AALSO Proficiency Program – Level I, II & III

Hello, and welcome to AALSO's 2010 Proficiency Program! AALSO offers a multi-level operator competency acknowledgment program based on test scores received from exams administered by designated program managers at the Hosting Symposium Facility.

Levels one, two or three are awarded to any zoo or aquarium life support operator with relevant experience who successfully passes the respective exam covering set recognition criteria for that level. It acknowledges general operator proficiency with routine operator tasks pertaining from Basic to advanced operator duties and covers such topics as: sand filtration, biological filtration, chemical filtration, USDA regulations, Cathodic protection, turbidity, safety, pump curves / trouble shooting, pool volume calculations, filter surface area calculations, and pool turnover rate calculations.

AALSO believes that it is appropriate to develop recognition criteria that calls for a proficiency program that is on-the-job training based, and encourages Zoo and Aquarium institutions to incorporate this training into their operator development program.

EXAMS I, II & III

- 25 Questions
- 7 Calculation Questions (5 on level III)
- 7 Lab and Chemistry Questions (9 on level III)
- 7 Operations Questions
- 4 Safety Questions

You will be able to use the Summary of Formulas in the folders given out and any notes taken during the study period at the symposium.

To qualify for each Level of Exam, you must be involved in the function of Life Support operations and a AALSO member with a minimum of one year experience. To qualify for subsequent level exams, you must have successfully fulfilled the requirements and passed the supporting examination of the previous level(s).

For each LSS operational status level, you must have successfully fulfilled the requirements and scored a 70% or better on the supporting examination in order to qualify for that level, as defined by *AALSO.*

AALSO Operator competency Program Information for Level One

Level One Requirement:

Anyone involved in the function of Life Support System operations with a minimum of one year experience and is a member of AALSO.

Level One Basic Overview:

- Sand Filtration
- Biological filtration
- Chemical filtration
- USDA
- Cathodic protection
- Turbidity
- Safety
- Pump curves / Trouble shooting
- Pool volume calculations
- Filter surface area calculations
- Pool turnover rate calculations

EXAMS

- 25 Questions
- 7 Calculation Questions
- 7 Lab and Chemistry Questions
- 7 Operations Questions
- 4 Safety Questions

You will be able to use the Summary of Formulas in the folders given out and any notes taken during the study period

You must have successfully fulfilled the requirements and passed the supporting examination, in order to qualify, as defined by *AALSO*, for the following LSS operational status Level 1.

A score of 70% or better is required to pass the exam

AALSO Operator competency Program Information for Level Two

Offers level one and two LSS Operator competency testing along with the training review prior to testing.

Level Two Requirement:

Anyone involved in the function of Life Support System operations with a minimum of two years experience has successfully passed level 1 examination and is a member of AALSO.

Level Two Advanced Overview:

- Sand Filtration
- Biological filtration
- Chemical filtration
- USDA
- Cathodic protection
- Turbidity
- Safety
- Pump curves / Trouble shooting
- Pool volume calculations
- Filter surface area calculations
- Pool turnover rate calculations

EXAMS

- 25 Questions on level 1
- 7 Calculation Questions
- 7 Lab and Chemistry Questions
- 7 Operations Questions
- 4 Safety Questions

You will be able to use the Summary of Formulas in the folders given out and any notes taken during the study period

You must have successfully fulfilled the requirements and passed the supporting examination, in order to qualify, as defined by *AALSO*, for the following LSS operational status Level two.

A score of 70% or better is required to pass the exam

AALSO Proficiency Program Information for Level Three

AALSO offers level one, two and three LSS Operator competency testing along with training review prior to testing.

Level Three Requirement:

Anyone involved in the function of Life Support System operations with a minimum of three years experience and has successfully passed levels I and II examination who is a member of AALSO.

Level Three Advanced Overview:

- Sand Filtration
- Biological filtration
- Chemical filtration
- USDA
- Cathodic protection
- Turbidity
- Safety
- Pump curves / Trouble shooting
- Pool volume calculations
- Filter surface area calculations
- Pool turnover rate calculations

EXAMS

- 25 Questions on level 3
- 5 Calculation Questions
- 9 Lab and Chemistry Questions
- 7 Operations Questions
- 4 Safety Questions

You can use the Summary of Formulas in the information given out and any notes taken during the study period

You must have successfully fulfilled the requirements and passed the supporting examinations for level one, two and three, in order to qualify, as defined by AALSO, for the following LSS operational status level three.

A score of 70% or better is required to pass the exam

Summary of Formulas

Length

Length of a Circular Clarifier Weir or the Circumference of a Circle

Length, ft. = 3.14 (Diameter, ft)

Area

Rectangle or Square

Area, sq. ft. = (Length, ft)(Width, ft)

Triangle

Area, sq. ft. = 1/2 (Base, ft)(Height, ft)

Circle

Area, sq. ft. = $0.785(\text{Diameter, ft})^2$

Volume

Rectangle or Square

Volume, cu.ft. = (Length, ft)(Width, ft)(Height, ft)

Cylinder

Volume, cu.ft. = $0.785(\text{Diameter, ft})^2$ (Height, ft)

Sphere

Volume, cu.ft. = $0.524\ (\text{Diameter, ft})^3$

Pressure

Water pressure is measured in terms of pounds per square inch (psi) and feet of head (height of a water column in feet). A column of water 2.31 feet high creates a pressure of 1 psi. The water pressure at the bottom of a storage tank can be used to determine the water level in the tank. Centrifugal pumps are rated in feet of Total Dynamic Head (TDH) but system pressures are measured in psi. LS operators should be able to convert from one pressure unit to the other. If the pressure (psi) is known, The height of the water column can be determined by multiplying the psi by 2.31.

psi X 2.31 = Feet of Head

Chemical Feed / Dosage

$$\text{Pounds of Chemical} = \frac{\text{mg/L X 8.34 X Gallons}}{1{,}000{,}000}$$

$$\text{mg/L} = \frac{(\text{Pounds of Chemical})\ (1{,}000{,}000)}{8.34\ (\text{Flow, gals})}$$

$$\text{Pounds of Compound} = \frac{\text{lbs of pure}}{\%\ \text{Available}}$$

Tanks and Filters

$$\text{Retention Time / Turnover Time, hrs.} = \frac{\text{Tank Volume, gals.}}{\text{Flow, gph}}$$

$$\text{Hydraulic Loading Rate, gpm/sq.ft.} = \frac{\text{Flow, gpm}}{\text{Surface Area, sq. ft.}}$$

Efficiency of a Treatment Process

$$\text{Efficiency \%} = \frac{(\text{Influent Concentration})\ (\text{Effluent Concentration})(100)}{\text{Influent Concentration}}$$

BTU

$$\text{BTU's/hr} = \frac{\text{Gallons of water X 8.34 X Temp Increase}}{24,\ \text{hrs (\% Efficiency)}}$$

Conversions

$$gpm = (cfs)(7.48)(60)$$

$$cfs = \frac{gpm}{7.48X60}$$

$$^{O}F = (^{O}C \text{ X } 1.8) + 32^{O}$$

$$^{O}C = (^{O}F - 32^{O}) \text{ X } 0.556$$

Pumps

Definitions:
Total Dynamic Head (TDH) is the total height that a fluid is to be pumped, taking into account friction losses in the pipe. **TDH = Static Lift + Static Height + Friction Loss**
where:
Static Lift is the height the water will rise before arriving at the pump (also known as the '**suction lift**').
Static Height is the maximum height reached by the pipe after the pump (also known as the '**discharge head**').
Friction Loss is the head equivalent to the energy losses due to viscose drag of fluid flowing in the pipe (both on the suction and discharge sides of the pump). It is calculated via a formula or a chart, taking into account the pipe diameter and roughness and the fluid flow rate, density and viscosity.

In a system where the reservoir feeding the pump is higher than the pump, the difference in elevation (height) between the pump center line and the free water surface of the reservoir feeding the pump is termed **static suction head**

The **total static head** of a pump is the total height that a pump must lift the water from the level of one reservoir to the level of another.

- **Head** - a measure of the pressure or force exerted by the fluid.
- **Capacity** - the rate of liquid flow that can be carried.
- **Current** - the amount of electricity, measured in amps, which is flowing in a circuit.
- **Power input** - the electrical input to the motor expressed in kilowatts (kW). A measure of the rate at which work is done.
- **Voltage** - the potential or electrical magnetic force (EMF) in an electrical circuit.
- **Power factor** - the ratio of the true power to the volt-amperes in an alternation current (ac) circuit.
- **Motor efficiency** (**Em)**- a measure of how effectively the motor turns electrical energy into mechanical energy. It is the ratio of power input to power output.
- **Motor horsepower (MHp)** - the amount of electrical energy that must go into the motor to produce the required BHp.
- **Brake horsepower (BHp)** - the amount of energy that must go into the pump to produce the required WHp.
- **Hydraulic horsepower (WHp)** - the pump output or the liquid horsepower delivered by the pump.
- **Total efficiency** - the ratio of the energy delivered by the pump to the energy supplied to the input side of the motor. It is sometimes referred to as the 'wire to water efficiency'.
- **Pump efficiency (Ep)** - the ratio of the energy delivered by the pump to the energy supplied to the pump shaft.

Formulas:

MHp = BHp/Em or WHp/EmxEp

BHp = WHp/Ep

WHp = [Head (feet) * Capacity (GPM)] / 3960

Total efficiency = (WHp / EHp) * 100%

Ep = (WHp / BHp) * 100%

Kw-hours of electricity = MHp x 0.746 Kw/Hp x Hours

Cost to operate for a year = Duty cycle*Power input*Electrical cost ($/kW hour)*Hours in a year

Quantity, Velocity, Area

Quantity (Q)- Discharge Rate, measured in cubic feet per second (cfs)

Velocity (V)- Flow Rate, measured in feet per second (fps)

Area (A) - Pipe Size, measured in square feet (sq. ft.)

Find the unknown by using the following formulas:

$Q = A \times V$ $V = \frac{Q}{A}$ $A = \frac{Q}{V}$

Misc. Equivalents

1 cu ft water = 62.4 lbs

1 cu ft water = 7.48 gals

1 gal water = 8.34 lbs

1 gal water = 3.785 liters

17.1 ppm = 1 grain per gal

1 ppm = 8.34 lbs per million gal

1 ppm = 1 mg/l

1 psi = 2.31 ft of head

1 ft of head = 0.433 psi

1 Hp = 33,000 ft./ lbs. / min

1 Hp = 0.746 Kw

1 BTU = 1^{o}F increase in 1 lb of water in 24 hours