STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608475 228 ■

ASME QFO-1-1998

STANDARD FOR THE QUALIFICATION AND CERTIFICATION OF OPERATORS OF HIGH CAPACITY FOSSIL FUEL FIRED PLANTS

AN AMERICAN NATIONAL STANDARD



The American Society of Mechanical Engineers

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608476 164 ■



The American Society of Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

STANDARD FOR THE QUALIFICATION AND CERTIFICATION OF OPERATORS OF HIGH CAPACITY FOSSIL FUEL FIRED PLANTS

ASME QFO-1-1998

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

Date of Issuance: January 25, 1999

The 1998 edition of this Standard is being issued with an automatic addenda subscription service. The use of addenda allows revisions made in response to public review comments or committee actions to be published on a regular yearly basis; revisions published in addenda will become effective 6 months after the Date of Issuance of the addenda. The next edition of this Standard is scheduled for publication in 2003.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. The interpretations will be included with the above addenda service. Interpretations are not part of the addenda to the Standard.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assumes any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations issued in accordance with governing ASME procedures and policies which precludes the issuance of interpretations by individual volunteers.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

Copyright © 1999 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All Rights Reserved
Printed in U.S.A.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

FOREWORD

(This Foreword is not a part of ASME QFO-1-1998)

The American Society of Mechanical Engineers, at the request of the U.S. Environmental Protection Agency (EPA) and, in recognition of the needs and benefits associated with standard qualifications of operators of high capacity fossil fuel fired plants, established the Qualifications of High Capacity Fossil Fuel Fired Operator (QFO) Committee in 1994. The purpose of the QFO Committee is to develop and maintain such a standard for operators.

This Standard includes qualifications, duties, responsibilities, and the certification requirements for operators as appropriate to The Clean Air Act as amended in 1990 for fossil fuel fired plants with inputs equal to or greater than 10E + 06 Btu/hr (10,550 E + 06 J/hr). This Standard does not cover the certification or validation of fossil plant operating procedures, operating practices, facility performance, nor compliance with any particular permit requirement.

Certification is based on three components; recommended education, experience, and passing a written examination.

There are six classes of available certification, which depend on the type of fossil fuel being fired and on the firing method(s). **Class A** certification applies to operators of fossil plants burning pulverized fuel (including cyclone). **Class B** applies to operators of fossil plants burning oil or gas or a combination of oil and gas in a single burner. **Class C** applies to operators of fossil plants that burn oil or gas or a combination of oil and gas in a multiple burner. **Class D** applies to operators of stoker fired fossil plants. **Class E** applies to operators of fluidized bed fossil plants. **Class F** applies to operators of auxiliary fired heat recovery steam generators (HRSG). The certification is not site specific and may be applied to the operation of a different facility provided the class of the certification is comparable with the equipment to be operated.

This Standard recognizes the titles or positions to which any particular fossil plant operator may apply, will vary within a facility. Therefore, this Standard does not attempt to identify the individual who is required to obtain certification in any class designation. The fossil plant owner is urged to contact the applicable jurisdiction in which the fossil plant is located in this regard.

This Standard does not in itself require certification but rather it serves as a means for complying with federal, state, and local regulations which may require operators of fossil fuel fired boilers with inputs equal to or greater than 10E + 06 Btu/hr (10,550 E + 06 J/hr) to be certified. The requirements of this Standard should be taken into consideration when drafting and enforcing such regulations; e.g., if modifications are made to any fossil fuel fired plant, a certain grace period should be allowed to let the existing certified operator be redesignated.

Safety codes and standards are intended to enhance public health and safety. Revisions to this Standard result from committee considerations of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions of this Standard were inadequate.

ASME codes and standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

Committee by requesting interpretations, proposing revisions, and attending committee meetings. Correspondence should be addressed to:

Secretary, QFO Main Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions will be made periodically to the Standard to incorporate changes which appear necessary or desirable, as demonstrated by the experience gained from the application of the requirements. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing:

(a) the paragraph numbers(s);

(b) the proposed wording; and

(c) a detailed description of the reasons for the proposal.

Requesting interpretations. On request, the Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the Main Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his request utilizing the following format.

(a) Subject. Cite the applicable paragraph number(s) and a concise description.

(b) Edition. Cite the applicable edition and addenda of the standard for which the interpretation is being requested.

(c) Question. Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation.

Requests which are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information which might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee or subcommittee.

Attending Committee Meetings. The QFO Main Committee and the various Subcommittees regularly hold meetings, all of which are open to the public. Persons wishing to attend any meeting or to apply to become a member of the Committee should contact the Secretary of the Main Committee.

This Standard, which was approved by the QFO Committee and ASME, was approved by The American National Standards Institute and designated an American National Standard on June 17, 1998.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

ASME QFO COMMITTEE
Qualification of High Capacity Fossil Fuel Fired Operator

(The following is the roster of the Committee at the time of approval of this Standard.)

OFFICERS

W. H. Axtman, *Chair*
R. M. DeHart, *Vice Chair*
R. W. McGinnis, *Secretary*

COMMITTEE PERSONNEL

W. P. Armbrust, Industrial Resources
W. H. Axtman, Gray Gull Associates
D. D. Ball, United Association Plumbers & Pipefitters
M. J. Bostic, Duke Power Company
M. K. Brewer, USA CERL
R. M. DeHart, Cogentrix Operations
M. H. Diehl, State of Maryland
J. A. Eddinger, Environmental Protection Agency
R. R. Fray, Trax Corp.
R. D. Griebenow, Electric Power Research Institute
L. Hamm, Consultant
R. H. Hayes, Consultant
B. E. Hrubala, Hartford Steam Boiler
R. L. Johnson, Alabama Power Co.
M. H. Long, Consultant
J. Moscatiello, The Training Center
R. H. Mosher, American Boiler Manufacturers Association
R. I. Mullican, M&M Welding Fabricators Inc.
J. F. Schmid, Consultant
B. A. Schroeder, Mercy Center
M. A. Trykoski, Edison Electric Institute
N. R. Wright, Anheuser Busch
T. L. Patterson, *Alternate,* Cogentrix Operations
S. C. Potter, *Alternate,* Duke Power Co.
A. H. Studebaker, *Alternate,* Naval Facilities Enginering

SUBCOMMITTEE ON DUTIES AND QUALIFICATIONS

N. R. Wright, *Chair,* Anheuser Busch
B. E. Hrubala, *Vice Chair,* Hartford Steam Boiler
M. M. Bailey, Salt River Project
D. D. Ball, United Association Plumbers & Pipefitters
R. M. DeHart, Cogentrix Operations
M. H. Diehl, State of Maryland

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

R. H. Hayes, Consultant
R. I. Mullican M&M Welding Fabricators, Inc.

SUBCOMMITTEE ON TESTING

W. P. Armbrust, *Chair,* Industrial Resources, Inc.
J. P. Millman, *Secretary,* ASME
M. J. Bostic, Duke Power Company
R. M. DeHart, Cogentrix Operations
M. D. Witte, ABB CE Services
J. A. Eddinger, Environmental Protection Agency
L. Hamm, Consultant
R. I. Mullican, M&M Welding Fabricators
M. A. Trykoski, Edison Electric Institute
E. Zanoni, GPU Generation Corp.

SUBCOMMITTEE ON DEFINITIONS

B. A. Schroeder, *Chair,* Mercy Center
R. H. Mosher, *Vice Chair,* American Boiler Manufacturers Association
L. Hamm, Consultant
T. L. Patterson, Cogentrix Operations
S. C. Potter, Duke Power Co.

SUBCOMMITTEE ON CERTIFICATION

J. Moscatiello, *Chair,* The Training Center
S. C. Potter, *Vice Chair,* Duke Power Co.
J. P. Millman, ASME
R. L. Johnson, Alabama Power Co.
R. H. Mosher, American Boiler Manufacturers Association
B. A. Schroeder, Mercy Center
J. Moscatiello, *Alternate,* The Training Center

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

CONTENTS

Foreword iii
Committee Roster v

1 Scope and Purpose 1
1.1 Scope 1
1.2 Exclusions 1
1.3 Purpose 1
1.4 Definitions 1

2 Duties and Qualifications 3
2.1 General 3
2.2 Duties 3
2.3 Fossil Combustion Operator Class Designations 3
2.4 Qualifications 3
2.5 Certification 3

3 Testing 5
3.1 General 5
3.2 Part 1 5
3.3 Part 2 5

4 Certification Process 7
4.1 Introduction 7
4.2 Application Process 7
4.3 Operator Certification 7
4.4 Certificate Transportability 8
4.5 Recertification 8
4.6 Changes to Facility 8
4.7 Change of Ownership 8
4.8 Revocation of Certification 8
4.9 Appeals 8

Appendices
I Examination Guidelines 9
II Useful Definitions 11

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STANDARD FOR THE QUALIFICATION AND CERTIFICATION OF OPERATORS OF HIGH CAPACITY FOSSIL FUEL FIRED PLANTS

SECTION 1-0
SCOPE AND PURPOSE

1.1 Scope

1.1.1 This Standard specifies the requirements leading to certification as a fossil combustion operator of a high capacity fossil fuel fired plant as appropriate to the Clean Air Act as amended in 1990, for a fossil fuel fired boiler with an input equal to or greater than 10E + 06 Btu/hr (10,550 E + 06 J/hr).

1.1.2 This Standard provides a procedure for qualification, examination, and certification of the operator. Due to the diversity of size, operation, and process of the organizations and plants affected, this Standard does not identify which specific position(s) or which individual(s) will be certified.

1.2 Exclusions

1.2.1 This Standard does not cover plants (boilers) exclusively firing:

(a) wood;
(b) wood residue;
(c) industrial waste;
(d) municipal waste;
(e) combustion turbine exhaust.

1.3 Purpose

1.3.1 This Standard provides requirements to be used in certifying an individual as a fossil combustion operator. These requirements recognize the knowledge, training, and experience in the physical operation of a plant needed to comply with the plant's air quality operating permits and related environmental criteria.

1.3.2 This Standard does not cover the certification or validation of plant operating procedures, operating practices, facility performance, nor compliance with permit requirements.

1.4 Definitions

boiler: a closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof by direct application of heat. The term boiler shall include fired units for heating or vaporizing liquids other than water where these systems are complete within themselves.

coal: solid hydrocarbons resulting from the decomposition of vegetable material under the influence of time, temperature, pressure, and micro-organisms, as defined by ASTM D 388.

Continuous Monitoring Systems (CMS): the total equipment, required under the applicable emission monitoring sections of Title 40 U.S. Code of Federal Regulations, used to sample and condition (if applicable), to analyze and to provide a permanent record of emission, or process parameter. This includes Continuous Emission Monitoring Systems, Continuous Opacity Monitoring Systems, or Alternative Monitoring Systems approved per the requirements of 40 CFR Parts 60 and 75.

criteria: the standard EPA has established for certain pollutants, which limits both the concentration and the number of violations per year.

cyclone coal burner: a scroll, vortex, or radial burner firing crushed coal into a cyclone furnace consisting of a horizontal water cooled cylinder attached to the side of the boiler furnace.

cyclone furnace: a water-cooled horizontal cylinder into which fuel is fed and mixed with air; combustion is completed in a minimum of time with high temperatures 2450°F to 2550°F (1345°C to 1400°C) generated in the burner. Combustion is virtually completed in the cyclone. Cyclone burners are adaptable for burning bark, oil, gas, and coal or a combination of these fuels.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

facility: see Fossil Fuel Fired Plant.

fluidized bed: a process in which a bed of granular particles is maintained in mobile suspension by an upward flow of air or gas.

Fossil Combustion Operator (FCO): the person certified under this Standard. See Section 2.0.

fossil fuel: natural gas, petroleum, coal, or solid, liquid or gaseous fuel derived from such materials.

fossil fuel fired plant: any facility containing one or more fossil fuel fired boilers with input rates per fired boiler equal to or greater than 10E + 06 Btu/hr (10,550 E + 06 J/hr).

fuel oil: any hydrocarbon oil defined by ASTM D 396.

general industry: an enterprise(s) or organization(s) that produce(s) or supplies goods or services.

Heat Recovery Steam Generator (HRSG): a heat exchanger that uses a series of heat transfer sections (e.g., superheater, evaporator, and economizer) positioned in the exhaust gas flow of a combustion turbine or an internal combustion engine to recover heat and supply a rated steam flow at a required temperature and pressure.

high capacity: aggregate heat input rate equal to or greater than 10E + 06 Btu/hr (10,550 E + 06 J/hr).

industrial process: the manufacturing or treatment of products, goods, or services.

natural gas: a naturally occurring mixture of hydrocarbons (methane or higher) maintaining a gaseous state at standard atmospheric temperature and pressure conditions.

plant: see Fossil Fuel Fired Plant.

pulverized fuel: solid fuel reduced to a size such that more than 50% will pass through a 200 mesh sieve (74 μ).

stoker (mechanical stoker): a device consisting of a mechanically operated fuel feeding mechanism and a grate, used for the purpose of feeding solid fuel into a furnace, distributing it over a grate, admitting air to the fuel for the purpose of combustion, and providing a means for removal or discharge of refuse.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

SECTION 2-0
DUTIES AND QUALIFICATIONS

2.1 General

This section establishes the duties and qualifications of a fossil combustion operator of a high capacity fossil fuel fired boiler. The title of positions of the fossil combustion operator may vary within each facility. The fossil combustion operator shall be either an individual who operates and controls the boiler combustion process (and/or associated emissions control systems) or is responsible for supervision, technical direction, or training of those that operate and control.

2.2 Duties

The duties and responsibilities of a fossil combustion operator may include, but are not limited to, the following:

(a) overall operation of the boiler(s);

(b) establishing site specific operating procedures for the boiler(s);

(c) operating the boiler(s) in accordance with policies and procedures established for the location;

(d) assuring boiler plant personnel are qualified and trained in combustion technology, combustion equipment, emission control, and monitoring equipment, policies, and procedures;

(e) assuring boiler plant operation is consistent with applicable federal, state, and local environmental requirements;

(f) supervising, training, and monitoring performance of personnel that operate the boiler plant.

2.3 Fossil Combustion Operator Class Designations

The fossil combustion class designations listed below are based on the type of fossil fuel fired and firing methods.

Class A — Pulverized fuel fired plants and cyclone furnaces

Class B — Single burner oil, gas, or combination fired plants

Class C — Multiple burner oil, gas, or combination fired plants

Class D — Stoker fired plants

Class E — Fluidized bed plants

Class F — Auxiliary fired heat recovery steam generators

2.4 Qualifications

The qualifications for fossil combustion operator under this Standard are as follows:

(a) High school diploma or equivalent and two years experience in general industry or industrial process. The applicant's experience shall include boiler operations; or

(b) An associate degree in technical studies or sixty credits of course work from an accredited institution, plus one year experience in general industry or industrial process. The applicant's experience shall include boiler operations and the coursework must be in the following subjects:

(1) advanced mathematics;

(2) chemistry;

(3) fluid dynamics;

(4) thermodynamics;

(5) materials science;

(6) combustion theory;

(7) environmental, mechanical, civil, chemical, or electrical engineering; or

(c) A baccalaureate degree in physical science or engineering and one year experience in general industry or industrial process. The applicant's experience shall include boiler operations; and

(d) They shall have demonstrated the understanding of fossil combustion principles and combustion safety principles by passing a written examination as outlined in Section 3 of this Standard.

2.5 Certification

Operator certification, renewal, or change in class designation shall be in accordance with Section 4.0 of this Standard.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608486 003 ■

SECTION 3-0
TESTING

3.1 General

There shall be separate examinations for each of the class designations listed in para. 2.3. The examinations shall be structured as closed book, multiple choice, written examinations. Each examination shall consist of two parts.

Part 1. Addresses general knowledge and shall include no less than 75 nor more than 125 questions. Part 1 shall be a two (2) hour examination.

Part 2. Addresses the specific fossil combustion operator class designation(s); one examination for each classification. Each specific class designation examination shall include no less than 50 nor more than 75 questions. A one (1) hour time period will be allotted for each specific class designation.

To achieve certification, an applicant must correctly answer at least 70% of the questions in Part 1 and at least 70% of the questions in each Part 2 taken.

3.2 Part 1

The general knowledge examination shall include the categories as listed in the Examination Guidelines (Appendix I).

3.3 Part 2

Each specific class designation examination shall include applicable questions on the various categories listed in the Examination Guidelines (Appendix I).

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608487 T4T ■

SECTION 4-0
CERTIFICATION PROCESS

4.1 Introduction

This section covers the process necessary to certify the fossil combustion operator of a high capacity fossil fuel fired plant in accordance with this Standard.

4.2 Application Process

Each applicant for high capacity fossil fuel fired operator certification shall complete a written application on forms which allow for verification that the applicant's education and experience meet the requirements outlined in Section 2.0 of this Standard.

4.2.1 Single Class Designation Application. Individuals desiring certification for a single class designation shall submit a Single Class Designation Application. This application requires the individual to complete Part 1 and one Part 2 examination. Single Class Designation Applications shall provide the following:

(a) Documentation of experience confirming operational knowledge of the equipment for the applied class designation. Documentation shall include type and size of the applicable equipment;

(b) A brief history of applicable training.

4.2.2 Multiple Class Designation Application. Individuals desiring certification for more than one class designation shall submit a Multiple Class Designation Application. This application requires the individual to complete Part 1 and more than one Part 2 examination. Multiple Class Designation Applications shall provide the following;

(a) Documentation of experience confirming operational knowledge of the equipment for all applicable class designations. Documentation shall include type and size of all applicable equipment;

(b) A brief history of all applicable training.

4.2.3 Application for Additional Class Designation. The application for additional class designation shall be completed by the applicant who is currently certified in one or more of the class designations outlined in para. 2.3. A currently certified individual is exempt from retaking Part 1 of the examination. The application for additional class designation shall provide the following:

(a) Documentation of experience confirming operational knowledge of the equipment for the applied class designation(s). Documentation shall include types and sizes of the applicable equipment;

(b) A brief history of applicable training.

4.2.4 Application Forms. Application forms for certification can be obtained from:

QFO Certification Program
ASME Accreditation & Certification
Three Park Avenue
New York, NY 10016-5990

Upon acceptance of the completed application, ASME will notify the applicant of the dates and locations of scheduled examinations.

4.3 Operator Certification

A high capacity fossil fuel fired operator certificate will be issued when the following requirements are met:

(a) Certification qualifications for the class designations outlined in para. 2.3;

(b) Successful completion of an operator certification examination as outlined in Section 3 of this Standard.

4.3.1 The certificate shall expire five (5) years after its issue unless renewed.

4.3.2 Each certificate shall contain the following minimum information:

(a) Identification as a high capacity fossil fuel fired operator certificate;

(b) Class designation of certification in accordance with para. 2.3;

(c) Certified individual's full name;

(d) Effective date of certification;

(e) Expiration date of certification;

(f) Serial number to assure traceability and accuracy;

(g) Signature of a designated ASME representative.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608488 986 ■

4.4 Certificate Transportability

The certificate is transportable and applies only to the scope of equipment and equipment classification listed on the certificate.

4.5 Recertification

4.5.1 The certificate holder shall submit an application for recertification prior to the expiration of the existing certification.

4.5.2 A written examination for recertification is not required provided the certificate holder submits notarized documentation showing they have maintained experience in their class designation for a minimum of 3 of the previous 5 years. The certificate holder(s) shall take a written examination for recertification when they are unable to document operational experience in the class designation.

4.5.3 If the recertification experience requirement is not met, the existing certification will expire. To regain certification, the individual must complete the requirements of para. 4.2 of this Standard.

4.6 Changes to Facility

Equipment changes or modifications resulting in a new Class operator designation requires that certified individuals take the examination for the new Class certification.

4.7 Change of Ownership

A change in the ownership of a fossil fuel fired plant shall not invalidate the operator's certificate.

4.8 Revocation of Certification

High capacity fossil fuel fired operator certification(s) may be revoked by ASME for reasons of falsifying or providing inaccurate information in the certification process.

4.9 Appeals

Appeals regarding operator certification(s) shall be conducted in accordance with the ASME appeal policies and procedures.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608489 812 ■

APPENDIX I EXAMINATION GUIDELINES

(This Appendix is an integral part of ASME QFO-1-1998.)

	Part 1	Part 2 — Class Designations					
Categories	**General Knowledge**	**Class A: Pulverized Fuel and Cyclone Furnaces**	**Class B: Oil/Gas—Single Burner**	**Class C: Oil/Gas—Multiple Burner**	**Class D: Stoker Fired Plants**	**Class E: Fluidized Bed Plants**	**Class F: Auxiliary Fired HRSG's**
Systems and Equipment	Fundamentals: •Steam system •Hot water system •Primary and secondary air flow paths •Combustion gas flow path	•Burner/boiler design •Primary air •Secondary air •Ignition system •Burner management	•Burner/boiler designs •Water tube vs. Fire tube boilers •Primary air •Secondary air •Ignition system •Burner management	•Burner/boiler design •Primary air •Secondary air •Ignition system •Burner management	•Types of stokers •Settings •Undergrate air •Overfire air •Cinder reinjection •Furnace draft system •Ash removal system	•Burner/boiler design •Types of fluidized bed systems •Combustion air delivery systems •Fuel delivery systems •Limestone delivery systems •Ash cooling and removal systems	•HRSG design •HRSG configuration •Burners and piping systems
Operation	Fundamentals: •Monitoring steam/water circuit •Monitoring combustion •Combustion efficiency •Boiler efficiency •Start-up/shutdown procedures •Control systems •Instrumentation •Maintenance programs	•Basics of coal pulverization •Fuel analysis and preparation •Air flow and distribution control •Air temperature control •Burner operation •Controlling combustion •Ash handling •Purging the furnace	•Fuel analysis and preparation •Damper operation •Purging the furnace •Burner operation •Controlling combustion	•Fuel analysis and preparation •Damper operation •Purging the furnace •Burner operation •Controlling combustion	•Grate operation •Coal Feeder Operation •Undergrate air regulation •Overfire air regulation •Regulation of fuel bed •Start-up/shutdown •Banking	•Fluidized bed theory of operation •Boiler start-up and shutdown	•Steam generator operation •Burner operation
Combustion Quality	Fundamentals: •Combustion terms •Fossil fuel characteristics •Fuel analysis •Air/fuel mixture •Products of combustion	•Air to fuel combustion ratio •Excess air requirements •Fuel quality •Combustion of coal •Combustion products •Combustion measurements and interpretation	•Air to fuel combustion ratio •Excess air requirements •Combustion products •Combustion of oil/gas •Combustion measurements and interpretation	•Air to fuel combustion ratio •Excess air requirements •Combustion of oil/gas •Combustion products •Combustion measurements and interpretation	•Air to fuel combustion ratio •Excess air requirements •Fuel quality •Combustion products	•Air to fuel combustion ratio •Excess air requirements •Fuel quality •Combustion products •Fuel/sorbent characteristics and combustion	•Air to fuel combustion ratio •Excess air requirements •Fuel quality •Combustion products •Combustion controls
Air Pollution Control	Fundamentals: •Fuel dependent pollutants •Combustion dependent pollutants	•NOx control •SOx control •Particulate control •Continuous emission monitoring and interpretation	•NOx emission control •SOx emission control •Continuous emission monitoring and interpretation	•NOx emission control •SOx emission control •Particulate control •Continuous emission monitoring and interpretation	•NOx emission control •SOx emission control •Particulate control •Continuous emission monitoring and interpretation	•NOx control •SOx control •Particulate control •Continuous emission monitoring and interpretation	•NOx control •SOx control •Continuous emission monitoring and interpretation
Air Emissions Regulations	•Clean Air Act amendments •New source performance standards •Permits						

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services

STD.ASME QFO-1-ENGL 1998 ■ 0759670 0608490 534 ■

APPENDIX II
USEFUL DEFINITIONS

(This Appendix is an integral part of ASME QFO-1-1998.)

The following words are associated with, but not specifically mentioned in, this QFO document. These definitions are provided to aid the reader in the understanding of this Standard.

air quality standards: the ambient level of pollutants prescribed by law that cannot be exceeded during a specified time in a defined area.

cogeneration: the production of steam (or hot water) and electricity for use by single or multiple users generated from a single or multiple source.

commercial boiler: a boiler which produces steam or hot water primarily for heating in commercial applications with incidental use in process applications.

emission standard: the maximum amount of emission discharge legally allowed from a single source, mobile or stationary.

industrial boiler: a boiler which produces steam or hot water primarily for one or more process applications in the industrial setting and may produce steam or hot water for industrial use with incidental use for heating.

packaged boiler: a boiler equipped and shipped complete with fuel burning equipment, mechanical draft equipment, automatic controls, and accessories (usually shipped in one or more major sections).

utility boiler: a boiler which produces steam primarily for the production of electricity in the utility industry.

COPYRIGHT American Society of Mechanical Engineers
Licensed by Information Handling Services