or the laboratory itself is located within the borders of this state.

FOR THE HOUSING SYSTEM PRODUCER -- The LEAP Program is designed to assure equitable evaluation of industrialized housing products or techniques, particularly those of an innovative nature.

FOR THE CITIZEN -- The LEAP Program is one of the key elements needed to assure that building components, fabricated and assembled in factories, will be subjected to inspections equivalent to those given to on-site constructions.

FOR THE STATE -- The LEAP Program enables the state to summon the best combination of government and privately owned technical resources to the task of evaluating the design and quality of prototype dwelling units, and of certifying conformance of production units with approved prototypes by

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*Insert name of particular state in each blank

providing follow-up, compliance assurance services. LEAP also opens the door for competent, tax-supported, building department laboratories, to request accreditation by _____*_____. The credibility so established is intended to be the basis for informal interstate reciprocity of dwelling certification programs, with all the attendant economies that this entails.

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* Insert name of particular state

LABORATORY EVALUATION AND ACCREDITATION

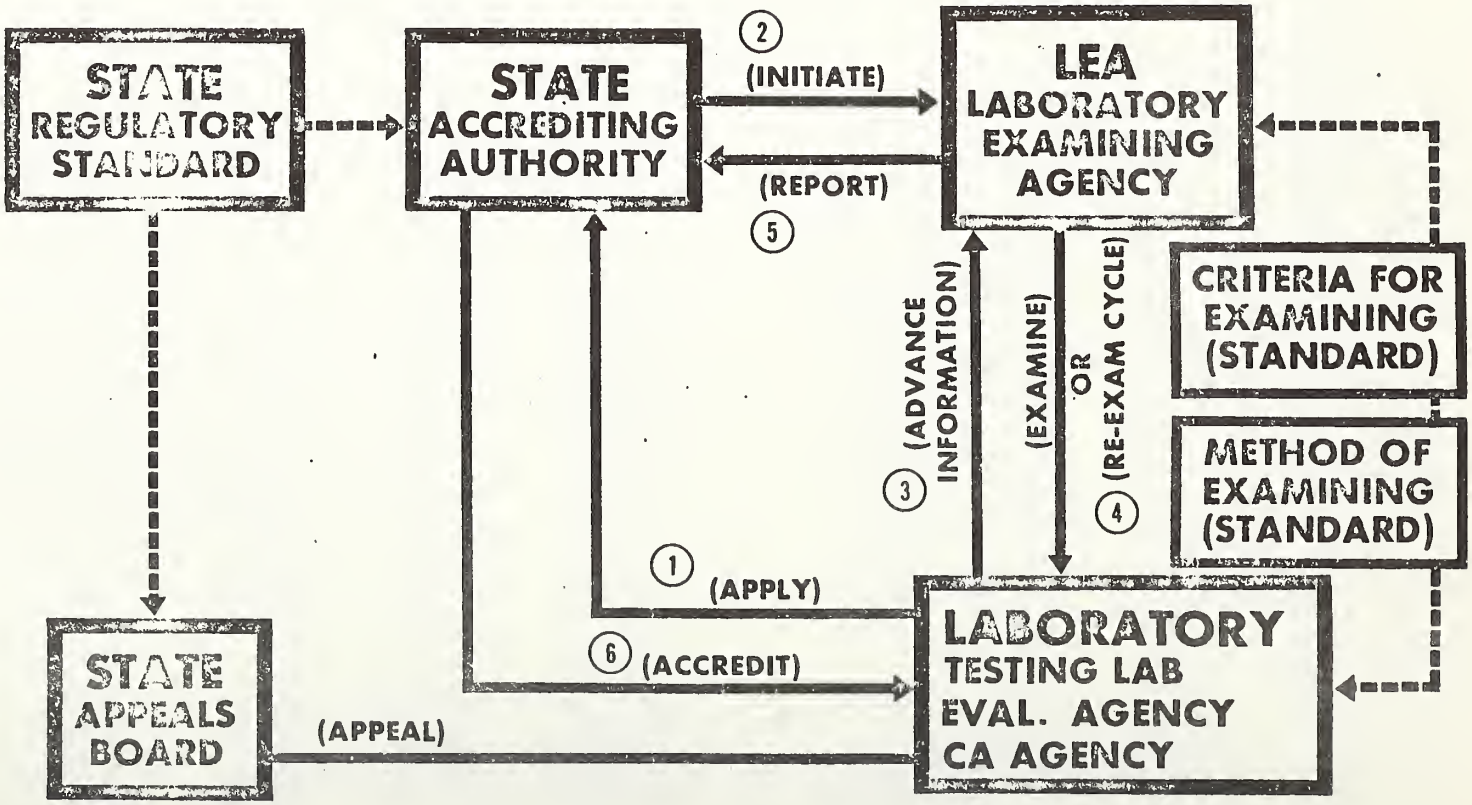


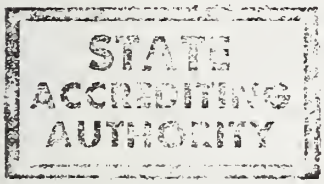
Figure 2

LABORATORY ACCREDITATION

The accreditation "team" lineup and relationships are illustrated in Figure 2. A summary of the functions and responsibilities of each member of the team follows.

Authority for the LEAP Program stems from state regulations entitled "Laboratory Evaluation and Accreditation Program." Basic elements of the regulations include:

- Establishment of a State Authority for Accrediting Laboratories.
- Adoption of a nationally recognized consensus dwelling standard.
- Establishment of a State Appeals Board.



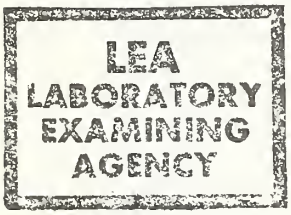
The accrediting authority is that state agency which is charged by LEAP Regulations with implementing the program. Functions of the accrediting authority include:

- Answers requests for information about laboratory accreditation.
- Notifies the Laboratory Evaluation Agency (LEA) to initiate evaluation of the laboratory's technical resources.
- Investigates non-technical aspects of an applicant laboratory's operations, such as finance, corporate relationships, credit, insurance, business reputation.
- Accepts a report from LEA covering the laboratory's technical resources and capability to do the required work.

- Grants or denies initial accreditation based on results of it's own investigation of laboratory operations and LEA's examination of laboratory technical capability.

- Withdraws accreditation, for cause, based on follow-up reports on laboratory operations or technical performance, or the results of the regular, periodic re-examinations specified in LEAP Guidelines.

Information gathered by the accrediting agency and LEA is considered proprietary and will be handled as provided by the LEAP Guidelines.



LEA is the Laboratory Examining Agency responsible for determining the capability of applicant laboratories to perform tests, evaluation, and/or compliance assurance required by the housing standard. The agency is composed of laboratory examiners skilled in the respective disciplines, and experts responsible for recommending to a consensus body those changes needed to upgrade the laboratory-evaluation procedure standard.

The laboratory-evaluation-procedure standard provides the criteria and methodology for LEA's examination of a laboratory. Cost of the examination is borne by the applicant laboratory. The examination itself is composed of three parts:

- Review of advance information on technical resources furnished by the laboratory to LEA.

- On-site examination of technical resources, including demonstrations by laboratory personnel of set-up and procedures for conducting required tests, analyses, and/or quality assurance tasks.

- Submission of a final report to the State Accrediting Authority.

While the Laboratory Examining Agency operates at the convenience of the state, the agency is staffed and supervised by an independent, nationally recognized organization and

functions neither as an arm of state government nor as a commercial or tax supported testing, evaluation or compliance assurance laboratory (See definition in "Laboratory" below).

As illustrated in the heading, the term "Laboratory" is used loosely here to describe any one or a combination of three types of organizations applying for accreditation under _____*_____'s LEAP Program for industrialized building including mobile homes. Distinctions between the terms Test Laboratory, Evaluation Agency and Compliance Assurance Agency are given in the definitions of the laboratory evaluation procedure standard. A laboratory having the appropriate competence may apply for accreditation in any or all of the above basic functions. However, the laboratory will be examined for competence using separate criteria for each of the functional areas requested.

Interested Test Laboratories and Evaluation Agencies must apply for accreditation in one or more of the following building system disciplines:

- o Electrical
- o Fire Safety
- o Heating, Ventilating and Air Conditioning (HVAC)
- o Plumbing
- o Structural

Continuation of the accredited status of a laboratory is contingent on successful re-examinations which are periodically conducted in accordance with LEAP Guidelines.

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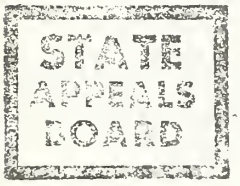
* Insert name of particular state

This consensus standard is the criteria used by the Laboratory Examining Agency in evaluating the capability of a particular facility. LEA examines the laboratory's capability to test, evaluate and/or perform follow-up compliance assurance work with reference to the nationally accepted consensus dwelling standard adopted by the LEAP Guidelines As discussed under the "Laboratory" block in page 13, the criteria provides that a particular facility may request accreditation to perform services covering one or all of the disciplines mentioned therein.



If the laboratory seeking accreditation believes that improper interpretation or application of the LEAP Guidelines by the accrediting authority has caused the denial of accreditation or the withdrawal of previous accreditation, the laboratory has recourse. The LEAP Guidelines include an appeals procedures and the establishment of an objective, third party, appeals board.

NEED MORE INFORMATION?

If you want additional information or you desire to apply for accreditation, contact:

State of _____

LEAP

_____, _____

Phone _____

GENERAL INFORMATION FOR LABORATORIES APPLYING FOR ACCREDITATION UNDER THE LEAP PROGRAM FOR INDUSTRIALIZED BUILDING INCLUDING MOBILE HOMES

It is the purpose of this information sheet to assist you in interpreting the application requirements for technical resource examination under the LEAP* program. The discussion that follows pertains to these three documents:

- Form for making application to (State) for accreditation under the LEAP Program
- ANSI A119.1-1969 Edition
- Criteria for Testing Laboratories

A thorough understanding of A119.1-1969 and the LEAP Criteria will be necessary in order to successfully complete the application.

You have indicated interest in accreditation as a Testing Laboratory to perform testing services on industrialized building.

The distinction between the terms Testing Laboratory, Evaluation Agency and Compliance Assurance Agency is given in the Definitions, Criteria Part 1. Note that a laboratory having appropriate competence may apply for accreditation to perform any or all of the above three basic functions. The laboratory will be examined for competence in each area requested.

As a Testing Laboratory you may apply for accreditation in one or more of the following building system disciplines:

- Electrical Testing
- Fire Safety Testing
- Heating, Ventilating and Air Conditioning (HVAC) Testing
- Plumbing Testing
- Structural Testing

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* Laboratory Evaluation and Accreditation Program

There is space on the application form to indicate those building system disciplines for which you wish to make application. If you select more than one discipline you will need to fill out a separate application form for each.

The Laboratory Examining Agency will collect data on your laboratory's technical resources and technical competence. The Laboratory Examining Agency will not evaluate this data but will submit it to the State Accrediting Authority for evaluation along with certain other information gathered by the state.

The technical resource examination conducted by the Laboratory Examining Agency consists of two parts:

- o Written and graphic information supplied to this office by your laboratory, as indicated on the application form.
- o An on-site visit by an examiner to inspect laboratory facilities, to review test procedures and policies and to observe test demonstrations by your laboratory personnel in accordance with instructions on the application form.

The application form includes several questions regarding the willingness of the laboratory to allow the examiner to do his job in a specific way. Unwillingness of the laboratory to cooperate with this aspect of the evaluation may result in rejection of the application.

In order to qualify as a testing laboratory it will be necessary to show in-house capability to perform all of the tests required under the appropriate discipline in A119.1 and the Criteria. The ability of your laboratory to witness or evaluate tests performed by others or to actually perform tests using outside equipment, instrumentation and facilities, will not in general, qualify you as a testing laboratory under this program.

The State Accrediting Authority may, under certain circumstances, permit a small part of the total testing to be subcontracted. Conditions for granting such exceptions will include, but not be limited to the following:

a) The percentage of the total testing capability to be subcontracted must be less than approximately _____%.*

*Percentage figure to be established by NCSBCS.

b) The prime laboratory assumes full responsibility for work done by the subcontractor.

c) The subcontractor is examined by the Laboratory Examining Agency, for the subcontracted portion only.

d) A full description of the tests to be subcontracted and a copy of the contractural provisions are furnished by the candidate prime laboratory and approved by the State Accrediting Authority.

e) The State Accrediting Authority finds the competence of the subcontractor to be acceptable. Note: The subcontractor will not be independently accredited.

f) Once accredited, the prime laboratory agrees to maintain the approved contract in force with the subcontractor until the prime laboratory requests and receives approval for different subcontract arrangements from the State Accrediting Authority. Failure to comply with this requirement may subject the prime laboratory to immediate revocation of accreditation.

A schedule for the on-site laboratory examination will be proposed by the Laboratory Examining Agency, subject to approval by the laboratory, after the completed applications have been received and accepted.

Please send completed forms to:

_____

_____

_____

APPLICATION FORM FOR LABORATORY APPLYING TO STATE FOR ACCREDITATION UNDER LEAP PROGRAM

Except as otherwise authorized by the candidate laboratory, information furnished by the laboratory in this application and in the subsequent on-site examination will be employed by the Laboratory Examining Agency and the cognizant state(s) solely for the purposes of establishing accreditation of the laboratory.

GENERAL INFORMATION

1. Name of laboratory _____

2. Name and address of parent or affiliate organization

   _____

3. Location of facilities _____

4. Mailing address _____
   (City) (State) (Zip Code)

5. Chief Executive

   Name _____
   Title _____
   Telephone _____
   (Area Code) (Number)

6. List each building system discipline for which you are now applying for accreditation under the LEAP Program.
   NOTE: Indicate one or more of the following building system disciplines associated with ANSI A119.1-1969: Electrical, Fire Safety, Heating Ventilation and Air Conditioning (HVAC), Plumbing, Structures.

7. List agencies from which your laboratory has received approval or accreditation.

Agency	Type of Approval	Effective Period	
		From	To

8. List Institutional affilitations with technical and/or professional organizations _____

_____

9. Describe the fields of services provided by your laboratory and number of years experience in each field. Briefly outline the laboratory's objectives regarding future scope and type of services.

10. Attach a brief description of the methods and procedures used by your laboratory to establish and to indicate when specific individuals have attained the necessary competence:

    a) To supervise a specific test.

    b) To conduct a specific test.

    NOTE: For all remaining items, information shall be submitted on separate forms for each of the building system disciplines for which accreditation is sought.

11. List the building system discipline for which this application is made _____

_____

    NOTE: List one of the following building system disciplines associated with ANSI A119.1-1969; Electrical, Fire Safety, Heating, Ventilating and Air Conditioning (HVAC), Plumbing, and Structures.

12. Laboratory Liaison*

    Name _____
    Title _____
    Telephone _____
    (Area Code) (Number)

13. Has the laboratory liaison thoroughly reviewed ANSI A119.1-1969 and the Criteria and clarified all questions that he may have had regarding the indicated requirements? YES _____ NO _____

_____

* This is the laboratory staff member or officer who will coordinate the laboratory's preparation and participation in the examination program.

14. Do you authorize the examiner to photograph pertinent test set-ups and equipment in your laboratory?
YES_____ NO _____

RELATED TESTING EXPERIENCE

1. List tests conducted by your facility during the past five years which are closely related to those required by ANSI A119.1-1969.

Type of Test	Product Tested	Manufacturer	Identification of Customer	Year

2. Attach examples of recent test reports whose format is typical of that proposed for compliance testing under ANSI A119.1-1969.

3. List recent test experiences not related to ANSI A119.1-1969, but which you believe are indicative of your laboratory's capability to test building systems or subsystems. Attach typical reports.

Type of Test	Product Tested	Manufacturer	Identification of Customer	Year

4. Do you authorize the Laboratory Examining Agency to contact producers and customers identified in this application in order to check references? YES_____ NO_____

5. Has your laboratory been the defendant in a lawsuit within the last five years wherein technical competence in testing building systems, subsystems or components was at issue: YES _____ NO _____

If answer is yes, provide all pertinent details including current status _____

6. Within the last five years, has your laboratory lost any accreditation conferred by a state, county, or city government jurisdiction or by an independent accreditation association? YES_____ NO _____

If answer is yes, provide all pertinent details including current status._____

_____
_____
_____
_____
_____
_____
_____
_____

PERSONNEL

1. Attach a current organization chart indicating lines of authority in your laboratory.

2. Attach a list of all full-time, part-time and consulting personnel engaged in test supervision, operations or technical support activities.

Name	Position Held (Responsibility)	Employment Status (Check One)			Responsible For Which Tests*	
		Full Time	Part Time	Con-tract	As Test Operator	As Test Engineer

3. Attach resumes for each person listed above. Resumes should be limited to one typewritten page and should include the name and a brief summary of education, training, experience, pertinent technical society or consensus standard affiliations, and pertinent publications. Where applicable, list pertinent licenses or registrations including the certificate number and authority.

* List pertinent tests under applicable heading.

TEST INSTRUMENTATION

1. Attach a complete listing of laboratory test instruments applicable to the requirements detailed in ANSI A119.1-1969 and the Criteria for Testing Laboratories.

Manufacturer (or in-house)	Model#	Model Year	Serial # or Identifying Mark	Used On Which Test

2. Attach a description of your instrumentation and equipment calibration plan including the basic elements described in the Criteria for Testing Laboratories.

3. Attach a list of the instrumentation items which are regularly calibrated under your calibration plan.

Item Identification	Organization Performing Calibration	Identify Calibration Source	Is Traceability Documented	If Outside Calibration--Where Are Maintenance/Calibration Records Located

4. Briefly describe all special or laboratory-fabricated instruments _____

TEST EQUIPMENT

1. Attach a complete listing of laboratory test equipment applicable to the requirements detailed in ANSI A119.1-1969 and the Criteria for Testing Laboratories.

Manufacturer (or in-house)	Model#	Model Year	Serial # or Identifying Mark	Used On Which Test

2. Attach photographs (minimum 3" x 5" glossy prints) and descriptions of all test equipment listed above.

3. Attach a list of test fixtures and equipment items which are regularly calibrated under your calibration plan.

Item Identification	Organization Performing Calibration	Identify Calibration Source	Is Traceability Documented	If Outside Calibration--Where Are Maintenance/Calibration Records Located

4. Briefly describe all special or laboratory-fabricated equipment. _____

FACILITIES

1. Attach a sketch of your test floor or area. Include all pertinent information related to the basic requirements for the test floor as given in the Criteria.

2. Attach a list of pertinent technical and standard references which are contained in your reference library (Ref. Criteria), including edition and year.

TEST PROCEDURES

1. Does your laboratory employ written test procedures?
   YES _____ NO _____

2. If yes, approximately what percentage of the test required in the Criteria are presently covered by written procedures?

3. Please attach a representative copy of one of the more detailed test procedures.

TEST DEMONSTRATION

As a part of the on-site examination, your laboratory will be required to conduct test(s) for the purpose of demonstrating competency in the application of equipment, instrumentation, and basic test procedures required by A119.1-1969 and the Criteria. As a minimum, the demonstration should include essential elements of the tests listed in Attachment A.

In the absence of a typical dwelling unit for testing, the laboratory shall propose one or more simple mock-ups of subsystems suitable for conducting the test demonstrations. Sketches and/or photographs of the proposed set-up shall be submitted with this application together with a summary of the instrumentation, equipment and procedures to be demonstrated.

SUBCONTRACTORS

1. List any of the tests required in your disciplinary area by ANSI A119.1-1969 and the Criteria which will be performed by a subcontractor.

   NOTE: If any test is to be subcontracted, proceed to the following items.

2. Attach a copy of the contract between your laboratory and the subcontractor.

3. Attach a separate application form and attachments, with complete information filled in by the subcontractor, in the same manner and to the same degree of completeness as required for your laboratory.

4. Will your laboratory be responsible for scheduling an on-site examination visit to the subcontractor?
   YES _____ NO _____

OWNERSHIP

1. Does your laboratory have legal ownership of all the instruments, test equipment and facilities which you have listed in this application?
   YES _____ NO _____

2. If the answer to item (1) is no, identify the items not owned, describe the terms of usage and identify the lessor or loaner.

CONFIRMATION

The information contained on this application and its attachments has been reviewed by me and it is true, to the best of my knowledge.

_____
Signature of Chief Officer of Laboratory

_____
Date

Notary Public

_____
Date

_____
Seal

ATTACHMENT 1

LIST OF STRUCTURAL TESTS TO BE INCLUDED IN LABORATORY'S TEST DEMONSTRATION

The Structural Laboratory shall conduct a test demonstration for the purpose of demonstrating to the examiner the laboratory's competency in the application of equipment, instrumentation and basic test procedures as required in the Criteria for Testing Laboratory.

The test demonstration shall be either (1) ASTM E72 Axial Wall Test, or (2) Roof Rafter Test, or an equivalent test that is indicative of the testing capabilities of your laboratory.

ATTACHMENT 1

LIST OF HVAC TESTS TO BE INCLUDED IN LABORATORY'S TEST DEMONSTRATION

The HVAC Laboratory shall conduct test demonstrations for the purpose of demonstrating to the examiner the laboratory's competency in the application of equipment, instrumentation and basic test procedures required by ANSI A119.1-1969 and the Criteria for Testing Laboratories. As a minimum, the demonstrations should include essential elements of the following tests:

1. Static Leak Test - Gas Piping System
2. Wet Leak Test - Oil Tank and Piping System
3. Gas Pipe Sizing
4. Sizing of Ducts
5. Container (LPG) Restraint

ATTACHMENT 1

LIST OF ELECTRICAL TESTS TO BE INCLUDED IN LABORATORY'S TEST DEMONSTRATION

The Electrical Laboratory shall conduct test demonstrations for the purpose of demonstrating to the examiner the laboratory's competency in the application of equipment, instrumentation and basic test procedures required by ANSI A119.1-1969 and the Criteria for Testing Laboratories. As a minimum, the demonstrations should include essential elements of the following tests:

1. Dielectric Strength Test

2. Continuity of Ground

ATTACHMENT 1

LIST OF FIRE SAFETY TESTS TO BE INCLUDED IN LABORATORY'S TEST DEMONSTRATION

The Fire Safety Laboratory shall conduct a test demonstrations for the purpose to demonstrating to the examiner the laboratory's competency in the application of equipment, instrumentation and basic test procedures required by ANSI A119.1-1969 and the Criteria for Testing Laboratories. As a minimum, the demonstrations should include essential elements of the following test:

1. Test for Surface Burning Characteristics of Building Materials, ASTM E84-67.

ATTACHMENT 1

LIST OF PLUMBING TESTS TO BE INCLUDED IN LABORATORY'S TEST DEMONSTRATION

The Plumbing Laboratory shall conduct test demonstrations for the purpose of demonstrating to the examiner the laboratory's competency in the application of equipment, instrumentation and basic test procedures required by ANSI A119.1-1969 and the Criteria for Testing Laboratories. As a minimum, the demonstrations should include essential elements of the following tests:

1. Pressure Test on Water Supply System

2. Test on Drainage and Vent System (D&V)

   The laboratory shall have the option of performing one of the following D & V System Tests:

   a) Air Test

   b) Water Test

   c) Flood Level Test

   d) Fixture Test

3. Shower Stall Leak Test

4. Freeze Test

The laboratory, if it so desires, may utilize a single multi-purpose system mock-up for demonstrating the above tests.

ADVANCE PREPARATION

Associated with the Advance Preparation Phase are two basic objectives for the examiner:

- o Review the advance information and compare it to the minimum requirements of the Criteria.
- o Organize the information furnished and relate it to information to be sought during the on-site visit.

The Advance Preparation Phase begins when the Laboratory Examining Agency notifies the state than an application for examination has been received and that, at first glance, it appears complete. The state then initiates it own review of laboratory business operations while the Laboratory Examining Agency proceeds with a thorough review of the technical information provided by the candidate laboratory.

Resumes of laboratory personnel are reviewed by the Laboratory Examining Agency; specific individuals are keyed to appropriate parts of the questionnaire to be used for reference during the on-site examination. Pertinent education, training and experiences are tabulated for future inclusion in the technical report.

Lists of the laboratory's instrumentation and test equipment, and sketches and photographs of building facilities, test area and special test equipment are reviewed by the examiner. Where possible, the review is augmented by study of manufacturer's operating instructions and maintenance handbooks. The examiner utilizes this information both to acquaint himself with the laboratory's resources in advance of the on-site visit and to check that minimum requirements of the Criteria are satisfied.

If critical deficiencies in laboratory resources or gaps in information are evident, these are resolved with the laboratory before scheduling the on-site visit. Failure to correct critical deficiencies (reference minimum requirements specified in the Criteria) within __*__ months will result in termination of the examination process, with notification to this effect being sent to the laboratory, through the state. The laboratory may submit a new request for accreditation, to the state, no sooner than __*__ months after the date of termination.

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*To be determined by the National Conference of States on Building Codes and Standards.

In addition to the general approach just outlined, two detailed procedures are given in this section to facilitate the examiner's preparation for the on-site visit. These are:

- Typical Interview Outline
- Interview Guidelines

TYPICAL INTERVIEW OUTLINE

The examiner will organize and prepare an interview outline to aid him in collecting the required information from laboratory personnel during the on-site visit. While the contents may vary with the situation and the examiner, the following is suggested as a minimum outline:

ABC LABORATORIES, INC.

1.0 OPENING INTERVIEW - Mr. J. Alpha
Vice President and Manager

1.1 INTRODUCTION

1. Self

2. LEAP Purpose

1.2 SCOPE

1. General On-Site Inspection (Covers areas of information furnished by application.)

2. Specific Areas:

Calibration

Training

Operation - Test

Records

2.0 METHOD

2.1 OPENING INTERVIEW - Mr. K. Bravo

2.2 TEST SUPERVISOR - Mr. L. Charles, Assistant Manager
Mr. M. Delta

1. Effective Flexural Rigidity

2. Roof Trusses

3. Wall

4. Total Structural Assembly

5. Chassis Assembly

6. Flooring

2.3 TECHNICIAN - Mr. N. Echo
Mr. O. Foxtrot

1. Effective Flexural Rigidity

2. Wall

3. Total Structural Assemby

4. Chassis Assembly

5. Equipment/Instrumentation Quiz

2.4 INSTRUMENTATION

2.5 EQUIPMENT

2.6 CLERICAL - (Inspect records, obtain samples)

Thank each person for their cooperation and time.

3.0 CLOSING INTERVIEW

3.1 REVIEW PERTINENT COLLECTED DATA (record additional information)

3.2 THANK MR BAKER FOR HIS TIME

3.3 PROMISE REPORT (Written report will be forthcoming from Laboratory Examining Agency. Notification of action on accreditation will come from state).

INTERVIEW GUIDELINES

The following guidelines pertaining to the interview are included for use by the examiner in preparing for the on-site examination of a laboratory. Special note should be made of the attitude of cooperation that these guidelines stress. The examiner should be aware that everything he says and does reflects on the total evaluation program. He should always conduct himself in a manner that will be a credit to himself and the program.

It is advisable to confer with the laboratory or section manager prior to approaching the supervisors and test operators. The manager should be given a brief overview of the examination program and his cooperation should be solicited. With the support or acquiescence of the manager, direct employee participation should then be sought.

The processes of fact gathering are probably fraught with more pitfalls than any other area pertaining to laboratory evaluation. The people supervising and performing the tests represent a prime source of information concerning the laboratory. The process of accumulating facts regarding the overall laboratory (as a system) may carry the implication, to the person supplying information, of dissatisfaction with current operations. Thus, this prime source of information may become resentful, fearful, and uncooperative. This potential problem can be minimized by using a tactful approach and by verification of data against alternative sources.

Getting along with people is extremely important in survey initiation and data gathering; however, it cannot be reduced to a set of rules. A friendly and pleasant manner coupled with a genuine interest in the other person constitutes the right combination.

Interviews with personnel should be researched and planned in advance. Organizational structure and position descriptions covering the area of the interview provide excellent preliminary data. In addition, previous examination reports, other data furnished on the application form, the Methodology procedures, and the Criteria for Testing Laboratories, provide valuable preliminary information. The examiner shall become thoroughly acquainted with this material.

From this advance information an interview outline will be developed. Armed with background knowledge of the laboratory gained from the advance information and an interview outline, the examiner is now ready to keep the interview appointment. Be prompt for the appointment. If a change in schedule must be made, make it as far in advance of the date set as possible.

Last minute cancellations or changes are discourteous and irritating.

Never argue! If an argument develops, change the subject to areas of known interest and try to avoid an early return to the subject of contention.

Take notes. They help organize the material and clarify thinking. The individual being interviewed is likely to be more cooperative if his ideas are important enough to be recorded. Be a good listener first, and a good talker second. You learn more by listening than talking.

Conclude the interview promptly when the necessary information has been acquired. Strive to keep the interview within the planned time span.

During preliminary study of the advance information, an attempt at blocking segments of time to be spent with each area should be made. As experience is gained, more precise allocations of time will be possible. However, it should always be uppermost in the examiner's mind that there are other interviews to be conducted and more questions to be answered. The examiner should avoid falling into the trap of being willing to listen beyond the established time of the interview. This creates the impression that the examiner has nothing else to do and eventually may lead to the examiner being blamed for wasting time.

Information obtained from the interview must be verified where possible. This can be accomplished by comparing the information obtained in various interviews. Where possible, discrepancies should be resolved by observation of actual operations or by returning to the individual at variance.

Existing laboratory records and documents may save the examiner a great amount of time and avoid the recording of facts already documented. Procedures, position descriptions, laboratory manuals, etc., all represent valuable sources of information. These, however, should be verified by observation, as they may or may not reflect current conditions in the laboratory. Recent figures may be available in final reports, control records, tabulated listings, etc.

The examiner should avoid making any judgmental remarks, i.e. "good show," "poor procedure," etc.

After preparation, advance study and practice, the examiner will still find situations that call for clear thinking and tact. As experience is gained, the accomplished interviewer will find his own means of establishing a successful interview technique that will enable him to handle the unusual situation.

TYPICAL OPENING REMARKS

"Mr. _____."

"My name is _____ and I represent the laboratory examining agency. I have your application for examination as a (discipline) testing laboratory for (state).

As you know, the purpose of this examination is to inspect your test facilities and test reporting system and to assess the capability of your laboratory personnel. To achieve this objective, questions will be asked of various persons in your laboratory and I will witness the demonstration tests agreed upon earlier. I will also ask for copies of certain reports and procedures.

The collected information will be reported to you and to (state), and will be evaluated by (state). Notice of your accreditation status will be sent to you by (state).

At the close of my examination today, I would like to meet with you, or with a person you designate, to review the information collected. Do you have any questions?

If you have no further questions, I would appreciate a short tour of the laboratory and introductions (*) to the supervisory and test personnel (hand over prepared list of names). These are the people I will be interviewing."

*Consideration should be given to asking the manager to call a meeting of his supervisors so that the examiner can explain the purpose of the examination and the manager can request supervisory cooperation. Time will be saved and the work can start earlier in the day if this interview can be conducted the afternoon before the scheduled examination.

CLOSING INTERVIEW

A closing interview shall be held with the manager or head of the laboratory or with such persons as he may designate. The examiner will review pertinent aspects of the information gathered and provide the manager an opportunity to make additions or clarifications. Record all additional information in its appropriate location on the questionnaire. Do not delete or remove any information obtained previously.

After a brief review, thank the manager or head of the laboratory for his time. Do not leave notes, reports, copies of reports, scratch paper, questionnaire or any personal items behind.

QUESTIONNAIRE FORMAT AND RATING SYSTEM

INTRODUCTION

The questionnaire is an organized series of questions arranged by building system discipline, to be employed by the examiner in collecting information during the on-site visit. Two types of questions are included; those in which the information is obtained through the personal observations of the examiner and those in which directed verbal questions or written technician quizzes are answered by laboratory personnel. The examiner will record the answers for both sources of information. The scope and wording of the questions are designed to minimize subjective judgments on the part of the examiner.

Appendix A "Evaluation Guidelines" provides assistance to the accrediting authority in evaluating the reported answers to the questionnaire.

ORGANIZATION

There is a questionnaire for each of the five building system disciplines used in the Criteria for Testing Laboratories. These are:

- o Structures
- o Heating, Ventilating and Air Conditioning (HVAC)
- o Fire Safety
- o Electrical
- o Plumbing

The questions under each discipline are divided into those related to General Testing Information and those associated with the Test Demonstration, as outlined below.

(DISCIPLINE)

GENERAL TESTING INFORMATION

Information is to be collected by visual inspection and by questions directed to laboratory personnel, in the areas of:

- o Equipment - Test machines and apparatus other than instruments

- o Instrumentation - Measuring instruments
- o Facilities - Buildings and building fixtures associated with the test area and engineering office.
- o Personnel - Laboratory management, supervisory and test personnel.

TEST DEMONSTRATION

The examiner witnesses test demonstrations and answers questions based on his observations. The nature of the tests is established during the Advance Preparation Phase. If an actual industrialized structure is unavailable, the tests may be conducted on a building subsystem mock-up.

FORMAT

The following example illustrates the format for the questions.

Weight	Identifier	Question
Keyword		
(Storage) (2) (0)	1.	Is there storage space available, when not in use?
(2)		(0)

In the example, a keyword identifying the substance of the question is provided for the benefit of the examiner. Below the keyword, the first symbol in parenthesis reveals whether or not the objective of the question is a "must" (M) or a "want" (reflected by a numerical weighting.)* The second symbol in parenthesis designates the person to whom the question is directed. The personnel code employed is as follows:

- (M) Manager - Person in charge of laboratory operations
- (S) Supervisor - Person in charge of the test(s) under consideration
- (0) Operator - Person conducting the test

*Reference "Rating System" below.

(E) Examiner - Person conducting the laboratory examination

RATING SYSTEM

The intent of the rating system is to provide a means of summarizing the body of examination data, in a manner which can ultimately lead to a figure of merit. This figure of merit can be related to a minimum rating established by the accrediting authority as commensurate with satisfactory technical competence.

Each question is classified either as a "must" or a "want." If a question related directly to a mandatory requirement of the Criteria, then it is a "must" (M). Musts represent Go, No-go criteria and thus they are not numerically weighted. If the objective of the question is a desirable, but not mandatory, characteristic or attribute of the laboratory, then it is a "want" question. "Wants" are expressed in terms of relative desirability and thus they are numerically weighted.

WEIGHTING SCALE

Weight is the value attached to the subject matter of the question.

The first step in the weighting process is to establish the position of each "want" objective relative to the desired goal of the laboratory's competence to perform physical testing. This is done by giving it a numerical weight of importance.

The particular scale used is arbitrary. However, it does allow for discrimination in recording the importance of each objective. Table 1 illustrates the weighting scale used in the Methodology Questionnaire.

SCORING SCALE

The score is the degree of completeness with which the laboratory meets the objectives underlying the question or the directed visual observation.

Only the answers to "want" questions are scored. If the laboratory fails to meet the requirements of a "must," the accrediting authority will generally consider this limitation a barrier to accreditation.

TABLE 1
WEIGHTING SCALE

CATEGORY	WEIGHT	SIGNIFICANCE
Must		A mandatory attribute
Want	5	Very high want, just short of must
	4	High want
	3	Medium want
	2	Modest want
	1	Low want

When assigning a numerical score of 0 to 5 to the "want" answers, the Laboratory Examining Agency must employ its judgment and experience since there are only two clear cut cases of scoring as illustrated in Table 2.

TABLE 2
SCORING SCALE

SCORE	SIGNIFICANCE
5	Complete compliance with objective
4	
3	
2	
1	
0	Total absence of compliance with objective

FIGURE OF MERIT

Equation 1 illustrates a suggested figure of merit that the accrediting authority may use.

$$\frac{\sum_{i=1}^{n} (W_i \times S_i)}{\sum_{i=1}^{n} \times W_i \times 5} = \text{Figure of Merit} \qquad \text{Equation 1}$$

Where: n = total number of Want questions in questionnaire

W_i = total weight of a given question

S_i = score of that answer

5 = maximum score for answer

Σ = sum of

The first case is i = 1.

The procedure is:

1. Multiply the weighted questions by their score.
2. Add all the resulting products.
3. Obtain the maximum weighted score points available.
4. Divide (3) into (2) and multiply by 100.

This value is the percentage rating or Figure of Merit for major functions of the laboratory or for the laboratory as a whole. The State Accrediting Authority may wish to further investigate problem areas revealed by the final report. As experience is gained, it is envisioned that the accumulated Figures of Merit for a number of laboratories will be reviewed by the various State Accrediting authorities to establish minimum acceptable values.

TECHNICIAN QUIZZES

Certain of the following questionnaires include attachments incorporating questions and related photographs under the general heading of Technician Quizzes. These abbreviated quizzes are intended to fill only a supplementary role along with other personnel evaluation procedures, including review of resumes, direct interviews, examination of training programs and observation of performance during demonstration tests.

The specific questions included in the quizzes are intended only to be suggestive and should be more fully developed as examining experience is gained. It is envisioned that advance information about the subject matter to be covered by the quizzes, would be given to the candidate laboratories.

GENERAL TESTING INFORMATION

Equipment

(Equipment) (E)	1. Verify equipment listed for load application. Inspect for condition, (broken wires, leaking valves or lines, etc.), operability, calibration, completeness when judged against manufacturer's specs. Are all parts and/or ancillary pieces available? Visually inspect every listed piece of equipment. Record conditions. Note applicable equipment not included in Advance Information. (Ref. Criteria Section 1.5, 2.1. 3.1).
(M) (S)	Is the required equipment in evidence?
(Operating Manuals) (3) (S)	2. Are manufacturer's equipment operating manuals or written operating procedures on hand? Visually inspect.
(Use) (3) (S)	3. If the equipment is labora-fabricated, are the use and care outlined in writing?
(Storage)	4. Is there storage space available when not in use?
(Knowledge) (3)(E)	5. Verify the personnel assignments as stated in the Advance Information. Check for knowledge of equipment by asking: a. What is the equipment? b. What limitations and load range? c. Used in what test?
(E4 & E74) (2)(S)	6. Are you familiar with ASTM E4 and E74?

a. Does your operational procedure make provisions for compliance to E4 and E74?
b. Are your reports on the listed equipment updated at regular intervals?
c. Do you have a report or reports covering all or some of the testing equipment in your laboratory?
d. May we have copies?

(Calibration) (2)(S)

7. There are two major factors in every test situation that are needed to correlate one set of data to another. For instance, an ASTM E72 Axial Compression Wall Test done in your laboratory compared to the same test with similar specimen at another laboratory. What are these two factors?

Instrumentation

(Instrumentation) (M)(S)

1. Verify instrumentation listed for load application. Inspect for condition (broken wires, leaking valves or lines, etc.), operability, calibration, completeness when judged against manufacturer's specs. Are all parts and/or ancillary pieces available? Visually inspect every listed piece. Record condition. Note applicable instrumentation not included in Advance Information. (Ref. Criteria).

(Storage) (2)(2)

2. Is there storage space available when not in use?

(Calibration) (5)(S)

3. Is the above instrumentation calibrated? If yes, how? When? Against what standard calibration?

(Knowledge) (3)(E)

4. Verify the personnel assignments as stated in the Advance Information. Check for knowledge of instruments by asking:

   a. What is the instrumentation?
   b. What limitations and load range?

Facilities

(Fixtures) (2)(S)

1. Are the test fixtures non-influencing? How do you determine this?

(Area) (4)(E)

2. Is there space to handle whole sections? Verify the sketch of the test floor: width, length, load capacity - ? lbs., overhead Crane capacity - ? tons.

(Area) (2)(E)

3. Is the work area neat and orderly?

(Temperature) (1)(S)

4. Is temperature controlled to (References)?

(References) (3)(E)

5. Verify references in Advance information.

   a. Books - standard references (detail), i.e. ASTM, AISC, PSC, NBS Building Science Series, etc.
   b. Papers, charts, graphs (literature surveys).
   c. Past analysis and forms.
   d. Uniform codes.
   e. References or manufacturer's data used on each instrument.
   f. Manufacturer's specs on equipment.

Personnel

(Verification) (2)(O)

1. What checking method is used to ascertain whether data

results are reasonable? Please explain.

(Clerical) (1)(0)

2. Are there filing systems, files, storage cabinets, etc., available for use in maintaining an office?

(Reports) (1)(E)

3. Are the filed reports easily accessible?

(Sample Copies)

4. Provide the following sample copies:

   a. Calibration records for (as applicable):

      - o Equipment
      - o Instrumentation
      - o Data Recording

   b. Data collection forms.
   c. Sample test reports.
   d. Sample customer test report.
   e. Written test procedures, as applicable.

Stipulated Tests

Effective Flexural Rigidity

(Equipment) (M)(S)

1. Do you have the following equipment as required in ANSI A119.1-1969, page 24? May we see it?

   a. Two each hydraulic jacks--5 ton capacity.
   b. Two each rear supports--heavy steel wall pipe with bearing plates welded to ends, 8 inch diameter pipe or equivalent.
   c. Steel shims in varying thickness and quantities required to level coach.
   d. Two each forward supports (5 ton capacity, screw jacks, adjustable).

e. 500 pounds of test weights, in easily moved increments, suitable for long term use and maintenance of accuracy.
f. Or Equivalent (describe).

(Instrumentation)

2. Do you have the following instrumentation as required in ANSI A119.1-1969, page 24? May we see it?

a. Two each 3-inch diameter dial gages with overall range of one inch and graduation of 0.001 inch.
b. One each tape measure, fifty foot in length graduated in 1.00 inch or .10 of a foot.
c. Two each apparatus stands suitable for mounting dial gages.
d. Or equivalent (describe).

Roof Rafter Or Trusses

(Equipment)

1. Do you have the following equipment as required in ANSI A119.1-1969, page 30? May we see it?

a. One each steel rule graduated in 1/8 inch.
b. Uniform loading units sufficient so as to simulate 30 pounds per square foot.
c. Supports for the truss/ rafter system being tested.
d. Or equivalent (describe).

(Instrumentation) (M)(S)

2. Do you have the following instrumentation as required in ANSI A119.1-1969, page 30? May we see it?

a. Taut wire system including wire, pulleys, weights.
b. Or equivalent (describe).

Flooring

(Equipment)
(M)(S)

1. Do you have the following equipment as required in ANSI A119.1-1969, page 13, Section 6.8? May we see it?

   a. One each 200 pound weight.
   b. One each 2-inch diameter disk.
   c. Or one each 200 pound weight or cylindrical shape with 2-inch diameter.
   d. Or equivalent (describe).

(Instrumentation)
(M)(S)

2. Do you have the following instrumentation as required in ANSI A119.1-1969, page 13, Section 6.8? May we see it?

   a. One each dial gage with 3-inch face, graduated in .001 inches.
   b. Support rod, extension rod and clamp for mounting the dial gage.

IMPLIED TESTING

Wall

(Equipment)
(3)(S)

(1)(S/O)

1. a. How do you determine that the load application devices are accurate to 1%?
   b. Do you have a set routine for performing both vertical and horizontal load applications? Please explain. If yes, may we have a copy of your written procedures?

(Instrumentation)
(3)(S)

2. a. Based on your listing of instrumentation, is the instrumentation listed for this test capable of a read-out accuracy of 5%?

(1)(S)

b. How do you verify true deflections of the specimen?

All Structural Assemblies (Ultimate Testing)

(Equipment) (S)

1. Is this equipment used for wall testing?

Exterior Joints

(Equipment-Optional) (M)(S)

1. May we see the following:
   a. Camera.
   b. Chemical analysis laboratory.
   c. ASTM B117, Appendix I. Does this chamber comply with ASTM B117, Appendix I?

(Facilities) (1)(S)

2. a. Do you have space for conducting this test?
   b. Is the temperature and humidity controlled for the test chamber?
      1. Temperature 95 + 2 or -3° F.
      2. Humidity as described in ASTM B117, Section 8b, page 72, 1969 Edition.

TEST DEMONSTRATION

(Errors) (3) (0)

1. Demonstrate an error reducing technique such as:
   a. "Zeroing" each instrument
   b. Load compensating techniques
   c. Calibrating each device
   d. Method used to determine maximum and minimum reading expected

(Recording)
(2)(O)

2. What method(s) are used for reading and recording data? Please explain. Collect sample test data sheet.

(Test Set-Up)
(2)(S)

3. Are the support fixtures, rods, structure capable of withstanding the reactive loads without movement adversely affecting the test data? By what means is this demonstrated?

(Analysis)
(2)(S)

4. What pre-test analysis and set-up method is used? Please explain.

(Analysis)
(2)(O)

5. How is the pre-test analysis used by the technician who runs the test? Please explain.

(Operation)

6. Observe test operation for:

(1)(E)

a. Communications between operating personnel.

(1)(E)

b. Ability to read gages, dials, etc.

(1)(E)

c. Recording of information.

(1)(E)

d. Technique (follows prepared procedure, appears to be familiar, etc.)

STRUCTURAL TECHNICIAN QUIZ

1. What type of concrete cylinder test is shown in Figure 1?

   a. compression
   b. tensile
   c. split tensile

2. Examine the instrument shown in Figure 2 and answer the following questions.

   A. What is the name of the instrument?

      a. strain gage
      b. dial gage
      c. micrometer

   B. What does the instrument measure?

      a. temperature
      b. pressure
      c. movement

   C. What is the reading on the instrument?

      a. 0.603"
      b. 0.206"
      c. 0.306"

3. Examine the instrument shown in Figure 3 and answer the following questions.

   A. What is the name of the instrument?

      a. manometer
      b. thermometer
      c. psychrometer

   B. What does the instrument measure?

      a. pressure
      b. humidity
      c. temperature
      d. movement

4. Examine the rule shown in Figure 4 and select the correct reading. Assume that the figure is approximately to scale.

   a. 40.54 inches
   b. 5.4 meters
   c. 454 millimeters

5. Examine the rule shown in Figure 5 and answer the following questions.

   A. What is the smallest division in inches of Scale A?

      a. $\frac{1}{100}$ inches

      b. $\frac{1}{32}$ inches

      c. $\frac{1}{64}$ inches

   B. What is the smallest division in inches of Scale B?

      a. $\frac{1}{100}$ inches

      b. $\frac{1}{32}$ inches

      c. $\frac{1}{64}$ inches

   C. At what reading is the arrow on Scale A?

      a. $15\ \frac{5}{8}$ inches

      b. $15\ \frac{26}{32}$ inches

      c. $15\ \frac{43}{64}$ inches

   D. At what reading is the arrow on Scale B?

      a. 2.6 inches
      b. 2.30 inches
      c. 2.25 inches

6. Examine the instrument shown in Figure 6 and answer the following questions.

   A. What is the name of the instrument?

      a. manometer
      b. thermometer
      c. psychrometer

B. What does the instrument measure?

a. pressure
b. humidity
c. temperature
d. movement

7. Examine the instrument shown in Figure 7 and answer the following questions.

A. What is the name of the instrument?

a. manometer
b. thermometer
c. psychrometer

B. What does the instrument measure?

a. pressure
b. humidity
c. temperature
d. movement

8. Examine the instrument shown in Figure 8 and answer the following questions.

A. What is the name of the indicating portion of the instrument?

a. vernier caliper
b. micrometer
c. divider

B. What is the reading on the instrument?

a. 2.55 inches
b. 1.255 inches
c. 2.2 inches

9. Examine the instrument shown in Figure 9 and answer the following questions.

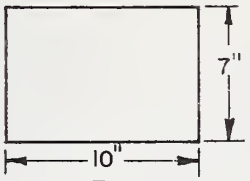
A. What is the name of the instrument?

a. vernier caliper
b. micrometer
c. divider

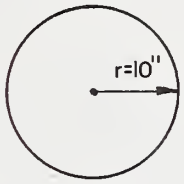
B. What is the reading on the instrument?

a. 0.209 inches
b. 2.9 inches
c. 0.29 inches

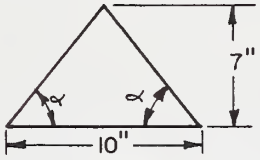
10. Calculate the area of the following plane figures.



Area - _____ in^2

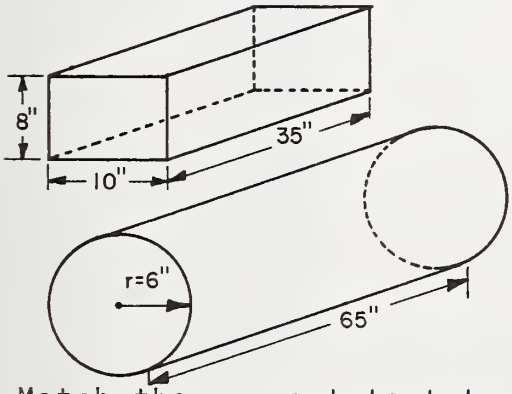


Area = _____ in^2



Area = _____ in^2

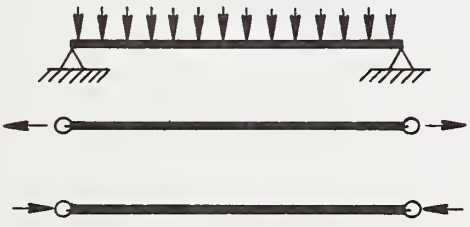
11. Calculate the volume of the following solids.



Volume = _____ in^3

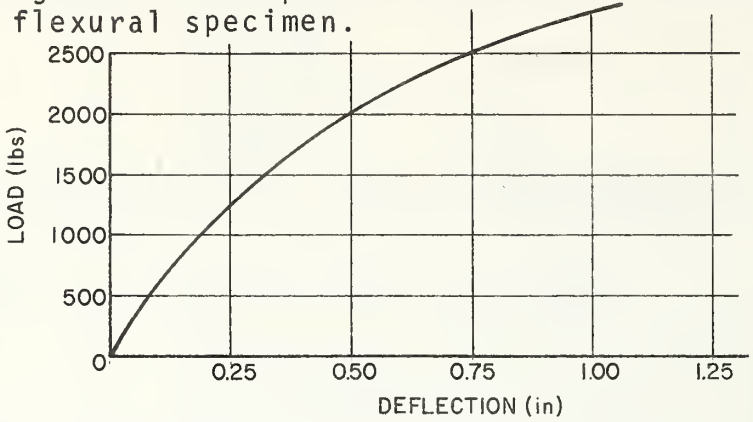
Volume = _____ in^3

12. Match the correct test type to that shown schematically on the left.



____ a. compression
b. flexural
____ c. torsion
d. tensile
____

13. The figure below represents the load-deflection history of a flexural specimen.



Select the deflection which would correspond to a load of 2500 pounds.

a. 0.75 inch
b. 0.65 inch
c. 0.75 feet

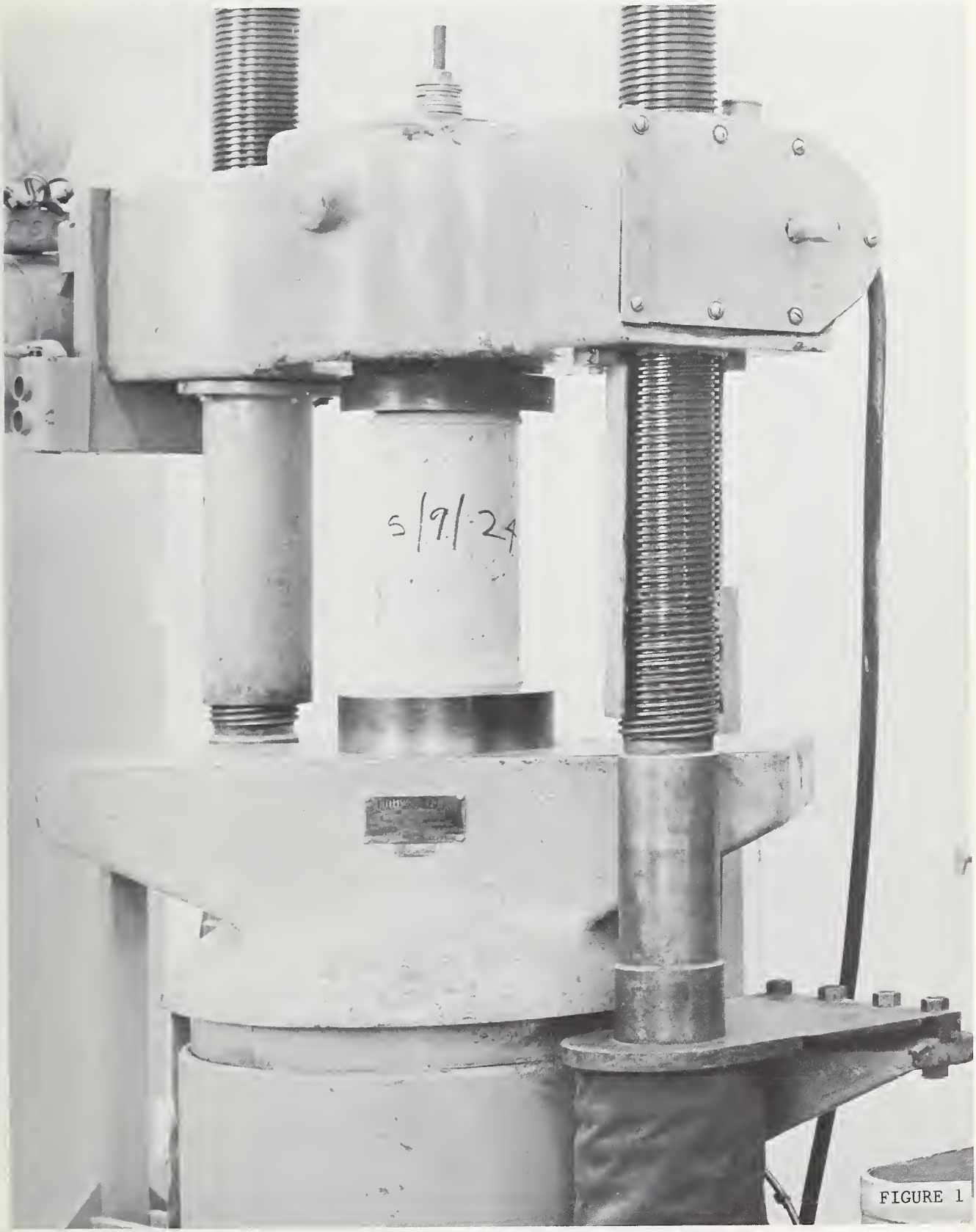
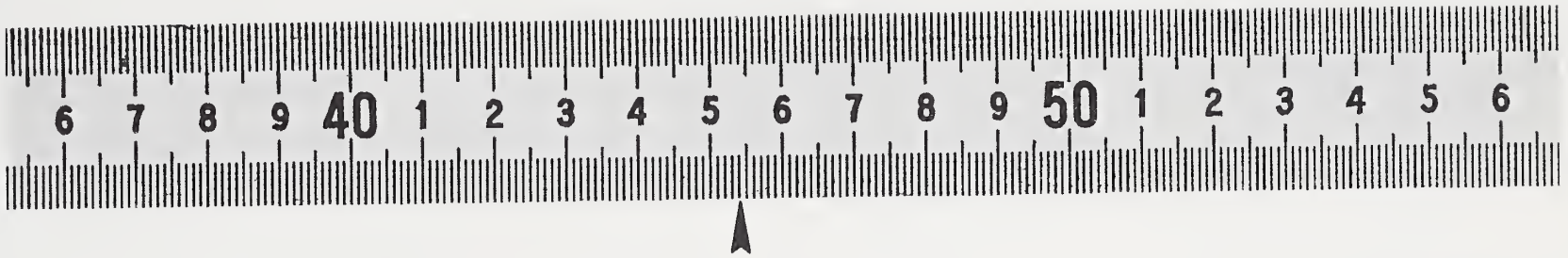


FIGURE 1


FEDERAL
FEDERAL PRODUCTS CORPORATION
Model D 813
0
10
20
30
40
50
60
70
80
90

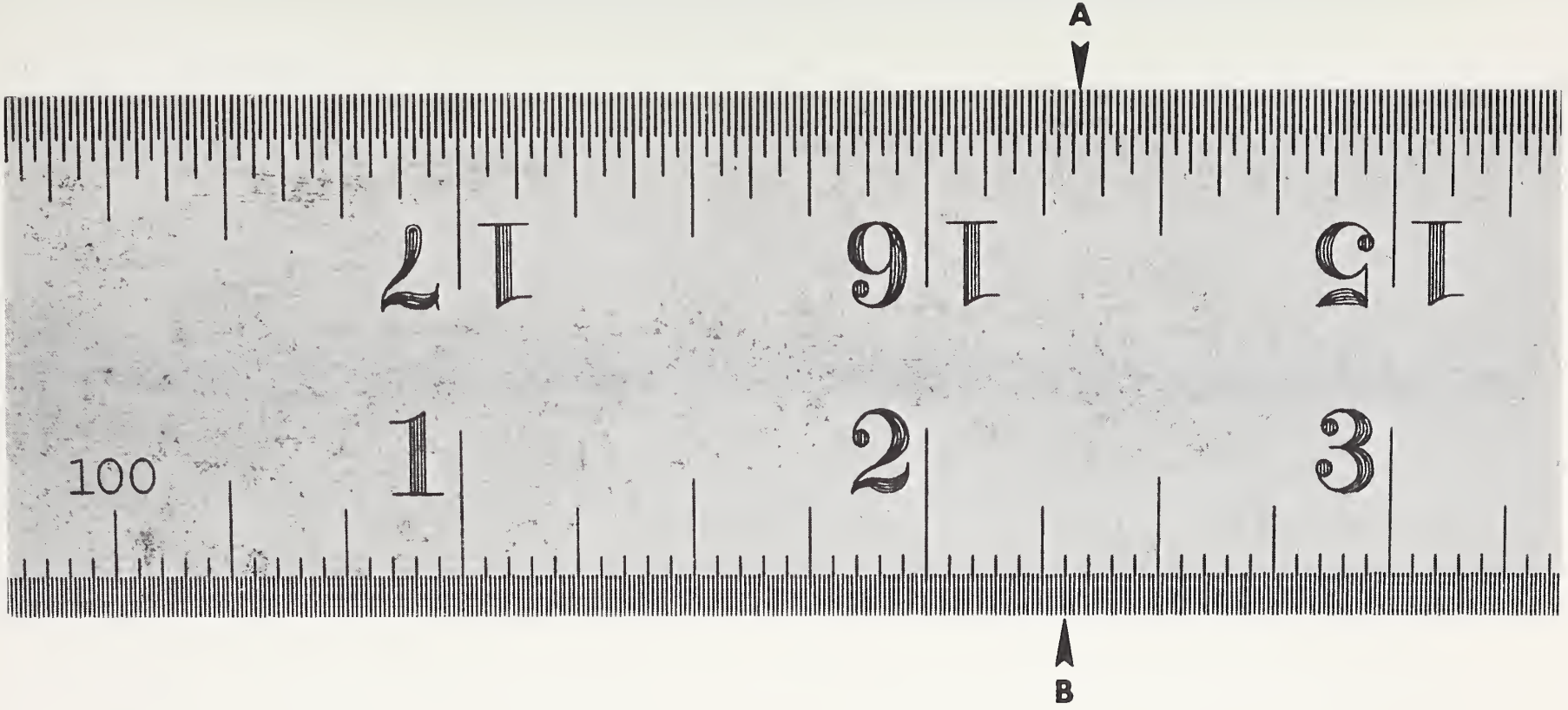
FIGURE 2

FIGURE 3



NOTE: Not to scale

FIGURE 4



NOTE: Not to scale

FIGURE 5

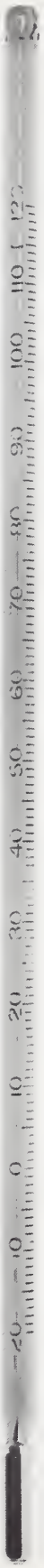


FIGURE 6

FIGURE 7

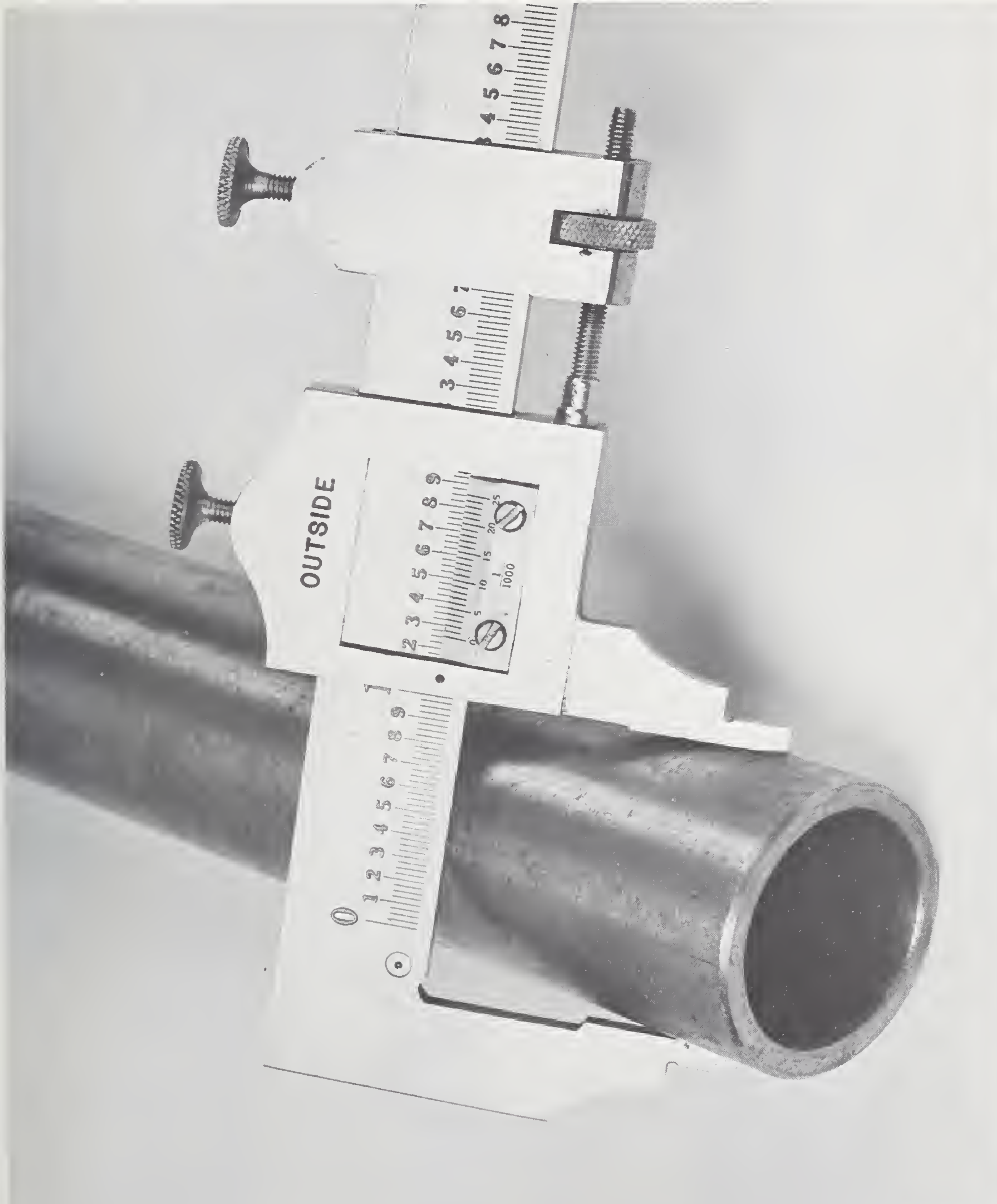


FIGURE 8

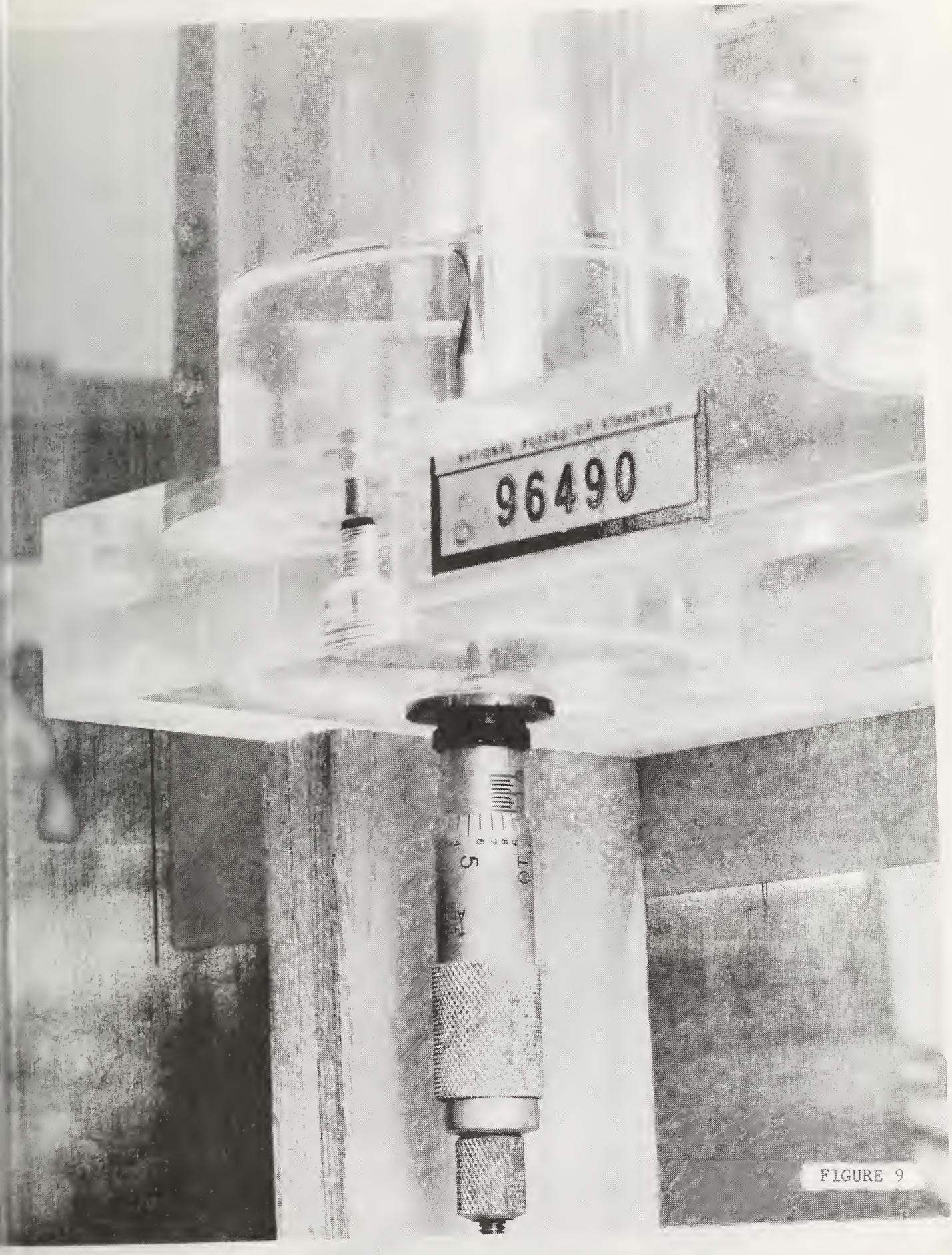


FIGURE 9

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

QUESTIONNAIRE

GENERAL TESTING INFORMATION

Equipment

(Condition)

1. Rate the overall physical condition of each item of test equipment. Factors to consider:

   - o Design suitable for intended purpose
   - o Clean
   - o Sound Threads
   - o Free of cracked glass/ plastic parts
   - o No missing parts

List of test equipment (Ref. Criteria for Testing Laboratories HVAC 5.1.1)

(5)(E) a. Compressed gas source.

(4)(E) b. Temperature tempering tank.

(2)(E) c. Miscellaneous regulators, connectors, hose and valves.

(1)(E) d. Soap solution and applicator.

(3)(E) e. Fuel oil(s), hose, connectors, stand.

(3)(E) f. Tubing and connectors for hook-up to duct, gas supply and appliance manifolds.

(2)(E) g. Air bag.

(4)(E) h. LPG load harness.

(Equipment Storage) (2)(E)

2. Does the provision for equipment storage protect against accidential damage or accelerated deterioration?

   Characteristics of storage space to consider:

   - o Dry
   - o Clean
   - o Spaceous
   - o Secure
   - o Accessible

Instrumentation

(Condition)

1. Rate the overall physical condition of each instrument. (Ref. Criteria HVAC 5.2.1). Things to consider:

   - o Suitable scale range (Ref. Criteria HVAC 5.2.2(9).
   - o Readable scale markings (Ref. Criteria HVAC 5.2.2(10).
   - o Mechanically/electrically sound.
   - o Clean.
   - o Sound threads or terminal posts.
   - o Free of cracked glass/plastic parts.
   - o No missing parts.

(4)(E)

a. Inclined HG manometer, 0-10 inches or equivalent plus means of enhancing scale readability.

(2)(E)	b.	Water manometer, 0-20 inches W.C.* minimum.
(3)(E)	c.	Static pressure pickup.
(4)(E)	d.	Inclined water manometer, 0-5 inches W.C.
(4)(E)	e.	Inclined water manometer, 0-1 inches W.C.
(5)(E)	f.	Positive displacement gas flowmeter, 0-2 cfm.
(1)(E)	g.	Calibrated liquid graduate, 0-10 ml. or equivalent.
(4)(E)	h.	Balance scale or burette.
(3)(E)	i.	Wattmeter, 120-240V, about 40 KW.
(5)(E)	j.	Temperature indicating potentiometer or strip chart recorder.
(4)(E)	k.	Force measuring gage, 0-600 pounds or equivalent.
(3)(E)	l.	Force measuring gage, 0-50 pounds or equivalent.
(Instrument Storage) (2)(E)	2.	Does the provision for instrument storage protect against damage or accelerated deterioration? Characteristics of storage space to consider: o Dry o Clean o Spaceous o Secure o Accessible

* W. C.- water column

(Calibration Records) (3)(E)

3. Examine the calibration and repair records for the calibrated instruments and spot check instrument calibration stickers. Do the records indicate compliance with the calibration plan? Things to consider:

   - o Completeness of calibration and repair history.
   - o Promptness in correcting damaged or out-of-date calibration condition.
   - o Compare "calibration due" against "calibrations accomplished."
   - o Adequacy of planned calibration frequency.
   - o Record of traceability.

(Calibration Accuracy) (4)(E)

4. Examine the calibration records for the energy, gas volume, and, oil volume measuring instruments. Do the records reflect instrument accuracies within $\pm$2% of full scale under reference conditions? Describe exceptions.

(Operating Accuracy) (5)(S)

5. Let us define "true value" as "an accepted reference level of a property," as used in ASTM E117. If you have conducted an error analysis on your test set-ups and procedures, do you estimate that all output data and required input test levels are accurate to within $\pm$5% of true value?

Facilities

1. Do the facilities meet the requirements of Criteria HVAC 5.3 with respect to:

(Test Floor) (M)(E)

a. Test floor sized to accept largest dwelling unit, temperature controlled within 75±15° F but capable of holding constant temperature at same point within this range during leak test of piping system, and provided with approved flue caps for heating system tests.

(Reports) (2)(E)

b. Space suitable for preparation, storage, and retrieval of test reports.

(Instrument Room) (3)(E)

c. Instrument calibration facilities (in-house or subcontracted).

(Library) (3)(E)

d. Library with suitable space and including references per Criteria HVAC 5.3.2.

Personnel

1. Personnel Policies

(Indorsement) (2)(O)

a. What methods did your supervisor use to determine that you were capable of conducting these tests without close supervision?

(Indorsement) (5)(S)

b. What methods did your supervisor use to determine that you are capable of interpreting and supervising these tests?

(Authority)
(2)(O)

c. What action do you take when test results are erratic or a system fails a test?

(Training)
(O)

2. Were you given any training in test procedures and the use of instruments? If yes,

(Advisors)
(5)(O)

a. Did your training include advisory information to help you avoid common instrumentation or testing pitfalls? In what form (e.g. advisory circulars, placards, written test procedures, lecture, demonstration, etc.)?

(Objectives)
(3)(S)

b. Is there a common understanding among laboratory personnel as to the ultimate objectives behind each test? If yes, how is this understanding made visible?

(Test Procedure)

3. If the majority of the laboratory's test procedures are in writing, proceed with this series of questions. Briefly review the content of each procedure.

(Completeness)
(5)(E)

a. Are the test procedures up-to-date, unambiguous and reasonably complete?

(Requirements Source)
(1)(E)

b. Do the procedures identify the standard or code which is the basic source of requirements for the test?

(Test Request)
(2)(E)

c. Is a suitable written test request form employed? Things to consider: Does the form enable the requested to:

- o Identify the unit to be tested?

o Describe the test objectives?

o Describe the expected results?

(Data Acquisition) (S)

4. Please describe the complete data acquisition process and provide photocopies of all data associated with a recent test. Include copies of the test request, data book or data forms, computations, and final test report.

(Clarity) (4)(E)

a. Does the laboratory's data acquisition process lend itself to clear and complete communication of what was done and the results obtained?

(Data Checks) (2)(E)

b. Does the laboratory use any regular procedure to check for data errors or omissions?

(Experience) (O)

5. In your personal experience, which instruments or types of measurements are the touchiest and what precautions do you take to get dependable results?

(5)(E)

Does the test operator exhibit a basic understanding of the instruments he uses?

(Experience) (S)

6. In your personal experience, which instruments or types of measurements are the touchiest and what precautions do you take to get dependable results?

(4)(E)

Does the test supervisor exhibit a basic understanding of the instruments used by his subordinates?

7. Personnel Tests

(Sensitivity)
(0)

a. (Optional Question) - What physical property does this instrument actually sense? (Examiner point to an instrument).

(2)(E)

Does the operator distinguish between what the instrument actually senses vs what is labeled on the dial face?

NOTE: For example, a hot-wire anemometer scale reads in units of velocity such as feet per minute, but the instrument actually senses the rate of heat transfer from a heated wire to a gas stream.

(Parallax)

b. One potential source of error in reading instruments is parallax, which is the apparent displacement of an object as viewed from two different points. What do you do to minimize the effects of parallax when reading an instrument?

(3)(E)

Does the operator know how to minimize the effect of parallax?

(Scale Selection)
(0)

c. When using a multi-range instrument, where you know ahead of time about what reading to expect, how do you determine which scale range to use?

(3)(E)

Does the operator know how to select the proper scale range? (Ref. Criteria HVAC 5.2.2(9) and (10).

(Technician Quiz) (5)(E)

d. See attachment HVAC Technician Quiz.

What percentage of the questions in the quiz were answered correctly?

TEST DEMONSTRATION

This section includes information gathering procedures unique to certain specific HVAC tests and is organized under the individual test titles. The questions are based on witnessing laboratory testing of dwelling unit or mocked-up subsystem. Prior to visiting the laboratory, the examiner will review and approve a sketch of the proposed demonstration test set-up and a listing of the test instruments and equipment that the laboratory proposes to employ in the demonstration.

In the headings below, the numbers in brackets refer to identically numbered paragraphs in the HVAC section of the Criteria.

Static Leak Test-Gas Piping System (1.1)

(Temperature Drift) (3)(E)

1. Does the operator keep the drift in gas temperature under 1°F during the test?

(Pressure Isolation) (5)(E)

2. When the specified applied pressure has been reached in the plumbing system, does the operator isolate the source of pressure by shuting off the gas supply valve and bleeding the supply side of the valve down to atmospheric pressure?

(Set-Up) (5)(E)

3. Does the operator employ appropriate instrumentation and procedures in a manner likely to produce dependable results? Things to consider:

   - o Resolution (readability) of pressure instrument (see suggestions in Criteria HVAC 1.1.2).
   - o Leveling of manometer.

		o Zeroing the manometer scale or noting the reading at zero pressure. o Security and tightness of tubing connections. o Knowledge of test requirements.
Container Restraint (4.1)		
(Loads) (5)(E)	1.	Does the equipment and procedure used for this test result in applying the specified load sequentially in each of six directions (i.e. three mutually perpendicular axes)?
(Requirements) (5)(E)	2.	Does the operator exhibit an awareness of the test requirements and objectives?
Wet Leak Test-Oil Tank and Piping System (1.3)		
(Head) (5)(E)	1.	Does the operator adjust the oil pressure head to $8 \pm 1/2$ ft.?
Gas Pipe Sizing (2.1)		
(Connections) (3)(E)	1.	Does the operator exhibit awareness of the possible errors produced by small leaks in the connections to the water manometer?
(Requirements) (5)(E)	2.	Does the operator exhibit an awareness of the test requirments and objectives?
Sizing of Ducts (3.2)		
(Static Specification) (3)(E)	1.	In the case of multi-speed or adjustable speed fans, does the test request or procedure indicate that the operator must use the specific furnace static pressure (or fan speed terminal position) specified for this system.

(Instrumentation) (5)(E)	2. Does the operator employ instrumentation that meets the minimum requirements of Criteria HVAC 3.2.2? Things to consider: o Inclined manometer, 0-5 inches W.C. o Appropriate means of measuring the energy input. See 3.2.2(2). o Stop watch. o Appropriate means of reading out temperature. o Static pressure pick-up. o Flue gas temperature probe.
(Technique) (4)(E)	3. Does the procedure used by the operator comply with the Criteria for measuring and adjusting the rate of energy input and static pressure rise, and the attainment of equilibrium (Ref, Criteria HVAC 3.2)?

HVAC TECHNICIAN QUIZ

1. Ref: Figure 1 -- What is the height of the liquid column?
   _____

2. Ref: Figure 2 -- What is the height of the liquid column?
   _____

3. Ref: Figure 1 & 2 -- Does Figure 1 or 2 best illustrate a a typical mercury manometer? _____

4. Ref: Figure 1 -- What should be done if the meniscus of a water or oil manometer assumes the shape of Figure 1?
   _____

5. Ref: Figure 3 -- What is the pressure differential in inches of liquid column? _____

6. Ref: Figure 4 -- What is the scale reading of the inclined manometer? _____

7. Ref: Figure 5 -- If Figure 5 represents the scale reading of an inclined manometer when zero pressure is applied, what pressure is being applied to the same manometer in Figure 4? _____

8. Ref: Figure 6 -- What property is measured by this instrument? _____

9. Ref: Figure 6 -- What special precautions should be taken during set-up, to assure accurate measurements with this instrument? _____

10. Ref: Figure 6 -- What scale reading is indicated by this instrument? _____

11. Ref: Figure 7 -- Which of the scales (A), (B), or (C) is the preferred one for reading out a quantity of 45.0 volts D.C.? _____

12. Ref: Figure 8 -- What is the scale reading of the instrument in Figure 8? _____

13. Ref: Figure 9 -- What is the micrometer reading of the Hook Pressure Gage? _____

14. Ref: Figure 10 -- What would be the best course to obtain accurate measurements with this instrument?
    _____

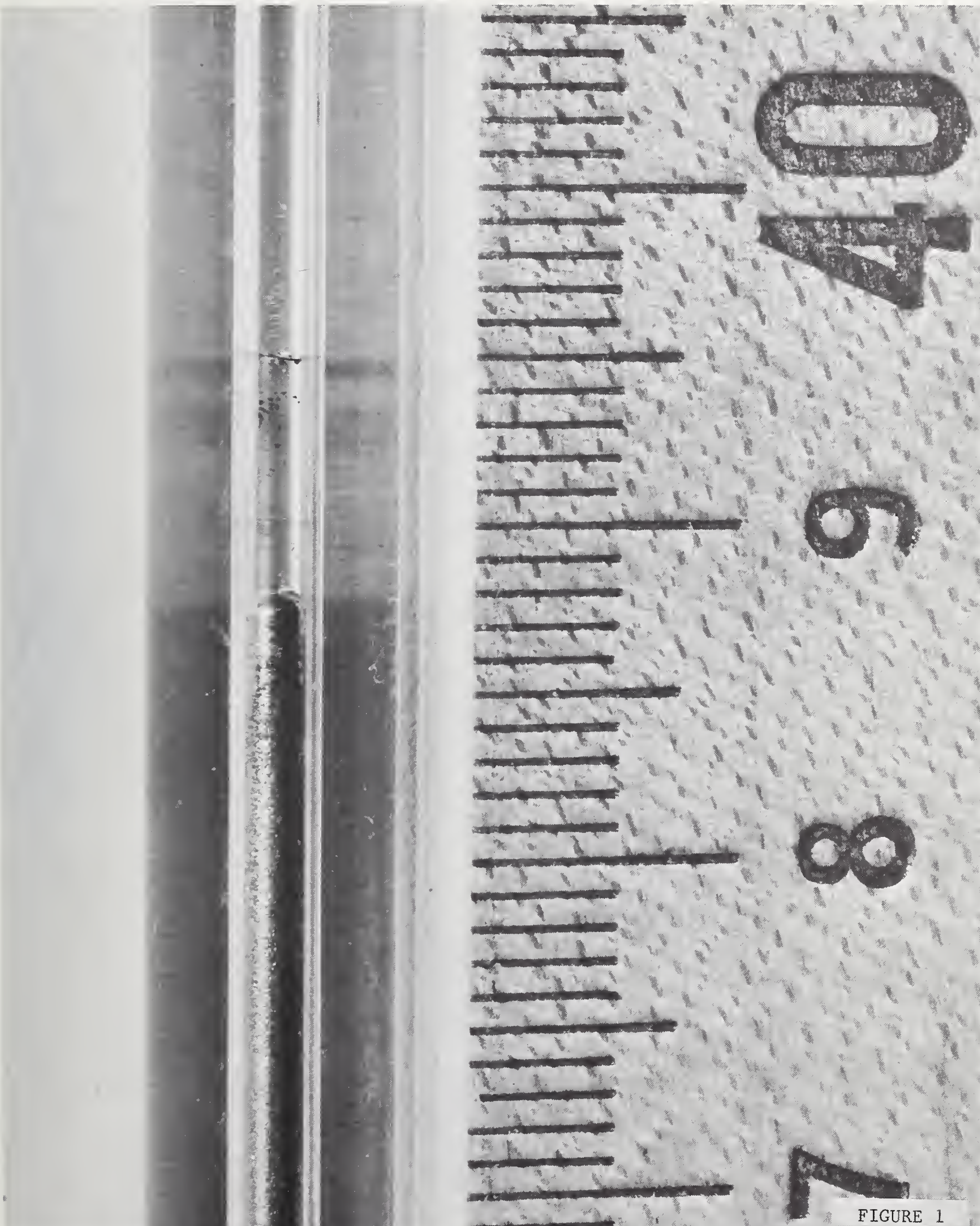
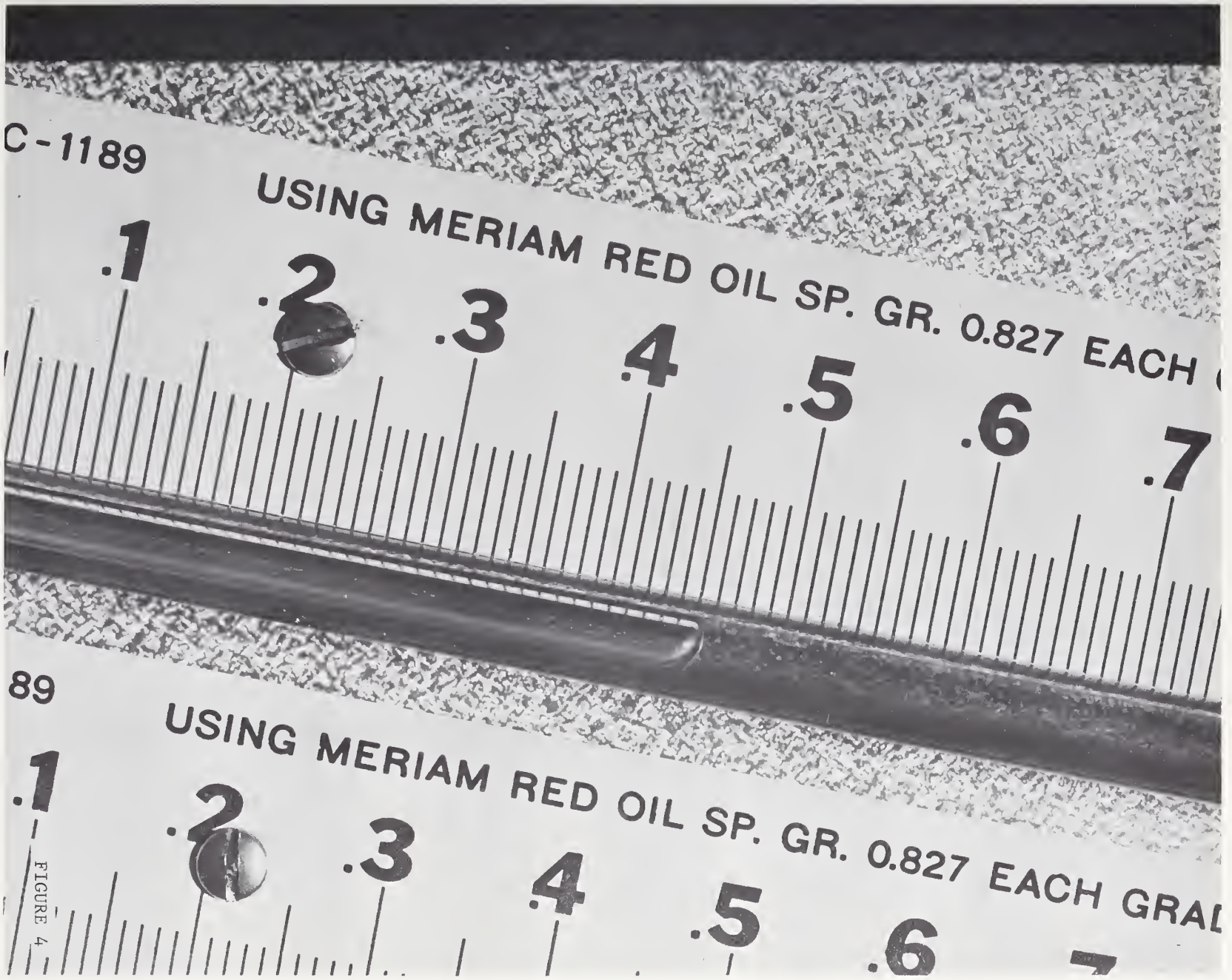


FIGURE 1

FIGURE 2

FIGURE 3


C-1189
USING MERIAM RED OIL SP. GR. 0.827 EACH
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.2
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.5
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.7
89
USING MERIAM RED OIL SP. GR. 0.827 EACH GRAD
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FIGURE 4

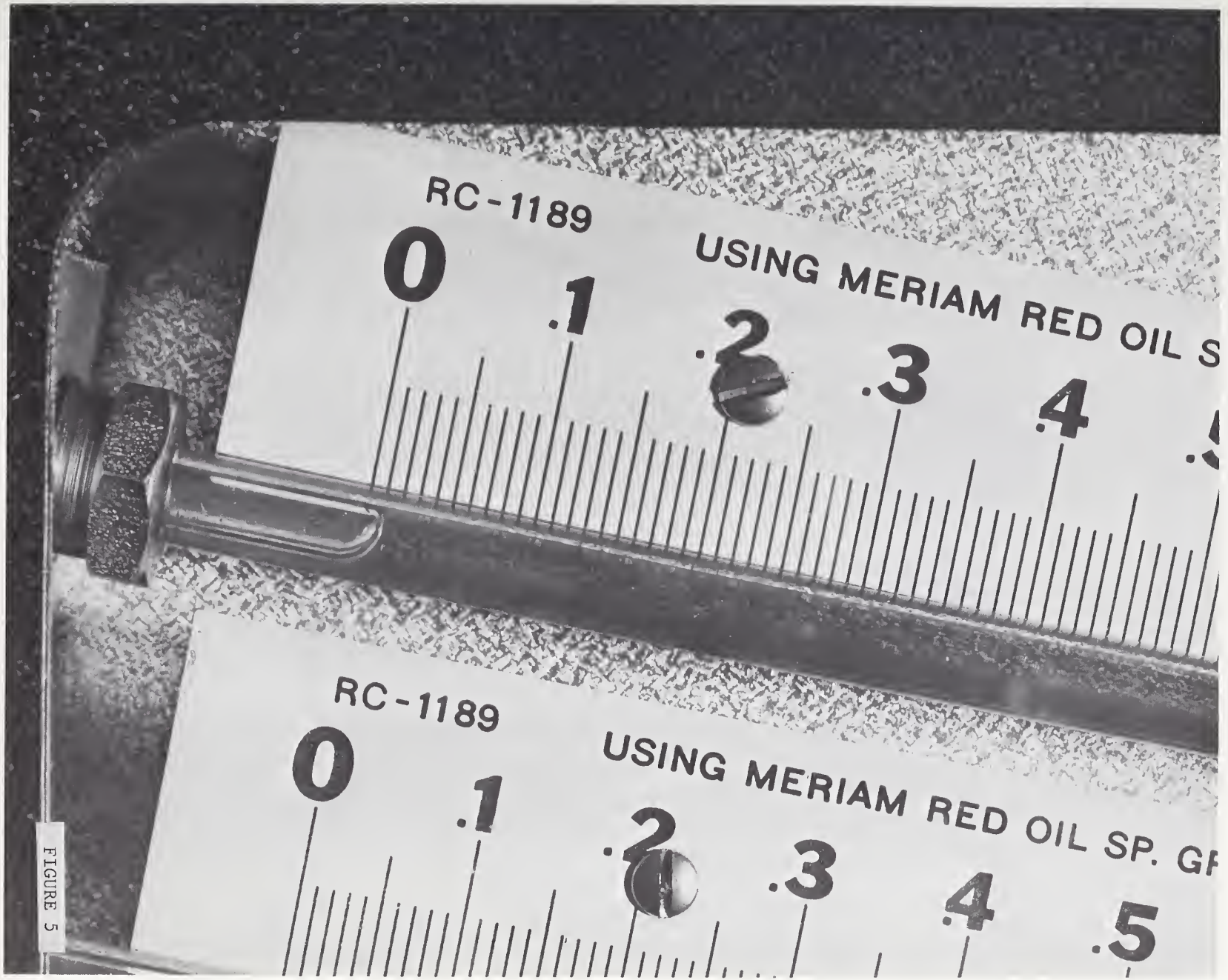
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FIGURE 5

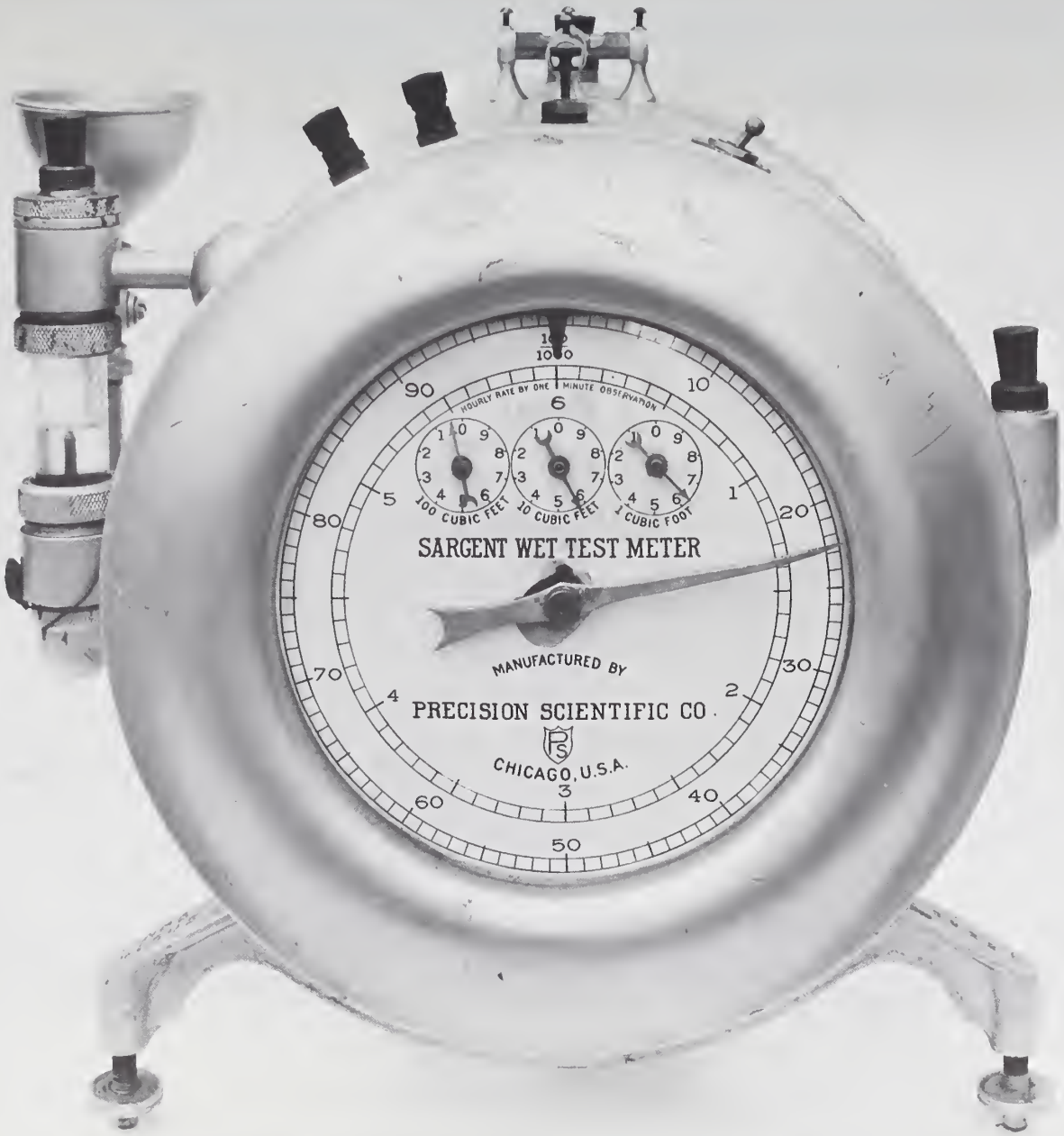
HOURLY RATE BY ONE MINUTE OBSERVATION
100 CUBIC FEET
10 CUBIC FEET
1 CUBIC FOOT
SARGENT WET TEST METER
MANUFACTURED BY
PRECISION SCIENTIFIC CO.
CHICAGO, U.S.A.

FIGURE 6


OHMS
D.C.
A.C.
A
B
C
Simpson
260
SERIES 6
VOLT - OHM - MILLIAMMETER
TAUT BAND SUSPENSION
ZERO DB-POWER LEVEL
.001 WATT 600 OHMS
OHMS PER VOLT
10 V RANGE: ADD 12 DB
50 V RANGE: ADD 26 DB
250 V RANGE: ADD 40 DB
Simpson
-10A.
+1 V.
-D.C.
+D.C.
A.C.
500 MA.
TRANSIT
2.5 V.
1 V.
10 V.
50 V.
MAMPS
250 V.
500 V.
1000 V.
100 MA.
10 MA.
AMPS.
1 MA.
Rx1
Rx100
Rx10,000
50 MAMPS.
250 MV.
+10A.
ZERO OHMS
COMMON
OUTPUT
1000 V.
A.C.
D.C.
260

FIGURE 7

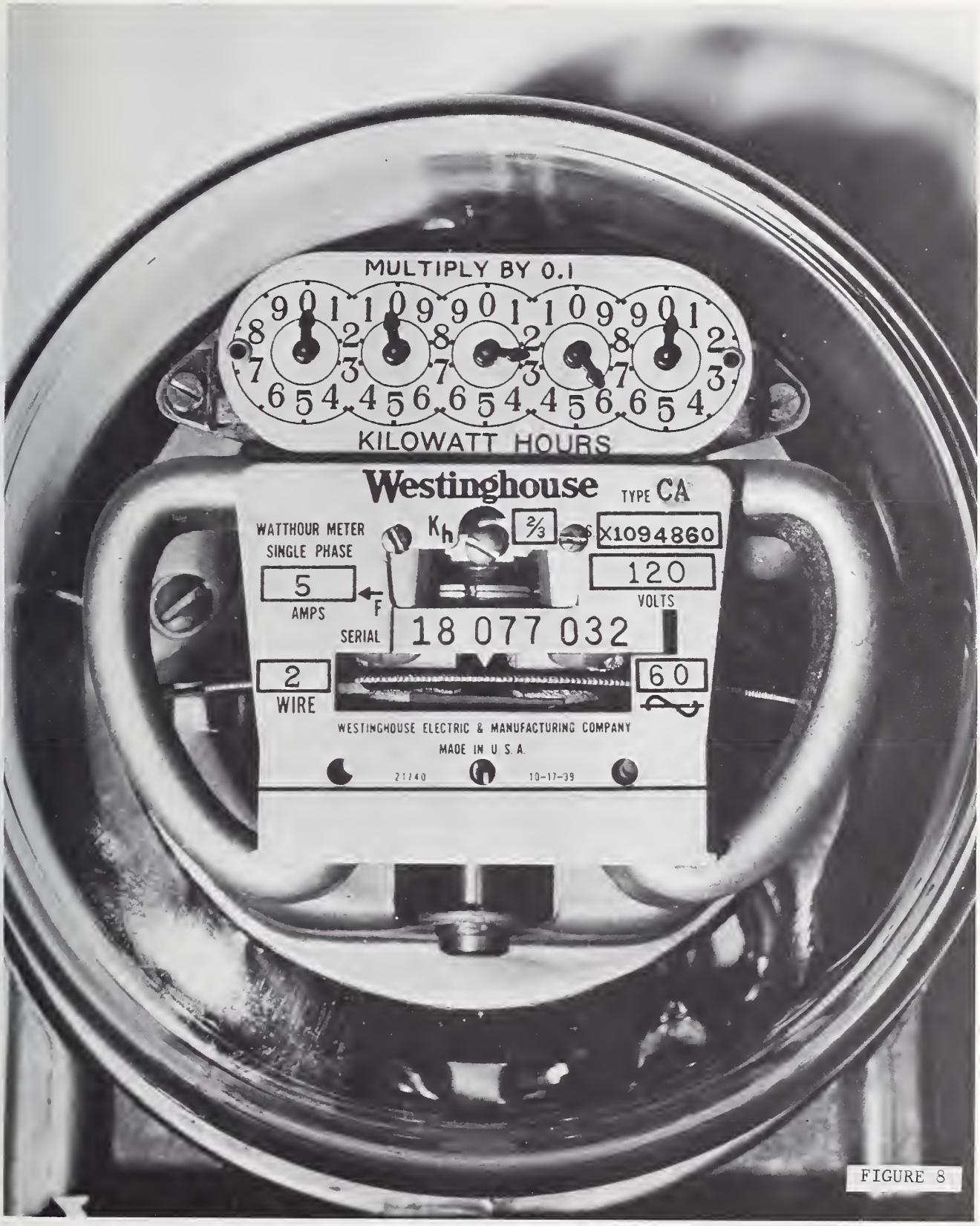
MULTIPLY BY 0.1
KILOWATT HOURS
Westinghouse
TYPE CA
WATTHOUR METER
SINGLE PHASE
Kh
2/3
X1094860
5
AMPS
120
VOLTS
SERIAL
18 077 032
2
WIRE
60
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
MADE IN U.S.A.
21140
10-17-39

FIGURE 8

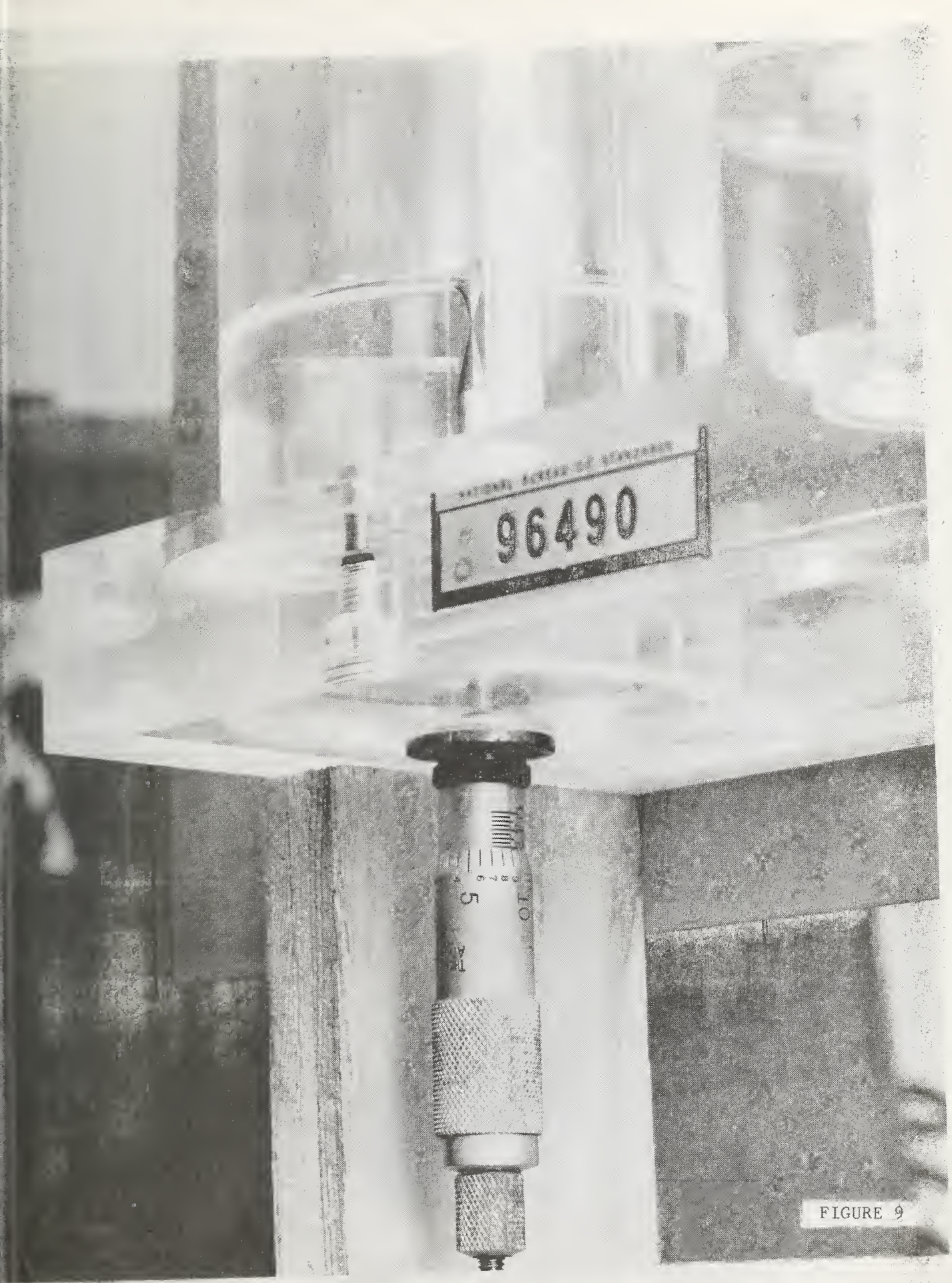

FIGURE 9

FIGURE 10

FIRE SAFETY QUESTIONNAIRE

GENERAL TESTING INFORMATION

Equipment

(Apparatus)
(O/S)

1. May we see the apparatus listed in ASTM E84? (Examiner please verify.)

Instrumentation

(Calibration)
(5)(S)

1. Do you have the listed recorders and meters to generate adequate records? Where needed, when did calibration take place? By whom? (See ASTM E4 and E74 for example.)

Facilities

(Facilities)
(5)(S)

May we see the facilities for performing the following stipulated tests? (Ref. Criteria).

a. Interior Finishes ASTM E84-67

b. Ducts UL 181 (E84) (Defines Class C)

Personnel

(Clerical)
(1)(M)

1. What is your clerical support and how is it organized?

(Publications)
(1)(M)

2. Have you published any papers in this field? List them.

(Training)
(1)(M)

3. Please show us your plans and/or programs to train people to do this work - particularly the technicians.

(Experience)
(1)(M)

4. In relation to your application to be accepted as a surface flamability test laboratory, we should like to get some appreciation of your interests in this field

and, therefore, would like to know: (1) Do you subscribe to and read the Fire Marshal's Journal, and Fire Prevention? (2) What materials and for what purpose have you tested for fire and flame properties?

(Test Method) (5) (O/S)

5. Do you have copies of the ASTM E84-6T test method?

(Instructions) (5)(O/S)

6. Do you have written supplementary apparatus operating instructions?

(Available) (3)(O/S)

7. Are these (5 & 6) readily available to the operator?

(Evaluation) (5)(S)

8. What procedures do you have for evaluation and reporting? May we have copies?

(Reports) (3)(S)

9. Do you issue reports? May we have a sample copy?

(Labels) (5)(S)

10. Do you furnish a labeling service? If so, please give us one of the labels, and outline the procedure for providing and controlling labels.

(Files) (1)(S)

11. Will you please show us your records and files? Examples of previous reports in this area?

TEST DEMONSTRATION

(Demonstration) (M)(O/S)

Will you now conduct the test demonstration for us. (When demonstration occurs, please make the following determinations.)

(Conditions) (5)(E)

1. Have the test samples been properly conditioned as specified at 70±50°F and 35-40% RH?

(Sample Size) (5)(E)	2. Are the test samples properly sized and mounted?
(Conditions) (5)(E)	3. Are the proper conditions being maintained to 70±5°F and 35-40% RH?
(Housekeeping) (1)(E)	4. Is the apparatus clean and in working order?
(Organization) (3)(E)	5. Is the operator or crew properly organized and have they well defined tasks?
(Fuel) (5)(O/S)	6. Do you know the heat rating of your fuel and how do you attain 5000 Btu/min.?
(Burner) (3)(E)	7. Is the burner standard and well regulated?
(Drafts) (3)(O/S)	8. Is the test affected by room drafts?
(Air Supply) (5)(O/S)	9. Is the air supply to the room ample and regulated to 70±5°F and 35-70 LH?
(Flame Front) (5)(E)	10. Can the operator properly interpret the flame front?
(Calculations) (5)(E)	11. Are there persons able to make the necessary calculations, for example, flame spread?
(Reference Samples) (1)(E)	12. Are there reference samples for comparison and/or calibration?

GENERAL TESTING INFORMATION

Equipment

(Verify)
(M)(E)

1. Verify that the required equipment listed in the Advanced Information exists.

   Note: the physical condition of each piece of equipment. Look for cleanliness, missing parts, broken glass or wires, readable scales, etc.

(Manuals)
(S)
(3)(E)

2. Are the operating equipment manuals or manufacturer's specifications readily available to the test operator?
   Verify.

(Storing)
(S)
(2)(E)

3. Is there provision for storing the equipment when not in use?
   Visually check adequacy.

(Procedures)
(S)
(3)(E)

4. Are there written procedures in the use, maintenance, and calibration of the equipment designed by the laboratory?
   Inspect for completeness.

(Calibration Label)
(5)(E)

5. For the equipment requiring calibration, is there tangible evidence on the equipment, such as a label or certificate, that calibration is being performed?

(Reference Standard)
(S)
(5)(E)

6. Against what reference standard is the test equipment being calibrated?
   Visually inspect these reference standards for completeness, if available.

(Accuracy) (M)(E)	7. Examine the calibration records. Do the records give evidence of obtaining 3% accuracy with these equipment?
Instrumentation	
(Verify) (M)(E)	1. Verify that the required instrumentation listed in the Advanced Information exists. Note the physical condition of each instrument. Look for cleanliness, missing parts, broken glass or wires, readable scales, etc.
(Manuals) (S) (3)(E)	2. Are the instrument operating manuals or manufacturer's specifications readily available to the test operator? Verify.
(Storing) (S) (2)(E)	3. Is there provision for storing the instruments when not in use? Check adequacy.
(Procedures) (S) (3)(E)	4. Are there written procedures for the use, maintenance and calibration of the instrumentation designed by the laboratory? Inspect for completeness.
(Label) (5)(S)	5. For the instruments requiring calibration, is there tangible evidence on the instruments, such as a label or certificate, that calibration is being performed? Verify that the label information is in accordance with the laboratory plan.
(Calibration Factors) (3)(S)	6. List two factors that your laboratory uses to establish the frequency of calibration for electrical instruments.

(Care) (4)(S)	7.	What precautions should be taken while transporting delicate electrical measuring instruments between the laboratory site and the field?
Facilities		
(Library) (3)(S)	1.	Verify that at least one current copy of the National Electrical Code and ANSI A119.1-1969 are readily available to the test operator.
(Filing) (3)(E)	2.	If a report filing system exists, verify that the reports are readily accessible. Obtain a recent sample report and attach to data.
(Working Standards) (3)((S)	3.	Does your laboratory have a standards area where your equipment and instruments are calibrated?
(Reference Standards)	4.	Are these reference standards traceable to higher standards as required by the Criteria for Testing Laboratories?
(Calibration Control) (4)(S)	5.	If the calibration is done by others, what procedures do you follow to check over the calibration as done by this group?
(Calibration Plan) (3)(S)	6.	Does the calibration plan time-span match the time the laboratory has been in operation? If not, when was the first calibration plan started?
(Work Area) (2)(E)	7.	Determine condition of the work area? (Clean, neat, etc.)

Personnel

Questions asked of the Dielectric Test supervisor.

(Procedure) (M)(S)	1.	Do you have written procedures describing the test? If yes, please supply one. If not, please briefly describe your test procedure.
(Failure) (4)(S)	2.	What constitutes failure in test? List two causes.
(Failure) (3)(S)	3.	To whom do you report the failure of the test?
(Error) (4)(S)	4.	How do you ascertain if the test results are reasonable?
(Report) (3)(S)	5.	Do you make a written report on the test? If yes, may I have a copy of a previous report?
(Read Out) (2)(S)	6.	How is the test data read out? How and by whom is it recorded?

Questions asked of the Continuity Test supervisor.

(Procedure) (3)(S)	1.	Do you have written procedures describing the test? If yes, please supply one. If no, please briefly describe your actual test procedure.
(Failure) (4)(S)	2.	What constitutes failure in this test? List two causes.
(Failure) (3)(S)	3.	To whom do you report the failure of the test?
(Report) (3)(S)	4.	Do you make a written report on the test? If yes, may I have a copy of previous report?
(Read Out) (2)(S)	5.	How is the test data read out? How and by whom is it recorded?

Questions asked of the manager of the laboratory.

(Training) (3)(M)
1. What type of training program do you have? Please provide an outline of the program.

(Responsibility) (2)(M)
2. Who has the final technical responsibility in your laboratory for the accuracy of your reports? Verify by looking in a recent report.

Questions asked of the Dielectric Test operator.

(Reading) (5)(O)
1. Determine the scale reading shown in Figure 1. Assume that the instrument is properly calibrated.

(Initial Steps) (4)(O)
2. What are the preliminary steps to be taken before applying the high voltage (HV) to the system?

(Safety)
3. If laboratory fabricated, what safety features exist in your High Voltage tester?

Questions asked of the Continuity Test operator.

(Initial Steps) (5)(O)
1. In performing the Continuity Test, assume the operator picked up the multi-tester or ohmmeter and applied the leads between the desired terminals. What steps should have been taken before applying the leads?

(Scale) (3)(O)
2. How do you determine the scale range to be used?

TEST DEMONSTRATION

After the examiner has witnessed the actual test demonstration, he will make the following observations:

(Connection) (3)(E)
1. Observe all the connections of the various instruments in the test set-ups. Are they correct?


OHMS
D.C
A.C
2.5 V.A.C
Simpson
260
SERIES 6
VOLT - OHM - MILLIAMMETER
TAUT BAND SUSPENSION
ZERO DB POWER LEVEL
.001 WATT 600 OHMS
OHMS PER VOLT
10 V RANGE: ADD 12 DB
50 V RANGE: ADD 26 DB
250 V RANGE: ADD 40 DB
DB
Simpson
-10A.
+1 V.
-D.C.
+D.C.
A.C.
500 MA.
TRANSIT
2.5 V.
1 V.
10 V.
50 V.
250 V.
500 V.
1000 V.
100 MA.
10 MA.
AMPS.
1 MA.
Rx1
Rx100
Rx10,000
50 AMPS.
250 MV.
+10A.
ZERO OHMS
COMMON
OUTPUT
1000 V.
A.C.
D.C.
260

FIGURE 1

(Precautions) (2)(E)	2. What precautions do the laboratory personnel take before turning the power on?
(Reading) (5)(E)	3. Are the laboratory personnel able to read the instruments correctly? Verify actual reading.
(Error) (5)(E)	4. If instrument requires it, does the operator zero it before using?
(Date) (3)(E)	5. Is the data being recorded neatly and correctly?

PLUMBING QUESTIONNAIRE

GENERAL TESTING INFORMATION

Equipment

(Caps & Plugs) (3)(S)

1. Do you segregate the caps and plugs used in the Water Distribution System Test from those used in the other tests?

(Air Test)

2. If the laboratory indicates that it performs the air test on drainage and vent system, the following questions are to be asked:

(M)(S)

a. Do you have a source of compressed air?

(3)(S)

b. Is the air supply adjustable from 0 to 10 psig?

Instrumentation

(Instruments) (M)(S)

1. Do you have a Bourdon gage and water manometer as required by the Criteria?

(Condition) (3)(E)

2. Inspect listed instrumentation for completeness and condition.

Facilities

(Test Floor) (E)

1. Based on your inspection of the test floor and the sketch furnished by the laboratory, does the test floor space and appurtenances meet the plumbing criteria regarding:

(Size) (5)

a. Is the area sized to accept the largest dwelling unit?

(Water) (M)

b. Is a potable water supply available within the test area?

(Sewer) (M)

c. Is a separate drainage system provided within the test area?

(Freeze) (M)

d. Do you have facilities to perform the Freeze Test on a prototype of the water distribution and drainage systems, at the minimum outside temperature upon which the units' heating systems design was predicated?

(Library) (M)(S)

2. Do you have at least one current copy of each of the referenced documents contained in Part II - Table II of ANSI A119.1-1969?

(Accessible) (5)(S)

3. Are these documents readily accessible?

(Filing) (5)(S)

4. Do you have a report filing system?

(Report-Accessible) (3)(S)

5. Are the reports readily accessible? Obtain a recent sample report.

Personnel

(Water Test) (M)(S)

1. What is the purpose of the Water Distribution System Test? Describe how it is performed.

(Drain Test) (M)(S)

2. What are the optional tests for the Drainage and Vent Systems? Describe each of the options?

(Option) (S)

3. Which option did you select for demonstrating a test on the Drainage and Vent System?

(3)(S)

Why did you select this option?

(Shower Stall)
(M)(S)

4. What is the purpose of the Shower Stall Pan Leak Test? Describe this test procedure.

(Freeze)
(M)(O)

5. What is the purpose of the Freeze Test? Describe the test procedure.

(Failure)
(M)(O)

6. What constitutes a failure in each of the test procedures?

(Failure)
(M)(O)

7. To whom do you report a failure?

(Report)
(M)(O)

8. Do you make a written report on each test? To whom is it directed?

(Manometer)
(5)(O)

9. When using a water manometer, what two items do you check to assure accurate representative readings?

TEST DEMONSTRATION

Water Distribution System Test

(Plugged & Capped)
(4)(E)

1. Verify that all openings, other than that in which the Bourdon gage has been installed, have been properly capped and/or plugged.

(Connection Check)
(4)(E)

2. After water pressure has been brought up to 100 psig, does the operator check all connections for leakage?

(Tap)
(4)(E)

3. Does the operator tap the gage prior to making his reading?

(Remmove Gage)
(3)(E)

4. After the test has been completed and before the system is drained, does the operator remove the gage and cap or plug the opening and then check for leaks?

(Time)
(3)(E)

5. Does the operator run the test under full 100 psig pressure for 15 minutes?

Drainage and Vent System Tests

(Plugged & Capped)
(M)(E)

1. Are all openings plugged and/or capped?

(Bled)
(5)(E)

2. After system is filled with water, are the higher runs bled of air?

(Manometer)
(M)(E)

3. If air pressure test is performed, is the water manometer installed properly, i.e., all connections checked for leaks, manometer level and checked for zero reading?

(Pressure)
(M)(E)

4. If air pressure test is used, is the system tested at the pressure set forth in the Criteria?

(Pressure Maintenance)
(3)(E)

5. Is the air pressure reading maintained or is there a loss of pressure?

(Leakage)
(3)(E)

6. In case of leakage, what does operator do?

(Time)
(M)(E)

7. If the flood level test is used, is the test sustained for 15 minutes?

(Check)
(5)(E)

8. If the flood level test is demonstrated, does the operator check to see that:

   a. Tub and shower drains are plugged?

   b. All fixtures are connected?

   c. The entire system filled with water to the rim of water closet bowl?

(High Fixtures) (5)(E)	9.	If the flood level test is demonstrated, does the operator check for leaks in the higher fixtures by filling them with water and simultaneously drain them to maintain maximum possible flow in drain piping?

Shower Stall Leak Test

(Pan Fill) (M)(E)	1.	Are the shower stall pans filled with water to top of dam?
(Water Level) (M)(E)	2.	Is the water level maintained constant without addition of more water for period of 15 minutes?

Freeze Test

(Fill) (M)(E)	1.	Are both water distribution and drainage systems filled with water?
(Temperature) (5)(S)	2.	What temperature are you going to maintain for 12 hours as a requirement of this test?
(Source) (5)(S)	3.	How was this temperature arrived at?
(Maintain Temperature) (3)(S)	4.	How do you maintain this temperature?
(Instrumentation) (3)(S)	5.	What instrumentation do you utilize to verify this temperature?

REPORT

Every laboratory examination shall be covered by a written report. The report and attachments shall present an organized summary of information collected from the application for examination and from the on-site visit. The basic purpose of the report is to provide technical information to the state accrediting authority in support of its evaluation of the laboratory's capabilities.

The report shall be reviewed and signed by the examiner and by the manager of the Laboratory Examining Agency, before being transmitted.

Copies of the report shall be furnished to the candidate laboratory and the cognizant state. At the request of the laboratory, limited copies of the report will also be furnished to other governmental or industrial organizations. The content of the technical report shall in no way be used for advertising purposes.

If, within a reasonable period of time*, the laboratory seeks accreditation in other states, a copy of the technical report will be furnished to those states in lieu of repeating the laboratory examination.

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*A regular cycle of periodic, updating examinations is envisioned in "This Is LEAP," page 10. A suggested "reasonable period of time" for utilizing the results of a previous examination for additional applications to other states would be up to one-half of the period of the normal, re-examination cycle.

ATTACHMENT "A"

EVALUATION GUIDELINES

The purpose of the attachment is to assist the accrediting authority in evaluating the examiner's report. In most cases, the intention underlying the requirement for a given observation to be made or question to be asked is self evident from the Criteria, and is not elaborated herein. However, in those cases where it is needed, further clarification of intent is provided in this attachment. The paragraph headings and numbers used are identical to those in the respective questionnaire.

STRUCTURES -- EVALUATION GUIDELINES

Equipment

1. Score	Answer
	The required equipment was in evidence and is:
1	Not maintained, but working.
3	Maintained as needed.
5	New or maintained regularly.

2. Score	Answer
3	Operating manual on file for testing machine only.
5	Yes, the operating manuals are on file on 90% of all equipment in the laboratory.

3. Score	Answer
3	All laboratory-fabricated equipment is covered by some specifications on file, but use is not outlined in writing. However, on-the-job training programs familiarizes all personnel with use.
5	All laboratory-fabricated equipment has a write-up including sketch of equipment and use.

5. Score	Answer
3	Some knowledge was exhibited by the personnel assigned to each piece of equipment as identified in the Advance Information. Limitations and load ranges on equipment were not known until engineer in charge explained to the technician.

	5	Interviewed personnel as identified in the Advance Information and all were found familiar and capable of operating the assigned equipment.
6.	Score	Answer
	0	No compliance to ASTM E4 and E74.
	3	Engineer in charge assures the examiner that reports are updated "once in a while."
	5	Laboratory procedures make provisions for complete compliance with ASTM E4 and E74.
7.	Score	Answer
	3	Calibration only.
	5	Calibration and standard test method.

Instrumentation

1.	Score	Answer
		The required instrumentation was in evidence and is:
	1	Not maintained, but working.
	3	Maintained as needed.
	5	New or maintained regularly.
3.	Score	Answer
	5	Calibration accomplished on a routine basis with procedures and resources up-to-date and in writing.
4.	Score	Answer
		Personnel interviewed exhibited:
	1	Little knowledge.

3	Some knowledge.
5	Complete knowledge.

Facilities

1. Score	Answer
5	Yes, by instrumentation or analysis of test fixtures.

2. Score	Answer
Comments	Inside space rates higher than parking lot.

Personnel

1. Score	Answer
5	Uses pre-test analysis or experience and then checks data results during test.

Test Demonstration

1. Score	Answer
1	Knows how to do one.
3	Demonstrates some knowledge.
5	Demonstrates knowledge of all.

2. Score	Answer
1	Numbers on a sheet, no identification.
5	Organized, legible, all pertinent items labeled or identified.

3. Score	Answer
5	Control instrumentation plus analysis or experience on all test fixtures, support rods, and test bed.

6. Score	Answer
a, b, c, d,	Rate 5 on each for full knowledge and demonstrated capability.

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) EVALUATION GUIDELINES

Instrumentation

4. The ± 2% is a guideline, not a must. Where one or more exceptions are noted, the weighted score should indicate the relative importance of that particular instrument and the degree to which it exceeds the tolerance guideline.

5.

Score	Answer
0	Have conducted no error analysis.
1 or 2	Yes, as supported by gut feel.
3 or 4	Yes, all but one test which we are working on, as supported by some "paper and pencil" analysis.

Personnel

1a. and 1b.

Score	Answer
0	I don't know.
1 or 2	I guess he went by my previous experience.
3 or 4	He checked into my graduation from an accredited technical school.
5	I graduated from an accredited technical school plus either 1) I am registered as a technician or engineer in my field or 2) I was trained and tested on my performance in running the required tests.

1c.

Score	Answer
0	None.
2 or 3	I log it in the data book and tear down the set-up.

4 or 5	I log it in the data book and notify the test supervisor before tearing down the set-up.

2a.
2b.

Score	Answer
0	No.
1	Yes, casual instruction.
3	Yes, lecture or demonstration.
4 or 5	Yes, lecture or demonstration backed by written materials.

4b.

Score	Answer
0	No.
1	Yes.
2	Yes, we have somebody look it over.
3	Yes, the test supervisor witnesses the test.
4 or 5	Yes, the written procedure specifies that we record the data and compare it as we go with expected results, or we plot a "running" curve to make sure the points fall about where they should.

6a. Comment: This optional question is most useful for the more sophisticated instruments which a laboratory may elect to use in lieu of the minimum required types.

Facilities

4. Score	Answer
5	Shows copies of written procedures.

5. Score	Answer
5	Shows labels and copy of procedures.

6. Score	Answer
5	Shows copies of reports in good format.

Test Demonstration

6. Score	Answer
5	Heat rating is obtained from the gas company and gas is measured with a gas meter or rotameter.

ELECTRICAL EVALUATION GUIDELINES

Equipment

2. Score	Answer
1	Manual for only one item.
3	Have only a few.
5	Have all the manuals.

4. Score	Answer
5	There are procedures in the use, maintenance, and calibration of the equipment.

Instrumentation

6. Score	Answer
5	Time elapsed, usage, improper handling, etc.

7. Score	Answer
5	Special covering to protect the instruments, (foam, etc.) box labeled fragile, carry in my hands.

Personnel

Dielectric Test Supervisor

2. Score	Answer
5	The protective current limiting device of the high voltage tester keeps on tripping or the voltage does not rise to the rated test value.

3. Score	Answer
3	To factory production foreman.
5	To my supervisor.

4.

Score	Answer
5	System withstands the voltage without breakdown.

Continuity Test Supervisor

2.

Score	Answer
5	Have a definite resistance reading.

3.

Score	Answer
3	To factory production foreman.
5	To my supervisor.

Manager

1.

Score	Answer
3	On-the-job training.
5	Formal program with lectures and demonstrations.

2.

Score	Answer
0	The operator.
4	The test supervisor.
5	Myself.

Dielectric Test Operator

1.

Score	Answer
5	Check continuity of ground and sound alarm or other means to warn people that a high voltage test is being performed.

3.

Score	Answer
5	Fast acting automatic current limiter, cabinet and panel at potential.

Continuity Test Operator

1. Score	Answer
5	Basic step is to zero the instrument before using it.

PLUMBING EVALUATION GUIDELINES

Personnel

1. Score	Answer
5	The purpose of the test is to determine whether the water distribution system will sustain a 100 psi pressure without leaking.

2. Score	Answer
5	The optional tests for the drainage and vent system are Water Test, Air Test, Flood Level Test, and Fixture Test.

3. Score	Answer
0	Don't know how to perform the other tests.
3	We are equipped only to run this option.
5	We selected this option because our laboratory feels it is the most fool-proof of the optional tests.

5 Score	Answer
5	The purpose of the Freeze Test is to ascertain whether or not the plumbing system is designed and protected so as to preclude freezing when used in the lowest design-temperature environment.

7. Score	Answer
0	I don't report failures.
5	I report failures to my supervisor.

8. Score	Answer
0	I don't make a written report.

5	I make a written report on each test and it is directed to my supervisor.

9.

Score	Answer
0	Don't know.
1	Level.
2	Zero reading.
5	Level and zero reading.

Test Demonstration

Drainage and Vent System Tests

6.

Score	Answer
0	Nothing.
5	Check where leaks are and report to supervisor.

Freeze Test

2.

Score	Answer
5	At the outside temperature for which the heating system of the unit is designed.

4. Comment: Examiner must inspect the system and area in which the test is made, listen to the explanation of the supervisor and record the information collected.

5.

Score	Answer
5	Examiner should check for a recording thermometer.

APPENDIX

SI CONVERSION UNITS

In view of present accepted practice in this country in this technological area, common U.S. units of measurement have been used throughout this paper. In recognition of the position of the USA as a signatory to the General Conference on Weights and Measures, which gave official status to the metric SI systems of units in 1960, we assist readers interested in making use of the coherent system of SI units, by giving conversion factors applicable to U.S. units used in this report.

Length

1 in = 0.0254* meter

1 ft = 0.3048* meter

Area

1 in^2 = 6.4516* x 10^{-4} $meter^2$

1 ft^2 = 0.09290 $meter^2$

Force

1 lb (LBF) = 4.448 newton

1 kip = 4448 newton

Pressure, Stress

1 psi = 6895 $newton/meter^2$

Mass/Volume

1 lb/ft^3 (lbm/ft^3) = 16.02 $kilogram/meter^3$

Temperature

°F (Fahrenheit) = 9/5 °C (celsius) + 32*

*Exactly