

# Pool and Spa Operator Handbook, 2017

## Highlights

These 1 Exam Prep Highlights are based on the *Pool and Spa Operator Handbook, 2017 Edition*.

<u>Page #</u>	<u>Highlight</u>
6	<b>Negligence:</b> “In other words, negligence deals with avoidable accidents that should have been anticipated and prevented by taking reasonable precautions. Even if no harm was intended, a person may still be negligent if the individual failed to take reasonable measures to prevent a foreseeable accident. Negligence is the failure to act in accordance with the corresponding standard of care.
16	<b>The Occupational Safety &amp; Health Administration (OSHA):</b> “This exposure may be a grave problem for workers and their employers. A key protective measure includes a Hazard Communication Program and Safety Data Sheets (SDS).
16-17	<b>Safety Data Sheets (SDS):</b> “The SDS must be available to all workers at the job site where the chemical is used.”
26	<b>Figure 3-1</b> Useful Conversions
28	<b>Figure 3-2a</b> Calculating Gallons in Constant Slope Pool
40	<b>Fecal Response:</b> “For any type of AFR, direct all users to leave the pool. If the filtration system services more than one body of water, all of the affected pools must be closed.”
40-41	<b>Formed stool:</b> “Raise the free chlorine level to 2 ppm (mg/L) and ensure the pH is 7.5 or less and the temperature is 77°F (25°C) or higher.)  “Maintain the chlorine concentration for at least 25 minutes before opening the pool. Local and state codes may vary on this requirement and should be consulted.”
41	<b>Diarrheal Discharge:</b> “Raise the free available chlorine level to 20 ppm (mg/L). Maintain the pH of 7.5 or less and a temperature of 77°F (25°C) or higher. Maintain the pH and chlorine level for 12.75 hours.”
43	<b>Legionella Pneumophilia:</b> “The bacteria can exist in poorly maintained pools and spas and is transmitted by the mists (breathable droplets) produced by spa aeration or by spray features.”

51 **Combined Chlorine:** “Chloramines evaporate and are the cause of the chlorine-like smell often witnessed in indoor pools. Chloramines are also more irritating to skin and mucous membranes. Thus, removal or destruction of combined chlorine is a common problem operator must work to solve.”

**Disinfectants:** “Disinfectants inactivate or kill the vast majority (greater than 99.9%) of microorganisms that can cause disease (pathogens).”

52 **Table 5-2.** Characteristics of Disinfectants

“These two disinfectants are highly reactive and provide residual properties that ensure continuous, efficient control of microorganisms.”

63 **“To lower the pH,** acids or acid salts such as sodium bisulfate (NaHSO<sub>4</sub>) are added to the pool or spa water.”

64 **Illustration 6-4:** Total Alkalinity Related Pool Problems

65 **Low Total Alkalinity:** “To increase total alkalinity, labels typically recommend adding sodium bicarbonate at the rate of 1.4 pounds per 10,000 gallons of water for a 10 ppm increase.”

67 **Galvanic Corrosion:** “As TDS increases, there is a greater probability of galvanic corrosion when there are dissimilar metals within the system.”

“Galvanic corrosion would be observed by the discoloration of metal parts in the water.”

68-69 **Saturation Index:** Highlight Saturation Index formula and Saturation Index Factors in Illustration 6-7 and Illustration 6-8. (See Examples 6.1, 6.2, and 6.3)

74 Example 7-3a No Product Label Chemical Adjustment.

76 **Combined Chlorine: Water and Air Quality:** The combined amount of both of these contaminants can be determined using a DPD test.”

“Total chlorine is the sum of free chlorine and combined chlorine. In other words, combined chlorine is the difference between total chlorine and free chlorine.” (highlight the formula).

77 **Example 7-4a** Sample breakpoint calculation

<u>Page #</u>	<u>Highlight</u>
80	<b>Green or Blue Green Water:</b> “A turbid green pool is usually the result of an algae problem.”
84	<b>Prevention of Algae:</b> “Brushing the pool/spa walls on a routine basis is an important preventative measure. It is far easier to prevent algae than to remove algae.”
90	<b>Collecting the Sample:</b> “The sample should be taken from a depth of at least 18 inches below the water surface and from a location well away from any return inlets.”
93	<b>DPD Testing:</b> “There are three DPD test methods available: colorimetric, photometric, and titrimetric. The colorimetric test using a color comparator test block is by far the most common of the methods available. The titration test, called Ferrous Ammonium Sulfate-DPD (FAS-DPD), does not have the visual uncertainty that is sometimes associated with colorimetric test block comparator.”
95	<b>Disinfectant Sensors:</b> “The most commonly used is Oxidation Reduction Potential (ORP). ORP, sometimes called redox, is a measure of the oxidizing capacity present in water expressed in millivolts (mV).”
96	<b>pH Testing:</b> “The pH of pool and spa water is usually measured by adding <b>phenol red</b> indicator to a pool water sample.”
106	<b>Dry Chemical Feeders</b>
121	<b>Flow Rate:</b> highlight formula
121	<b>Suction Side Elements and Entrapment:</b> “A system can be designed and operated to reduce or eliminate the possibility that direct suction can entrap and injure a person. The first line of defense involves ensuring that a drain cover is in place over any suction outlet to prevent entrapment or evisceration.”
123	<b>Main Drains:</b> “The openings in the main drain covers are part of the original design and are controlled by standards. The main drain should be visually observed on a daily basis as part of the vacuuming process and any cracked or broken element is cause for pool closure until the cover is replaced.”
123	<b>Surface Water Removal:</b> “Some codes may require that under certain circumstances, all of the circulation water must be removed from the surface. The commonly accepted practice is that 75% of the water be removed from the surface. Some codes allow a 50/50 ratio, and others have no requirement at all.”

<b><u>Page #</u></b>	<b><u>Highlight</u></b>
127	<b>Vacuum Gauges:</b> “A vacuum gauge located just prior to the pump allows the pool operator to measure just how hard the pump is working on the suction side.”
139-140	<b>Filter Media:</b> “ <b>Diatomaceous Earth (D.E.)</b> removes the smallest particle size of any pool/spa filtration device.”
141	<b>Filter Area: Sand Filters:</b> “dirt material is driven further into the sand bed, making cleaning more difficult during the backwash cycle. Channeling can bypass the filtration process, resulting in unfiltered water returning to the pool.”
142	Highlight formulas to determine: Filter Area (FA), Filter Media Rate (FMR), and Flow rate (FR). (See Examples 11-1)
144-145	<b>Backwashing Sand Filters:</b> “Backwashing is required when the water entering the filter (influent) and the water exiting the filter (effluent) reaches a 10 to 20 psi pressure difference. This difference is noted by observation of the pressure gauges, installed on each side of the filter flow per code in many areas. If there is only one pressure gauge, the filter should be backwashed when the pressure increases 8 to 10 psi over the starting pressure.”
147	<b>Cartridge Filtration</b> “Cartridge filters do not require backwashing to clean the cartridge so water is conserved”
148	<b>Handling D.E. powder:</b> “Second, D.E. is extremely hazardous when the pool operator fails to utilize breathing protection.”
149	<b>Pre-coating Vacuum D.E. Filter:</b> “Follow the directions as provided by the filter manufacturer concerning the proper amount of D.E. to use. The normal amounts range from 1 to 1.5 pounds for every 10 square feet of filter area. The commonly accepted value is 1.25 lbs/10 ft <sup>2</sup> .”
153	<b>Evaporative Losses:</b> “Evaporation is increased by high wind speeds, high air temperature low relative humidity, and high water temperature.”
160-161	<b>Air Circulation:</b> “Six to eight air changes per hour should occur, except where mechanical cooling is used. With mechanical cooling, the recommended rate is four to six air changes per hour for therapeutic pools.”
166	<b>Hyperthermia:</b> “In 1987, the CPSC helped develop requirements for temperature controls to make sure that spa water temperatures never exceed 104°F/40°C.”
193-194	<b>Protective Measures:</b> “Use basic PPE including, as a minimum, chemical goggles and liquid impervious gloves and boots for any chemical handling activities.”

<b><u>Page #</u></b>	<b><u>Highlight</u></b>
196	<b>Preventing Electrocutions</b>
197	<b>Lock Out/Tag Out:</b> “The Lock Out/Tag Out (LOTO) standard, Occupational Safety & Health Administration (OSHA), Regulation 29 CFR 1910.147, ‘The Control of Hazardous Energy,’ applies to all employees servicing and maintaining machines and equipment in which the unexpected energizing or start up of the machines or equipment or release of stored energy could cause injury to the employee.”
204	<b>Opening and Closing Checklist:</b> “Safety and rescue equipment in place and functional.”
207	<b>Emergency Response Plans:</b> “The plan must contain staff training requirements, alarm signals and their meanings, and the actions and procedures detailing how the facility expects the staff to respond to emergency situations.”
212	<b>Routine Maintenance:</b> “Routine or daily maintenance is the work performed by the aquatics staff as an ongoing responsibility. It begins and ends with unlocking/locking the facility and turning off/turning on any security system. In between, there may be a few tasks or dozens of tasks, depending on the size and complexity of the facility. A daily opening and closing checklist is provided in Appendix A-1.”
225	<b>Troubleshooting Pressure Sand Filters:</b> “Sand in Pool”
262	<b>B-2</b> Water Chemistry Adjustment Guide
285	<b>Glossary:</b> highlight the following terms: Page 287-Cyanuric Acid, Page 292-Sodium Thiosulfate