Written Examinations: The written examinations for all classifications are developed from need-to-know type exam questions. The design of the questions has been selected so that they are clear, not misleading or tricky.

Style of Questions: All exam questions are multiple choice. The style of questions and number of questions may change without notice.

Exam Content: The subjects typically covered on the various certification examinations are grouped by exam on the following pages. These subjects may change without notice.
S-4 & S-3 Study Guide

Chlorination
Chemicals used, advantages/disadvantages of different methods (ppm calculations, etc.), procedures (including disposal & handling), DPD, storage, testing, handling, safety, etc.

Contingencies and Emergencies/Security
Contingency Plan (requirements, key topics, examples).

Corrosion Control
Causes/effects of corrosion on interiors/exteriors, testing, cathodic protection.

Cross Connection Control
Definition; prevention and/or correction (devices and when each is used). What agency is responsible for inspections?

Customer Relations
Principles to maintain a good public image, contact with the public and handling customer complaints.

Hydrants
Definitions, specifications (types, size, barrel, etc), installation and inspection procedures, purpose (primary/secondary) winter maintenance, operation.

Hydraulics
Definitions, volumes, density, area, circumference calculations, pressure/hydraulic head calculations, abbreviations/conversions, basic hydraulic equations (continuity, head loss, etc.)

Instrumentation
Measuring & control of water equipment such as float levels and weirs, electrical controls, pressure controls.

Management
Handling given management situations (town meetings, employee relations & motivation), budgets.

Meters
Definitions, types of meters, flow measurement, interior/exterior installations (advantages and disadvantages, procedures), common types (magnetic, propeller, venture, turbine, etc), causes of malfunctions (failure, inaccurate readings, etc.)

Microbiology
Definitions, procedures, techniques, equipment, medias, preservatives, calculations, thorough understanding of results, routine testing, etc.

O & M
Procedures for general & preventative maintenance of equipment, trouble shooting.

Pipes & Joints
Definitions (coupon, saddle, corporation stop), pipe (names, materials, where used, advantages and disadvantages), types of joints (names, where used, advantages/disadvantages), C factors (define, high vs low).

Pumps and Motors
Understanding of pumps and motors, their operation, types, trouble shooting, calculations, etc.
**Recordkeeping**
Water quality and sample results (bacteriological and chemical), MDEQ reports, data management, regulations, etc.

**Safety**
Personal & site safety, confined space entry, fires/extinguishers, trench and excavation safety.

**Sampling**
Procedures (presampling, sampling – bacteriological/chemical, Pb/Cu), results – understanding and interpreting, routine sampling regulations and health benefits.

**SDWA**
Michigan Safe Drinking Water Act, (rules & regulations), National Primary & Secondary Drinking Water Standards, operator certification, MCL’s, notification, regulated compounds, etc., public health.

**Storage**
Calculations, maintenance, contact time, pressure, piping, pumpage rates, ground and elevated tanks (coatings, air vents, overflows, booster pumps, etc.), procedures for putting back online after O & M.

**Valves**
Types of valves, operation & maintenance, specifications (size, type, direction of operation), procedures & precautions (opening/closing, servicing).

**Water Quality**
MCL – health effects, common problems in systems (cause/effect).

**Water Main Installation**
Water main installation requirements (thrust restraints, disinfection, permits, separation, size, flushing, etc), procedure for tapping a new line off the main, trenching.
S-2 Study Guide

Chlorination
Advantages/disadvantages of different methods, procedures (including disposal & handling)
ppm & drop dilution method calculations.

Contingencies & Emergencies
Contingency plan (requirements, key topics, examples, etc.), dewatering a large portion of system.

Corrosion
Causes/effects of corrosion on interiors/exteriors, prevention (stabilization, coating, etc.), common
terms in dealing with corrosion and characteristics of aggressive water.

Cross Connections
Definition (also be able to give examples.), prevention and/or correction (devices and when each is
used), what agency is responsible for inspections?

Customer Relations
Describe situations where you may come in contact with the public, how to handle these situations and,
maintain a good public image.

Hydrants
Specifications (types, size, barrel, etc.), installation and inspection procedure, purpose
(primary/secondary), additives (keep from freezing).

Hydraulics
Volume, density, area, circumference, and pressure/hydraulic head calculations, know common
hydraulic terms, abbreviations, conversions, etc., system design (pressure, layout, overburden loads,
capacity, etc), know how to measure (pressure head, velocity head, etc.), understand general hydraulic
equations (head loss, continuity, Bernoulli’s equation, etc.)

Instrumentation
Electrical equipment (transformers, relays, controls, etc.), general instrumentation (different types and
their uses), control system alarms.

Main Installation
Installation requirements (disinfection, permits, separation, size, flushing, thrust blocking, etc.), leakage
calculation, procedure for tapping a new line off the main.

Management
Supervisory skills (motivation of employee, employee relations, etc.)

Meters
Interior/exterior installations (advantages/disadvantages), specifications (accuracy, standards, etc.),
common types (magnetic, propeller, venturi, turbine, etc.), causes of malfunctions.

O & M
Operational procedures and common installations, be able to describe a systematic maintenance
schedule on a grossly neglected system.

Pipes & Joints
Types of joints (names, where used, advantage/disadvantage, etc.), pipe materials (names, where
used, advantage/disadvantage, type of joints, allowable, etc.), c factors (define, have a general
understanding between a high & low value).
**Pumps & Motors**  
Characteristics, fittings, maintenance associated with pumps (submersible, turbine, centrifugal, etc.)

**Recordkeeping**  
Water quality & sample results (bacteriological/chemical), installation and inspection information, general plan (included, requirements, etc.)

**Safety**  
Confined space (entry procedures, definition), personal & site safety equipment, trench excavation & usage, electrical equipment repair safety and precautions.

**Sampling**  
Procedures (pre-sampling, sampling bacteriological/chemical), results (understand & interpret), lab forms (correctly fill out), routine sampling (regulations, benefits, examples of a good program, etc.)

**SDWA**  
Michigan Safe Drinking Water Act, (rules & regulations), National Primary & Secondary Drinking Water Standards, operator certification, MCL’s, notification, regulated compounds, etc., public health.

**Storage Reservoirs**  
Ground & elevated tanks (coating, air vents, overflows, booster pumps, etc.), procedure for putting back on-line after o & m (incl. disinfection methods, inspections, etc.), purpose of reservoirs (primary/secondary).

**Valves**  
Specifications (size, type, direction of operation, etc.), procedures & precautions (opening/closing, servicing, etc.), types, operation, inspection criteria & recommended maintenance.

**Water Quality**  
MCL’s (health effects associated with levels of contaminant), common problems in systems (causes/effects), federal lead/copper corrosion rule, bacteriological indicator used, why? Community flushing program
S-1 Study Guide

Chlorination
Advantages/disadvantages of different methods, procedures (incl. disposal & handling) ppm & drop dilution method calculations, method cost comparison (prices given).

Contingencies & Emergencies
Contingency plan (requirements, key topics, examples, etc.), dewatering a large portion of system/loss of pressure (how would you handle situation).

Corrosion
Causes/effects of corrosion on interiors/exteriors, prevention (stabilization, coating, etc.), common terms in dealing with corrosion and characteristics of aggressive water.

Cross Connections
Definition (also be able to give examples.), prevention and/or correction (devices and when each is used), what agency is responsible for inspections?

Customer Relations
Describe situations where you may come in contact with the public, how to handle these situations and, maintain a good public image. Complaint forms.

Hydrants
Specifications (types, size, barrel, etc.), installation and inspection procedure, purpose (primary/secondary), additives (keep from freezing).

Hydraulics
Volume, density, area, circumference, and pressure/hydraulic head calculations, know common hydraulic terms, abbreviations, conversions, how to use pump curves, etc., system design (pressure, layout, overburden loads, capacity, etc), know how to measure (pressure head, velocity head, etc.), understand general hydraulic equations (head loss, continuity, horsepower, efficiency, Bernoulli’s equation, etc.)

Instrumentation
Electrical equipment (transformers, relays, controls, etc.), general instrumentation (different types and their uses), control system alarms.

Main Installation
Installation requirements (disinfection, permits, separation, size, flushing, thrust blocking, etc.), leakage calculation, procedure for tapping a new line off the main.

Management
Supervisory skills (motivation of employee, employee relations, etc.)

Meters
Interior/exterior installations (advantages/disadvantages), specifications (accuracy, standards, etc.) common types (magnetic, propeller, venturi, turbine, etc.), causes of malfunctions.

O & M
Operational procedures and common installations, be able to describe a systematic maintenance schedule on a grossly neglected system.
Pipes & Joints
Types of joints (names, where used, advantage/disadvantage, etc.), pipe materials (names, where used, advantage/disadvantage, type of joints, allowable, etc.), C factors (define, have a general understanding between a high & low value).

Pumps & Motors
Characteristics, fittings, maintenance associated with pumps (submersible, turbine, centrifugal, etc.)

Recordkeeping
Water quality & sample results (bacteriological/chemical), installation and inspection information, general plan (included, requirements, etc.)

Safety
Confined space (entry procedures, regulations, definition), personal & site safety equipment trench excavation & usage, electrical equipment repair safety and precautions.

Sampling
Procedures (pre-sampling, sampling bacteriological/chemical/organic/inorganic/etc.) results (understand & interpret), lab forms (correctly fill out), routine sampling (regulations, benefits, examples of a good program, etc.)

SDWA
Michigan Safe Drinking Water Act, (rules & regulations), National Primary & Secondary Drinking Water Standards, operator certification, MCL’s, notification, regulated compounds, etc., public health.

Storage Reservoirs
Ground & elevated tanks (coating, air vents, overflows, booster pumps, etc.), procedure for putting back on-line after o & m (incl. disinfection methods, inspections, etc.), purpose of reservoirs (primary and secondary).

Valves
Specifications (size, type, direction of operation direction of operation, etc.), procedures & precautions (opening/closing, servicing, etc.), types, operation, inspection criteria & recommended maintenance.

Water Quality
MCL’s (health effects of levels of contaminant), fed. lead/copper corrosion rule, common problems in systems (causes/effects), community flushing program, bacteriological indicator used, why?, waterborne diseases (names, causes, organisms, etc.)
The following is a list of selected references for the **S-1 and S-2 examinations only**.

- Michigan Safe Drinking Water Act, 1976 PA 399, as amended
- Water Distribution System Operation & Maintenance, California State University, Sacramento, CA, 4\(^{th}\) or 5\(^{th}\) edition
- Water Treatment Plant Operation, Volume I, California State University, Sacramento, CA, 4\(^{th}\) or 5\(^{th}\) Edition
- Water Treatment Plant Operation, Volume II, California State University, Sacramento, CA, 3\(^{rd}\) Edition
- Small Water System Operation & Maintenance, California State University, Sacramento, CA, 4\(^{th}\) Edition
- Water Treatment Membrane Processes, AWWARF, McGraw Hill, 1996
- MDEQ Cross Connection Rules Manual, 3\(^{rd}\) Edition
- Recommended Standards for Water Works Design, 2003 Edition

The following is a list of selected references for the **S-3 and S-4 examinations only**.

- Michigan Safe Drinking Water Act, 1976 PA 399, as amended
- Water Distribution System Operation & Maintenance, California State University, Sacramento, CA, 4\(^{th}\) or 5\(^{th}\) edition
- Water Treatment Plant Operation, Volume I, California State University, Sacramento, CA, 4\(^{th}\) or 5\(^{th}\) Edition
- Water Treatment Plant Operation, Volume II, California State University, Sacramento, CA, 3\(^{rd}\) Edition
- Small Water System Operation & Maintenance, California State University, Sacramento, CA, 4\(^{th}\) Edition

The Michigan Safe Drinking Water Act can be found on the Internet at www.michigan.gov/deq. After you get to this site, click on **Water** and then **Drinking Water** and then **Community Water**. If you scroll down with your cursor, you can locate the laws that will include the Michigan Safe Drinking Water Act.