TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1432 (B1432)

The rate of heat transfer between two liquids in a heat exchanger will increase if the… (Assume single-phase conditions and a constant specific heat for both liquids.)

A. inlet temperature of the hotter liquid decreases by 20°F.

B. inlet temperature of the colder liquid increases by 20°F.

C. flow rates of both liquids decrease by 10 percent.

D. flow rates of both liquids increase by 10 percent.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1533

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$c_{p\text{-oil}}$ = 1.1 Btu/lbm-°F
$c_{p\text{-water}}$ = 1.0 Btu/lbm-°F
$T_{oil\ in}$ = 174°F
$T_{oil\text{-}out}$ = 114°F
$T_{water\text{-}in}$ = 85°F
$T_{water\text{-}out}$ = 115°F
$\dot{m}_{oil}$ = 4.0×10^4 lbm/hr
$\dot{m}_{water}$ = ?

What is the approximate mass flow rate of the cooling water?

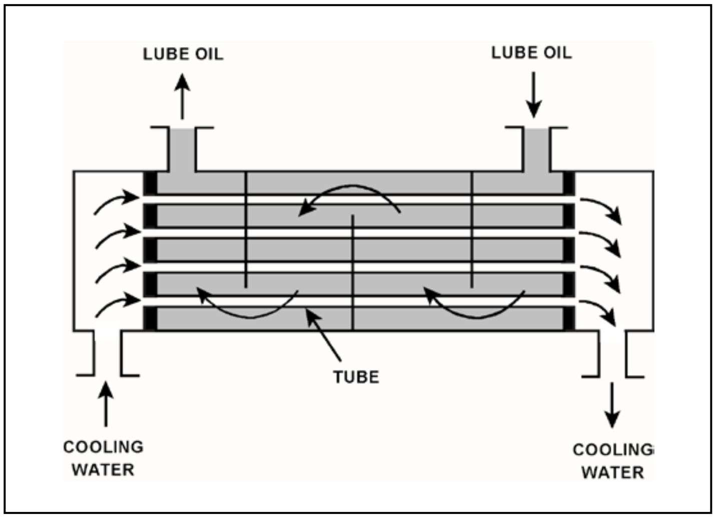
A. 8.8×10^4 lbm/hr

B. 7.3×10^4 lbm/hr

C. 2.2×10^4 lbm/hr

D. 1.8×10^4 lbm/hr

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1632 (B832)

The rate of heat transfer between two liquids in a single-phase heat exchanger will <u>decrease</u> if the... (Assume constant specific heat capacities.)

A. inlet temperatures of both liquids decrease by 20°F.

B. inlet temperatures of both liquids increase by 20°F.

C. flow rate of the colder liquid decreases by 10 percent.

D. flow rate of the hotter liquid increases by 10 percent.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1634 (B1631)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{m}_{oil}$ = 2.0×10^4 lbm/hr
$\dot{m}_{water}$ = 3.0×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = 125°F
$T_{oil\text{-}in}$ = 180°F
$T_{oil\text{-}out}$ = ?

Which one of the following is the approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

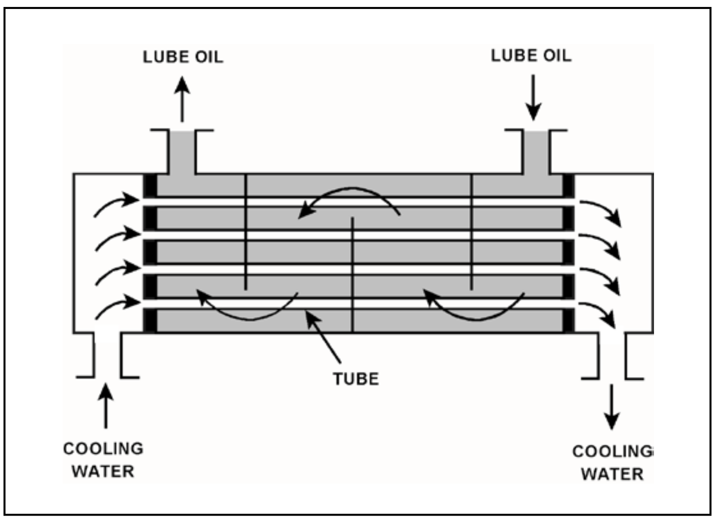
A. 126°F

B. 135°F

C. 147°F

D. 150°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1732 (B1732)

Which one of the following will reduce the heat transfer rate between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The inlet temperatures of both liquids decrease by 20°F.

B. The inlet temperatures of both liquids increase by 20°F.

C. The inlet temperature of the hotter liquid increases by 20°F.

D. The inlet temperature of the colder liquid increases by 20°F.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1832 (B631)

Refer to the drawing of an operating heat exchanger (see figure below). Assume the overall heat exchanger heat transfer coefficient does not change.

The rate of heat transfer between the two liquids will increase if the…

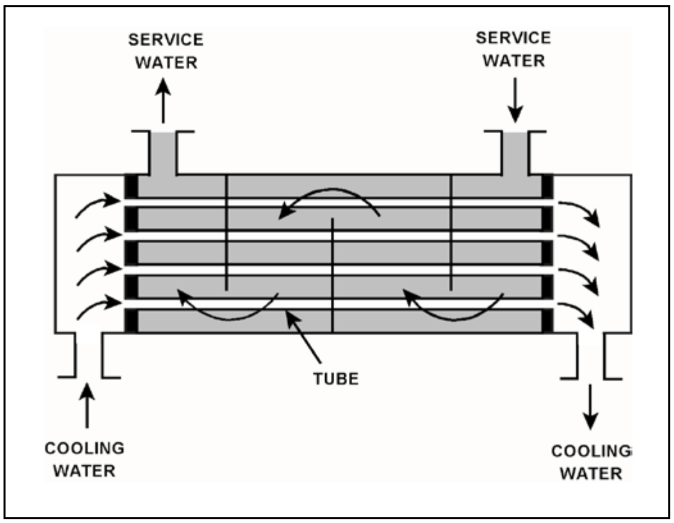
A. inlet temperatures of both liquids increase by 20°F.

B. inlet temperatures of both liquids decrease by 20°F.

C. mass flow rate of the hotter liquid increases by 10 percent.

D. mass flow rate of the colder liquid decreases by 10 percent.

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P1934 (B1933)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{m}_{oil}$ = 1.5×10^4 lbm/hr
$\dot{m}_{water}$ = 2.5×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = 125°F
$T_{oil\text{-}in}$ = 160°F
$T_{oil\text{-}out}$ = ?

Which one of the following is the approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

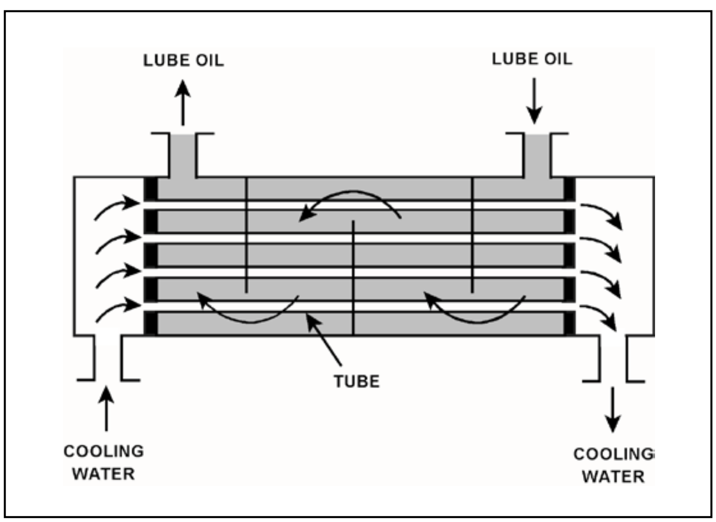
A. 110°F

B. 127°F

C. 135°F

D. 147°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P2034

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$c_{p\text{-oil}}$ = 1.1 Btu/lbm-°F
$c_{p\text{-water}}$ = 1.0 Btu/lbm-°F
$\dot{m}_{oil}$ = 1.2 x 10^4 lbm/hr
$\dot{m}_{water}$ = 1.61 x 10^4 lbm/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 120°F
$T_{water\ out}$ = 110°F
$T_{water\ in}$ = ?

Which one of the following is the approximate cooling water inlet temperature ($T_{water\ in}$) for the heat exchanger?

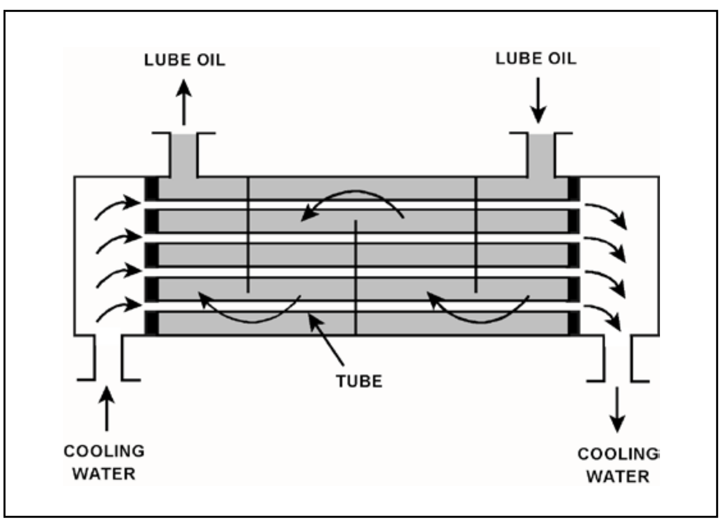
A. 65°F

B. 69°F

C. 73°F

D. 77°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P2232

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 190°F
$T_{oil\text{-}out}$ = ?

What is the approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

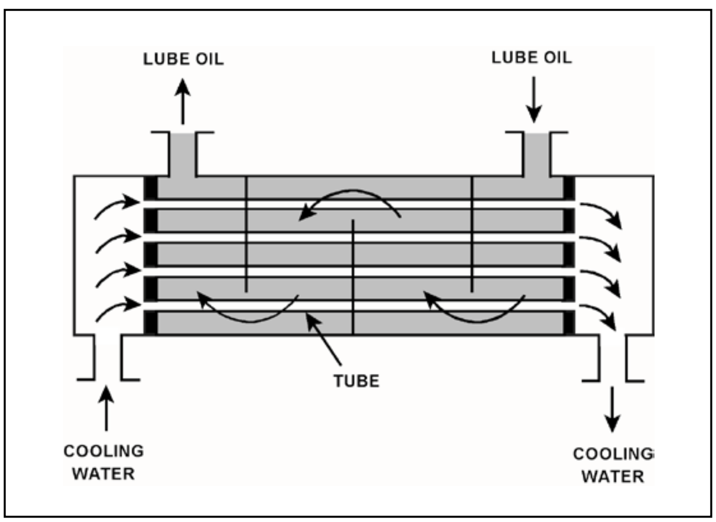
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P2532 (B2534)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{m}_{oil}$ = 1.5×10^4 lbm/hr
$\dot{m}_{water}$ = 2.5×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{oil\text{-}in}$ = 160°F
$T_{oil\text{-}out}$ = 110°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = ?

Which one of the following is the approximate temperature of the cooling water exiting the heat exchanger ($T_{cw\text{-}out}$)?

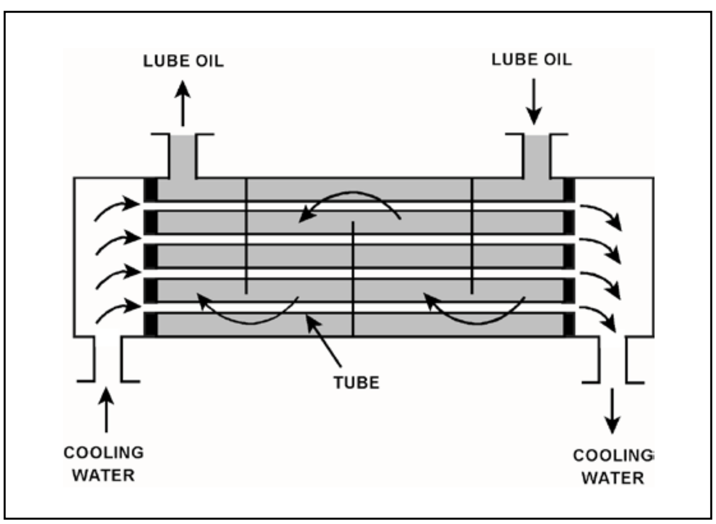
A. 110°F

B. 115°F

C. 120°F

D. 125°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P2632 (B2531)

The rate of heat transfer between two liquids in a heat exchanger will <u>decrease</u> if the: (Assume single-phase conditions and a constant specific heat for both liquids.)

A. inlet temperature of the hotter liquid increases by 20°F.

B. inlet temperature of the colder liquid decreases by 20°F.

C. flow rates of both liquids decrease by 10 percent.

D. flow rates of both liquids increase by 10 percent.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P3034 (B3082)

Refer to the drawing of a lube oil heat exchanger (see figure below).

Given the following heat exchanger parameters:

- Lube oil flow rate is 200 lbm/min.
- Lube oil enters the heat exchanger at 140°F.
- Lube oil leaves the heat exchanger at 100°F.
- Specific heat of the lube oil is 0.8 Btu/lbm-°F.
- Cooling water flow rate is 400 lbm/min.
- Cooling water enters the lube oil heat exchanger at 60°F.
- Specific heat of the cooling water is 1.0 Btu/lbm-°F.

What is the approximate temperature of the cooling water leaving the lube oil heat exchanger?

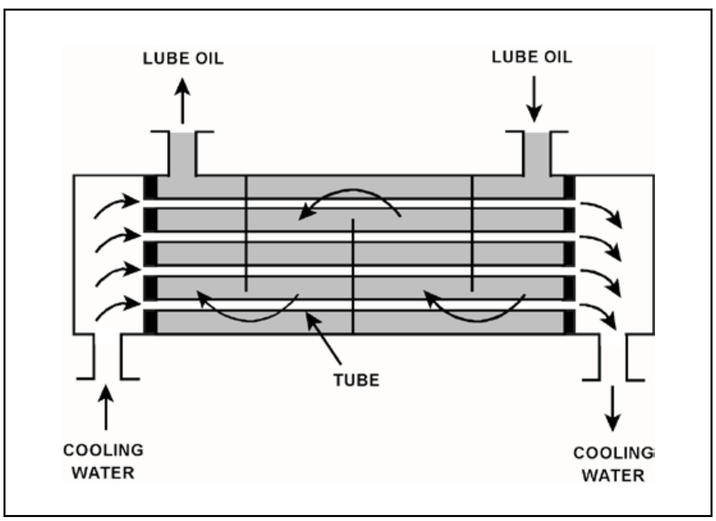
A. 76°F

B. 85°F

C. 92°F

D. 124°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P3132 (B934)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{Q}_{oil}$ = 1.0×10^7 Btu/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 134°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 112°F
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{water}$ = ?

Which one of the following is the approximate mass flow rate of the cooling water?

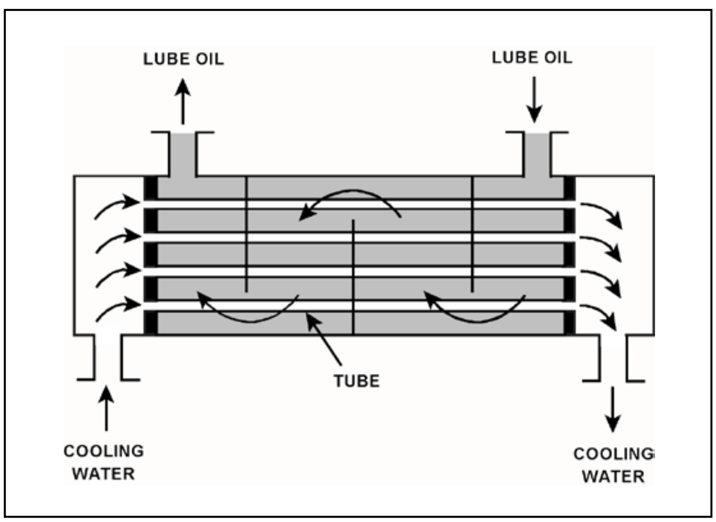
A. 4.5×10^5 lbm/hr

B. 3.7×10^5 lbm/hr

C. 2.5×10^5 lbm/hr

D. 1.2×10^5 lbm/hr

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P3432 (B1331)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 170°F
$T_{oil\text{-}out}$ = ?

What is the approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

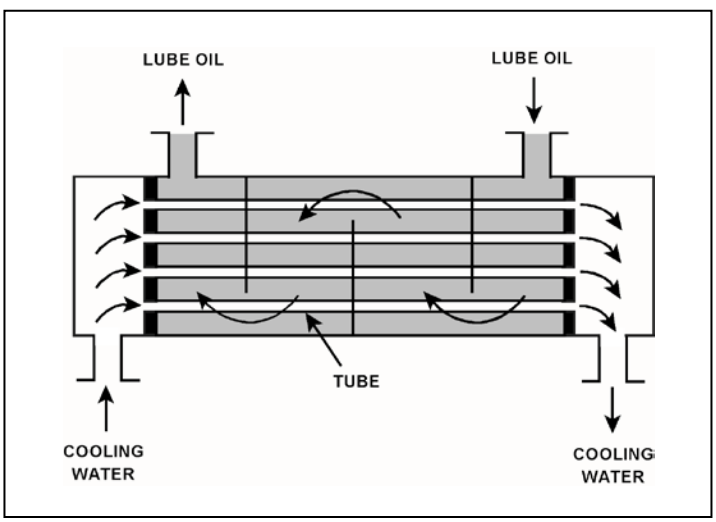
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P3632 (B3631)

Refer to the drawing of an operating water cleanup system (see figure below).

If cooling water flow rate is 1.0×10^6 lbm/hr, what is the approximate water flow rate in the cleanup system?

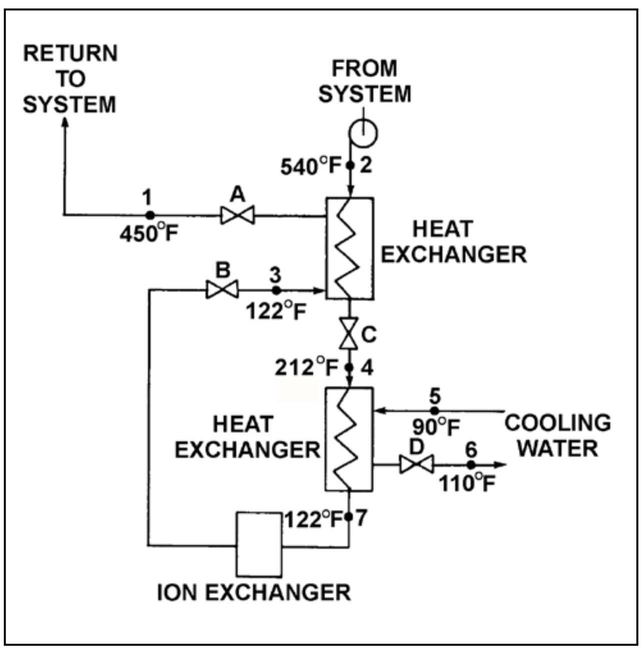
A. 2.2×10^5 lbm/hr

B. 3.2×10^5 lbm/hr

C. 2.2×10^6 lbm/hr

D. 3.2×10^6 lbm/hr

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P3833 (B3832)

A main turbine-generator was operating at 80 percent load with the following initial steady-state lube oil and cooling water temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the following current steady-state heat exchanger temperatures are observed:

$T_{oil\ in}$ = 177°F
$T_{oil\ out}$ = 111°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume the lube oil system is a closed system. Also, assume the following did not change:

- Cooling water mass flow rate
- Cooling water and lube oil specific heats
- Heat exchanger heat transfer coefficient

Which one of the following could be responsible for the differences between the initial and current steady-state heat exchanger temperatures?

A. The current main turbine-generator load is lower than the initial load.

B. The current main turbine-generator load is higher than the initial load.

C. The current main turbine lube oil mass flow rate is less than the initial flow rate.

D. The current main turbine lube oil mass flow rate is greater than the initial flow rate.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P5316 (B5317)

A main turbine-generator was operating at 80 percent load with the following initial steady-state lube oil and cooling water temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the current steady-state heat exchanger temperatures are:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 120°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 120°F

Assume that the lube oil mass flow rate does not change, and that the specific heat values for the cooling water and lube oil do not change. Also assume that the main turbine lube oil system is a closed system.

The differences between the initial and current steady-state heat exchanger temperatures could be caused by the current main turbine-generator load being __________ with the current heat exchanger cooling water mass flow rate being __________.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P5716 (B5716)

Refer to the drawing of an operating parallel-flow lube oil heat exchanger (see figure below). Assume that lube oil (LO) inlet temperature is greater than cooling water (CW) inlet temperature.

Unlike a counter-flow heat exchanger, in a parallel-flow heat exchanger the __________ temperature can never be greater than the __________ temperature.

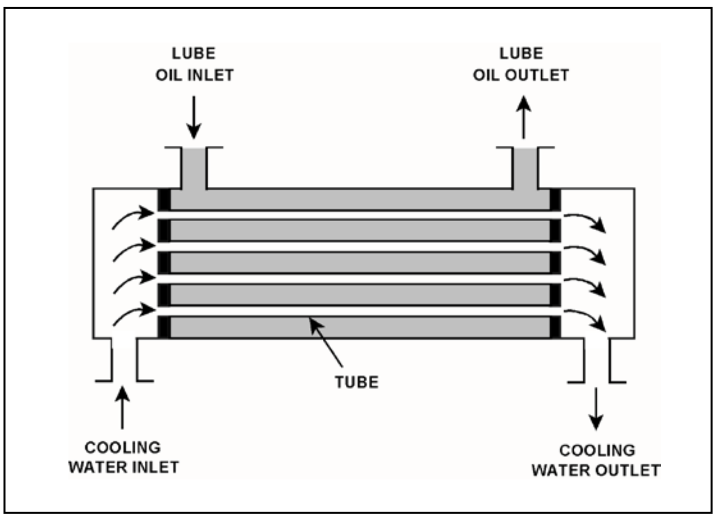
A. LO outlet; CW inlet

B. LO outlet; CW outlet

C. CW outlet; LO inlet

D. CW outlet; LO outlet

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P5916 (B5917)

Refer to the drawing of an operating process water cleanup system (see figure below).

Assume there is no heat loss from the process water cleanup system to the surroundings and the process water flow rate does not change. If valve D closes fully, what will be the final steady-state temperature of the process water flowing through the filter?

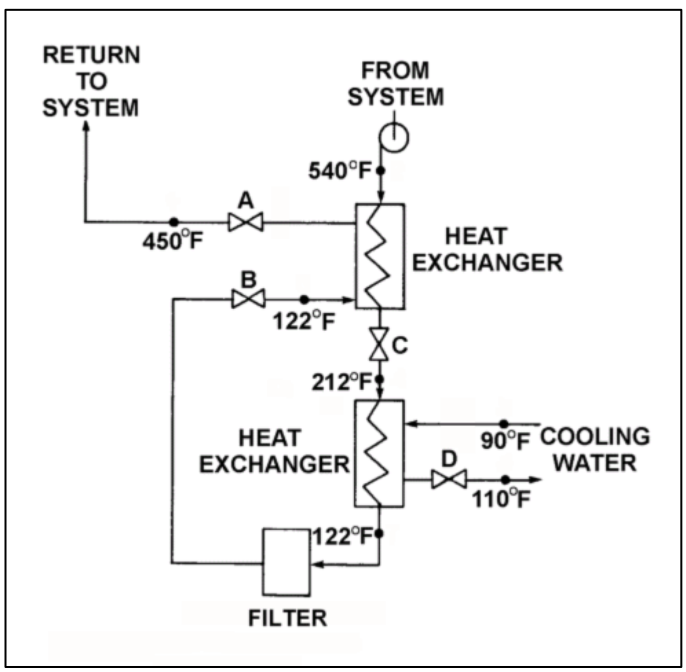
A. 212°F

B. 302°F

C. 450°F

D. 540°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P6116 (B6143)

A counter-flow heat exchanger is being used to cool the lube oil for a main turbine and generator.

The main turbine and generator was initially operating at 100 percent load with the following stable heat exchanger conditions:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Main turbine and generator load was reduced, and the heat exchanger cooling water mass flow rate was decreased to one-half of its initial value, resulting in the following stable current conditions:

$T_{oil\ in}$ = 178°F
$T_{oil\ out}$ = 138°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = ?

Assume that the lube oil mass flow rate and the specific heats of both fluids did not change.

Which one of the following is the current cooling water outlet temperature?

A. 115°F

B. 125°F

C. 135°F

D. 145°F

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P7016 (B7017)

Given the following parameter values for a feedwater heater:

Feedwater inlet temperature	=	320°F
Feedwater inlet pressure	=	1,000 psia
Feedwater mass flow rate	=	1.0×10^6 lbm/hr
Extraction steam pressure	=	500 psia

Assume that the extraction steam enters the heater as a dry saturated vapor and leaves the heater as a saturated liquid at 500 psia.

Which one of the following is the approximate mass flow rate of extraction steam required to increase feedwater temperature to 380°F?

A. 5.2×10^4 lbm/hr

B. 7.9×10^4 lbm/hr

C. 8.4×10^4 lbm/hr

D. 8.9×10^4 lbm/hr

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P7316 (B7316)

Refer to the drawing of an operating parallel-flow lube oil heat exchanger (see figure below).

Unlike a counter-flow heat exchanger, in the parallel-flow heat exchanger the __________ temperature will always be greater than the __________ temperature.

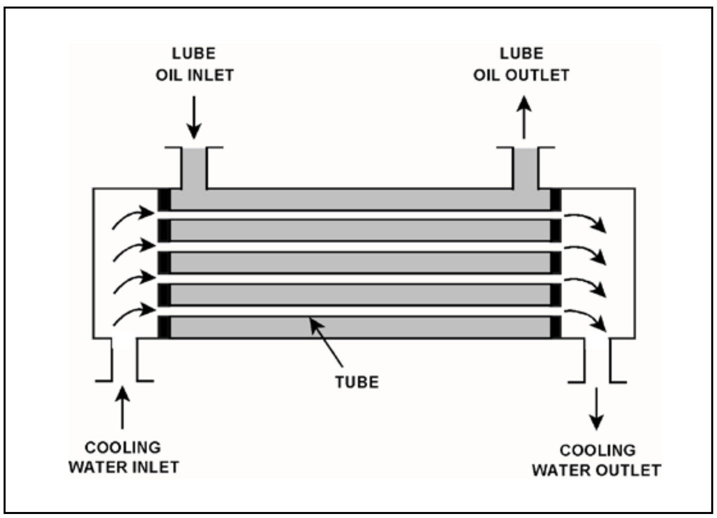
A. CW outlet; LO inlet

B. CW outlet; LO outlet

C. LO outlet; CW inlet

D. LO outlet; CW outlet

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.03 [2.2/2.3]
QID: P7786 (B7786)

Given the following parameters for an operating lube oil heat exchanger:

Lube oil inlet temperature = 150°F
Lube oil outlet temperature = 105°F
Cooling water inlet temperature = 60°F
Cooling water outlet temperature = 110°F

Considering only counter-flow and parallel-flow heat exchanger designs, the lube oil heat exchanger described above must be…

A. counter-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

B. counter-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

C. parallel-flow, because the lube oil outlet temperature is less than the cooling water outlet temperature.

D. parallel-flow, because the change in lube oil temperature is less than the change in cooling water temperature.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.04 [2.5/2.7]
QID: P6716

A reactor is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS), and that the RHR system provides complete thermal mixing of the RCS. Also, assume that core decay heat is the only source of heat addition to the RCS.

Given the following information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.5% rated thermal power
RHR system heat removal rate	=	5.3×10^7 Btu/hr
RHR and reactor coolant c_p	=	1.05 Btu/lbm-°F
Combined RCS and RHR inventory	=	425,000 lbm

Which one of the following actions will establish a reactor cooldown rate between 20°F /hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.04 [2.5/2.7]
QID: P7116

A reactor is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS), and that the RHR system provides complete thermal mixing of the RCS. Also, assume that core decay heat is the only source of heat addition to the RCS.

Given the following information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.5% rated thermal power
RHR system heat removal rate	=	5.7×10^7 Btu/hr
RHR and reactor coolant c_p	=	1.05 Btu/lbm-°F
Combined RCS and RHR inventory	=	450,000 lbm

Which one of the following actions will establish a reactor cooldown rate between 20°F/hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.04 [2.5/2.7]
QID: P7616

A reactor is shut down with core decay heat being removed by the residual heat removal (RHR) system. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS), and that the RHR system provides complete thermal mixing of the RCS. Also, assume that core decay heat is the only source of heat addition to the RCS.

Given the following information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.6 percent of rated thermal power
RHR system heat removal rate	=	8.1×10^7 Btu/hr
RHR and reactor coolant c_p	=	1.05 Btu/lbm-°F
Combined RCS and RHR inventory	=	450,000 lbm

Which one of the following actions will establish an RCS cooldown rate between 20°F/hour and 30°F/hour?

A. Increase RHR heat exchanger flow rate to increase the cooldown rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to increase the cooldown rate by 20°F/hour.

C. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 10°F/hour.

D. Reduce RHR heat exchanger flow rate to decrease the cooldown rate by 20°F/hour.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.04 [2.5/2.7]
QID: P7775

A reactor is shut down with the residual heat removal (RHR) system in service. Assume that only the RHR heat exchangers are removing heat from the reactor coolant system (RCS), and the RHR system provides complete thermal mixing of the RCS. Also, assume that core decay heat is the only source of heat addition to the RCS.

Given the following current information:

Reactor core rated thermal power	=	2,950 MW
Core decay heat rate	=	0.6 percent of rated thermal power
RHR system heat removal rate	=	4.7×10^7 Btu/hr
RHR and reactor coolant c_p	=	1.05 Btu/lbm-°F
Combined RCS and RHR coolant mass	=	450,000 lbm

Which one of the following actions will establish a reactor coolant heatup rate between 10°F/hour and 20°F/hour?

A. Increase RHR heat exchanger flow rate to reduce the heatup rate by 10°F/hour.

B. Increase RHR heat exchanger flow rate to reduce the heatup rate by 110°F/hour.

C. Decrease RHR heat exchanger flow rate to increase the heatup rate by 10°F/hour.

D. Decrease RHR heat exchanger flow rate to increase the heatup rate by 110°F/hour.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.04 [2.5/27]
QID: P7815 (B7815)

The manufacturers of shell and U-tube heat exchangers recommend a maximum tube fluid velocity to limit the __________ of the tubes; and a minimum tube fluid velocity to limit the __________ of the tubes.

A. erosion; fouling

B. erosion; thermal contraction

C. thermal expansion; fouling

D. thermal expansion; thermal contraction

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P5616 (B5617)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given:

- The cooling water inlet temperature is constant.
- The lube oil inlet temperature is constant.
- The lube oil mass flow rate is constant.

If the cooling water mass flow rate increases, the lube oil outlet temperature will __________; and the cooling water outlet temperature will __________.

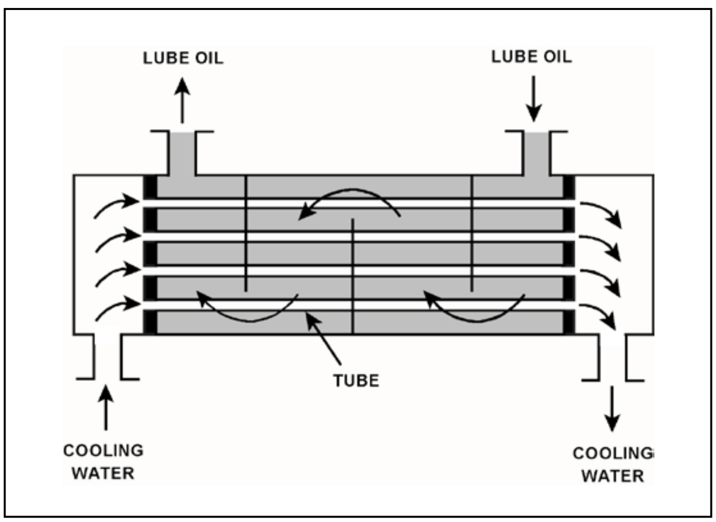
A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.2/2.3]
QID: P7676 (B7676)

Which one of the following will increase the heat transfer rate between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The mass flow rate of the hotter liquid decreases by 10 percent.

B. The mass flow rate of the colder liquid decreases by 10 percent.

C. The inlet temperature of the hotter liquid increases by 20°F.

D. The inlet temperature of the colder liquid increases by 20°F.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P7805 (B7806)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The rate of heat transfer between the lube oil and cooling water will increase if the cooling water inlet temperature __________; or if the cooling water mass flow rate __________.

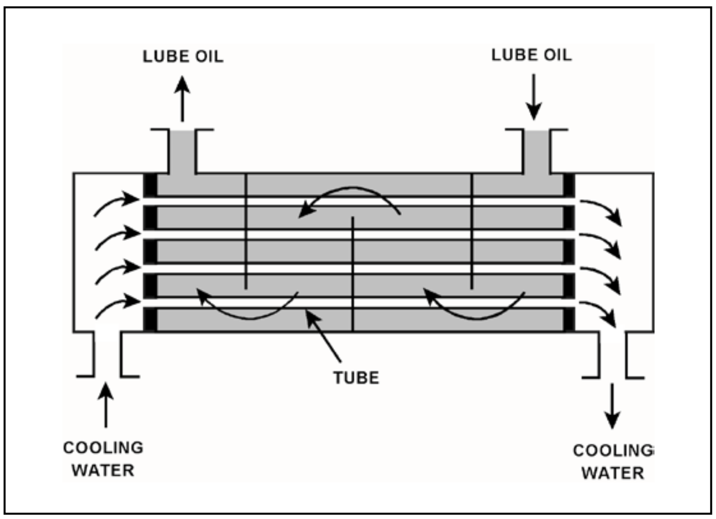
A. decreases; decreases

B. decreases; increases

C. increases; decreases

D. increases; increases

ANSWER: B.



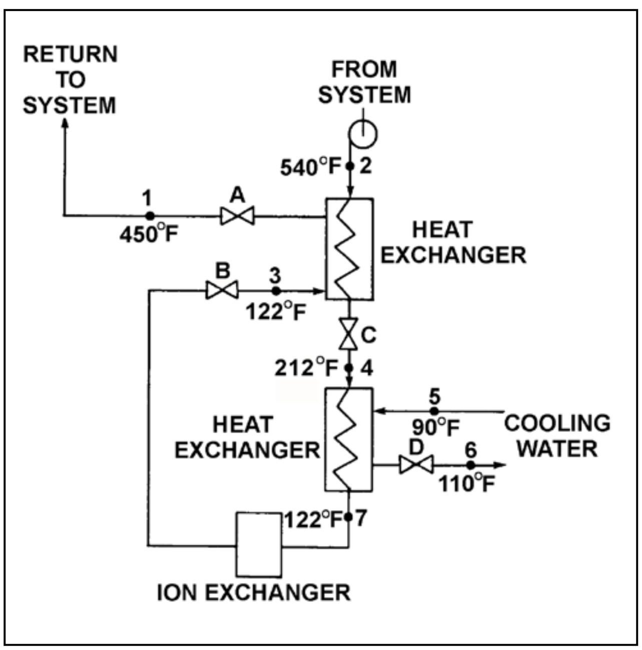
TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P7824 (B7824)

Refer to the drawing of an operating water cleanup system (see figure below) in which valves A, B, C, and D are fully open. Currently, the centrifugal pump is providing a cleanup water flow rate of 120 gpm.

If valve C is throttled to 50 percent, how will the temperatures at points 3 and 6 be affected?

	Point 3	Point 6
A.	Decrease	Decrease
B.	Decrease	Increase
C.	Increase	Decrease
D.	Increase	Increase

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P104 (B231)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50 percent open. To lower the temperature at point 7, the operator can adjust valve __________ in the open direction.

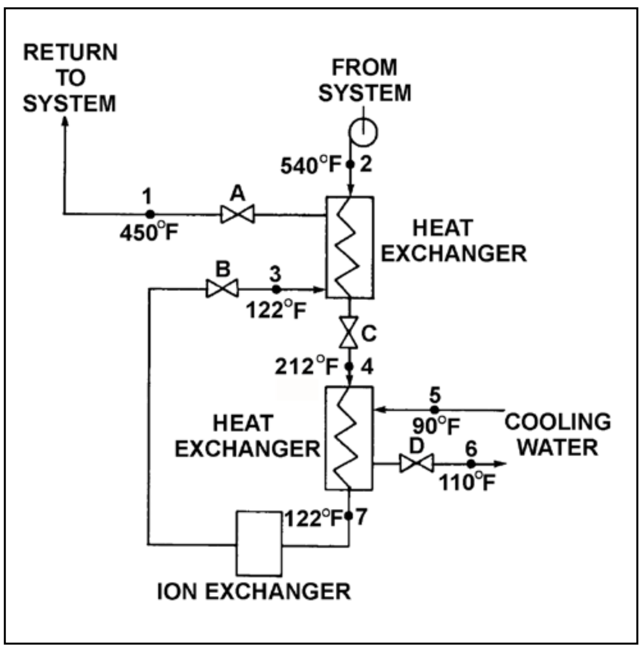
A. A

B. B

C. C

D. D

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P534 (B331)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Increasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to __________ and the cooling water outlet temperature to __________.

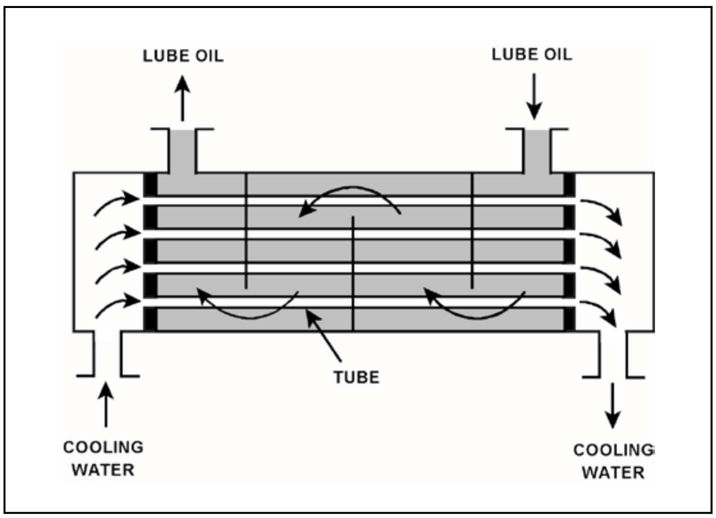
A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P632 (B431)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Assume that the inlet lube oil and inlet cooling water temperatures are constant and cooling water flow rate remains the same. Decreasing the oil flow rate through the heat exchanger will cause the lube oil outlet temperature to __________ and the cooling water outlet temperature to __________.

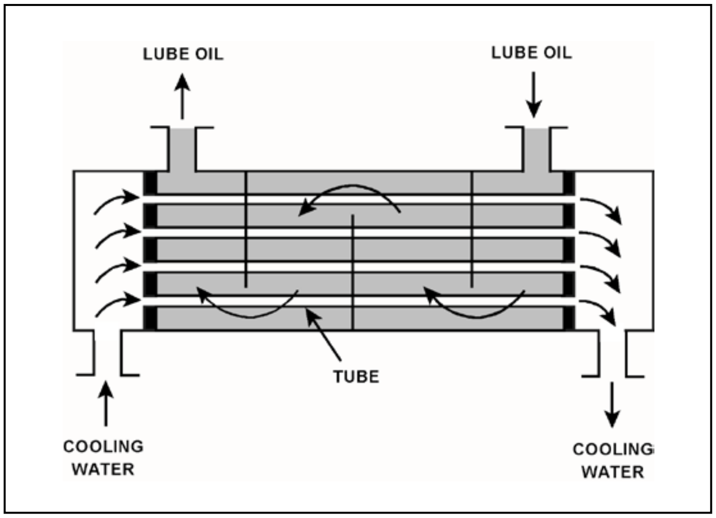
A. increase, increase

B. increase, decrease

C. decrease, increase

D. decrease, decrease

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P732 (B1834)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 80 percent open. If valve D is throttled to 50 percent, the temperature at point...

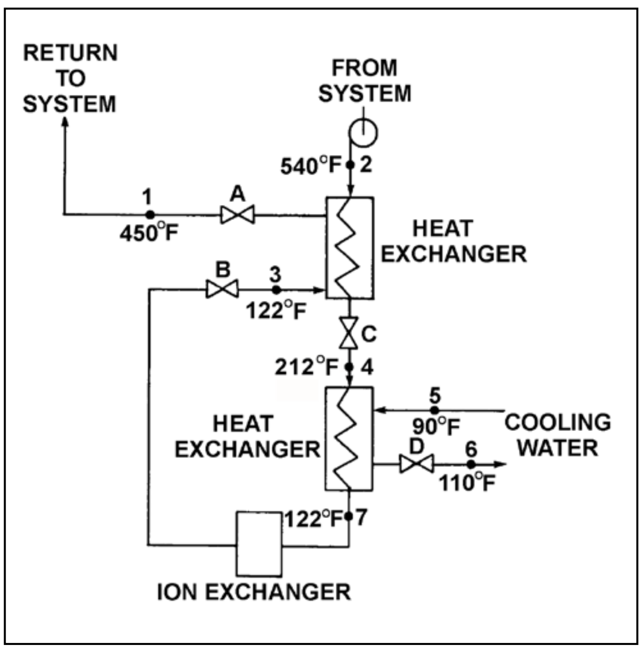
A. 3 will decrease.

B. 4 will increase.

C. 5 will increase.

D. 6 will decrease.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P1032 (B1031)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 20 percent open. If valve D is opened to 100 percent, the temperature at point...

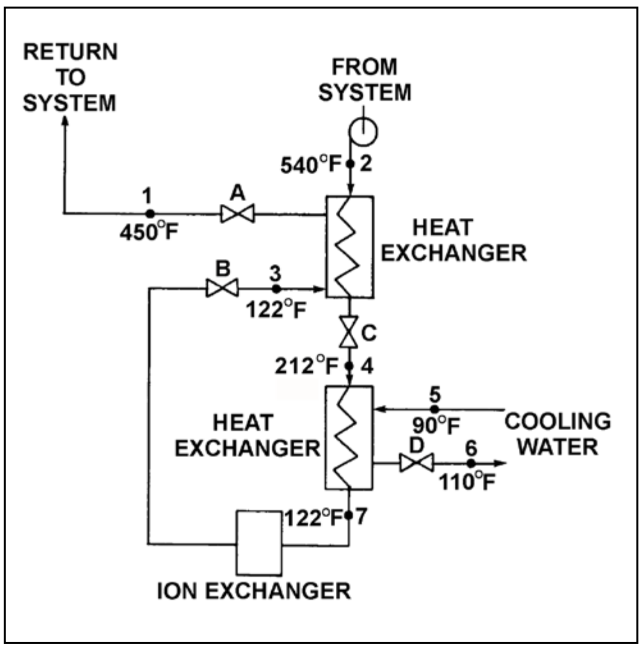
A. 3 will increase.

B. 4 will decrease.

C. 5 will decrease.

D. 7 will increase.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P1231 (B1231)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50 percent open. To lower the temperature at point 4, the operator can adjust valve __________ in the __________ direction.

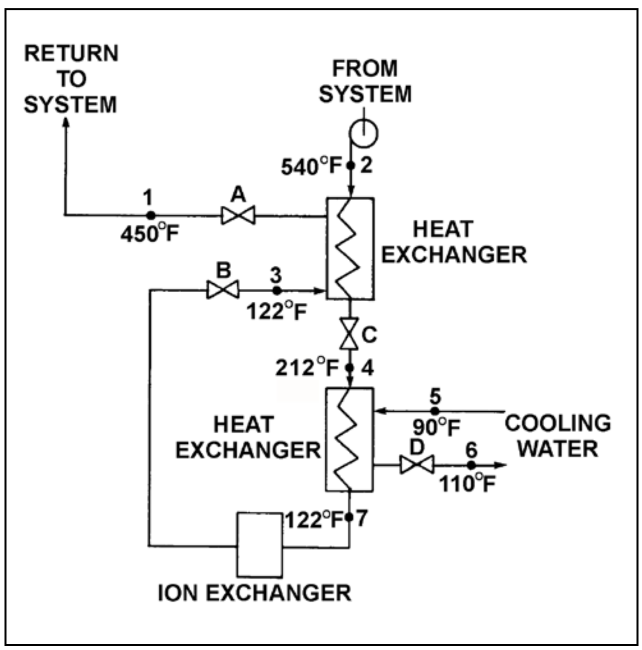
A. A; open

B. B; close

C. C; open

D. D; close

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2133 (B2132)

Refer to the drawing of a lube oil heat exchanger (see figure below).

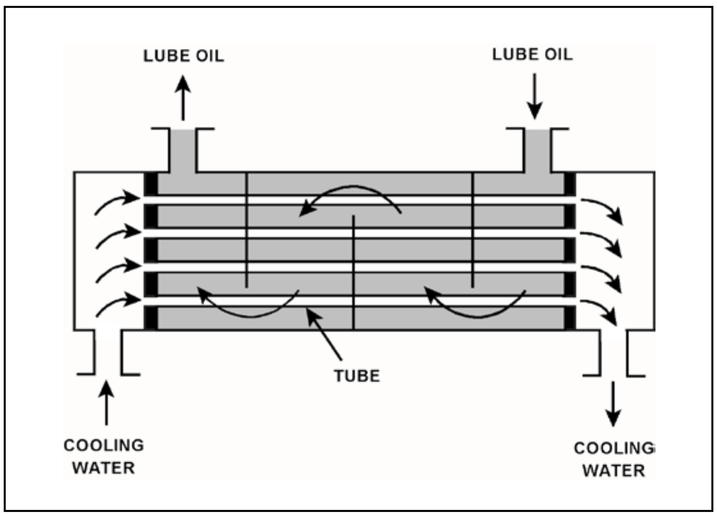
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 120°F
Cooling water inlet temperature = 60°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	90°F	90°F
C.	80°F	80°F
D.	80°F	100°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2434 (B2233)

Refer to the drawing of a lube oil heat exchanger (see figure below).

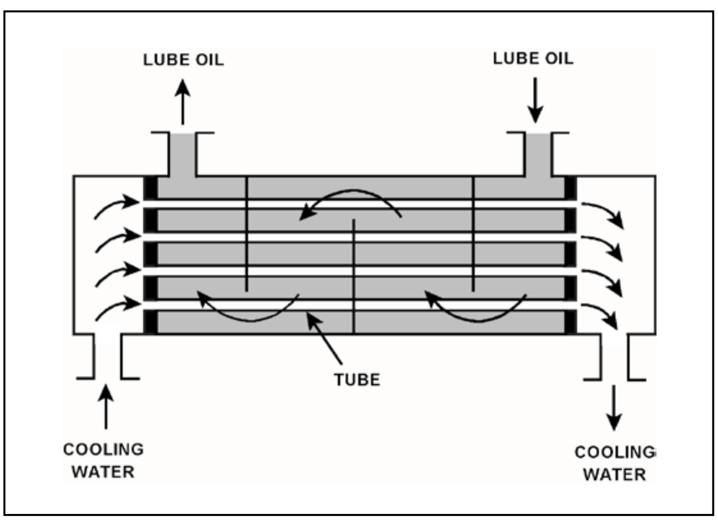
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	100°F
B.	90°F	110°F
C.	100°F	100°F
D.	100°F	110°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2633 (B2632)

Refer to the drawing of a lube oil heat exchanger (see figure below).

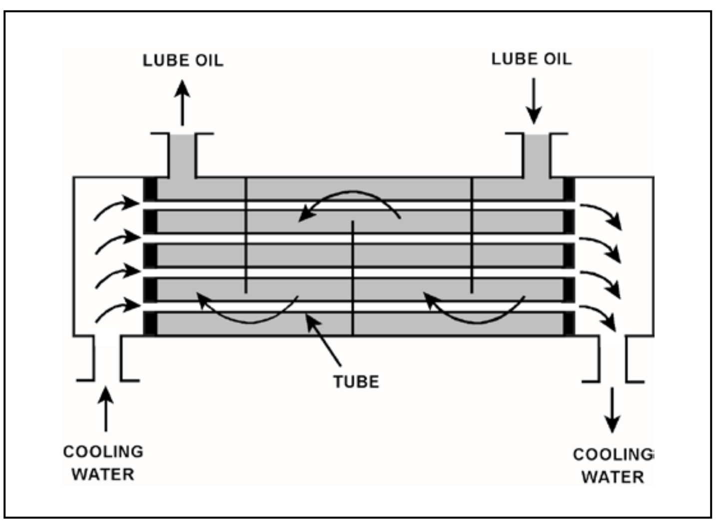
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 110°F
Cooling water inlet temperature = 75°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	100°F	90°F
C.	90°F	100°F
D.	90°F	90°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2732 (B2732)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50 percent open. To raise the temperature at point 4, the operator can adjust valve __________ in the __________ direction.

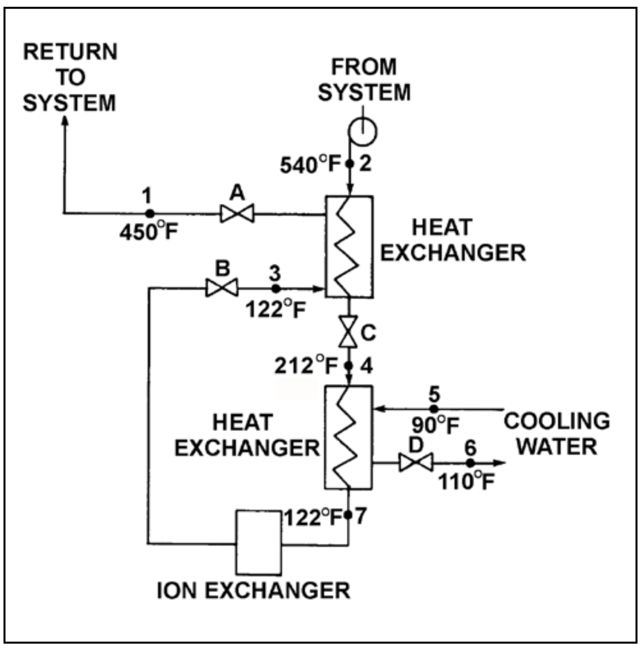
A. A; shut

B. B; shut

C. C; open

D. D; open

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2733 (B2733)

Refer to the drawing of a lube oil heat exchanger (see figure below).

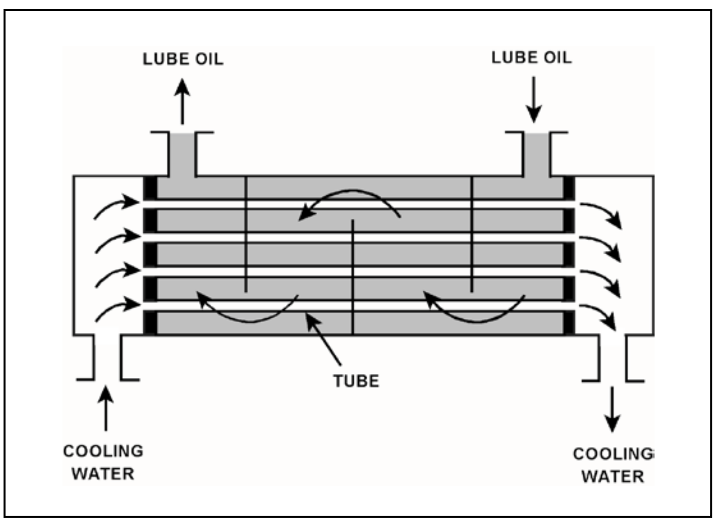
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is not possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	86°F
B.	100°F	85°F
C.	110°F	84°F
D.	120°F	83°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P2934 (B2933)

Refer to the drawing of a lube oil heat exchanger (see figure below).

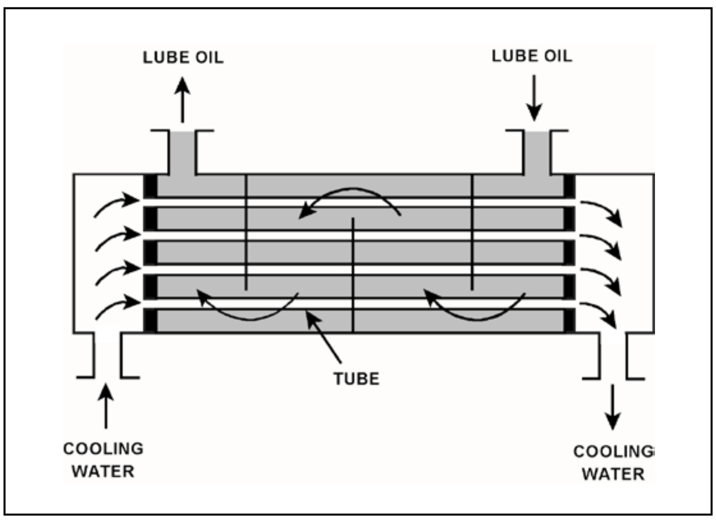
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assuming the cooling water flow rate exceeds the lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	90°F
B.	100°F	100°F
C.	110°F	90°F
D.	110°F	100°F

ANSWER: A.



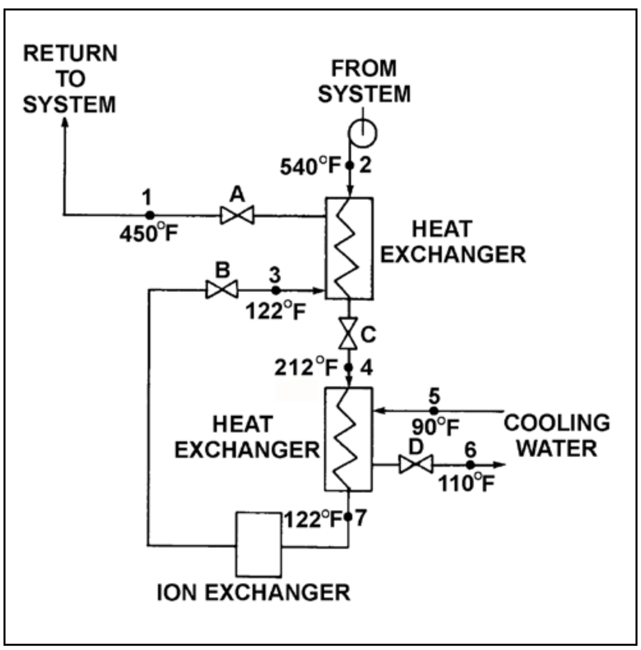
TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P3232 (B632)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and D are fully open and valve C is 50 percent open. If valve C is opened to 100 percent, how will the temperatures at points 3 and 6 be affected?

	Point 3	Point 6
A.	Decrease	Decrease
B.	Decrease	Increase
C.	Increase	Decrease
D.	Increase	Increase

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P3332 (B1930)

Refer to the drawing of an operating water cleanup system (see figure below). All valves are identical and are initially 50 percent open.

To raise the temperature at point 7, the operator can adjust valve _____ in the close direction.

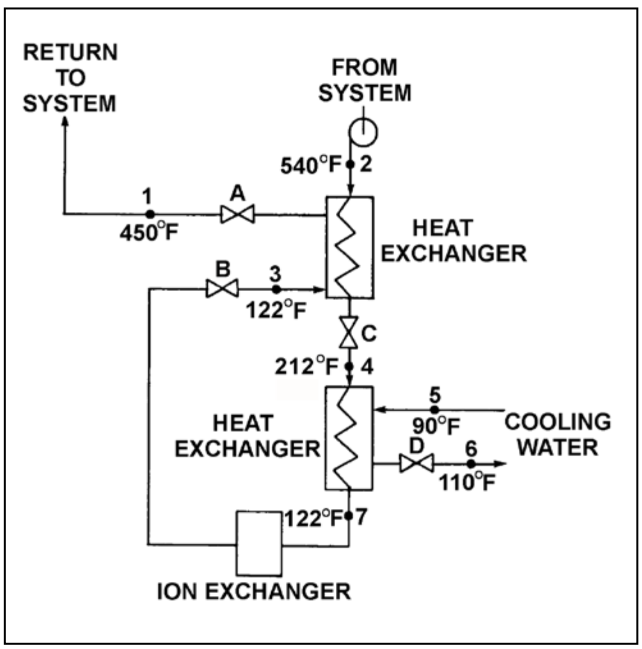
A. A

B. B

C. C

D. D

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P3732 (B3732)

Refer to the drawing of a lube oil heat exchanger (see figure below).

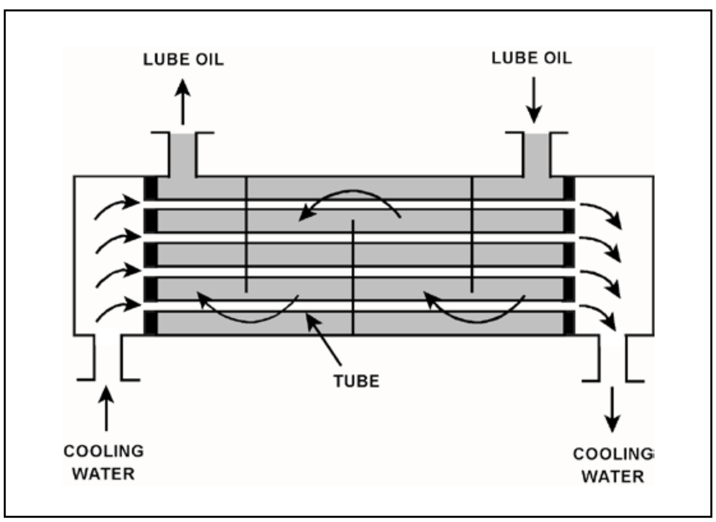
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assume that cooling water mass flow rate is less than lube oil mass flow rate, and that both fluids have the same specific heat. Which one of the following pairs of heat exchanger outlet temperatures is not possible?

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	105°F
B.	105°F	105°F
C.	110°F	90°F
D.	115°F	90°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P4416 (B4416)

Refer to the drawing of a lube oil heat exchanger (see figure below).

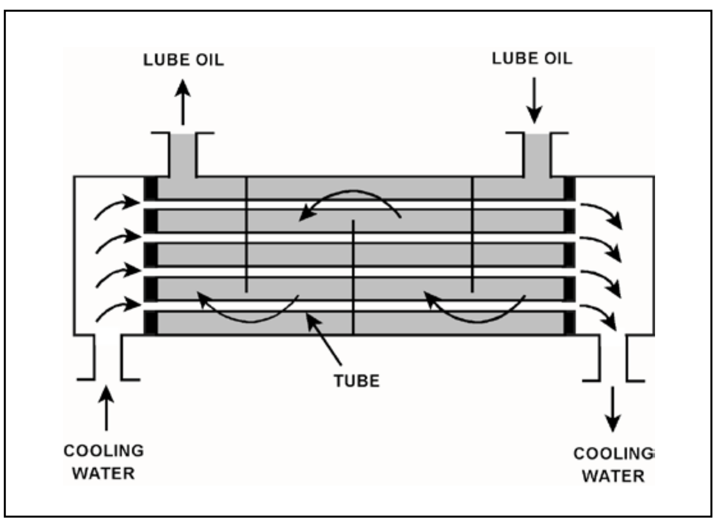
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 120°F
Cooling water inlet temperature = 60°F

Assuming that cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	100°F
B.	90°F	85°F
C.	95°F	100°F
D.	95°F	85°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P5516 (B5517)

Refer to the drawing of a lube oil heat exchanger (see figure below).

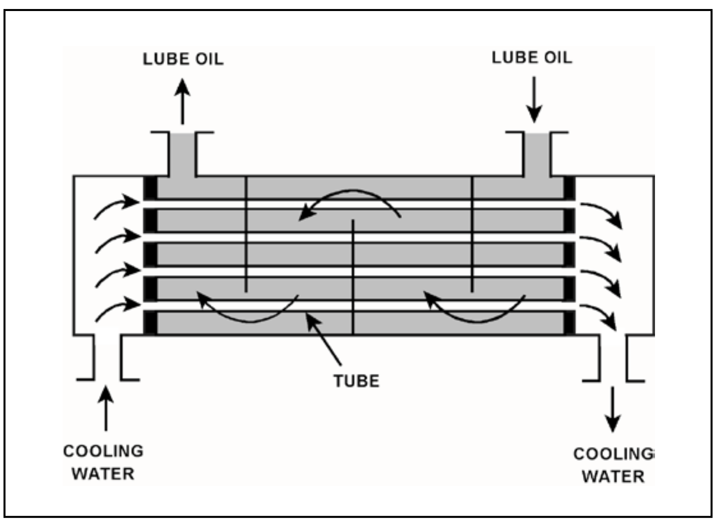
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Given that cooling water mass flow rate is greater than lube oil mass flow rate, which one of the following pairs of heat exchanger outlet temperatures is not possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	105°F
B.	90°F	100°F
C.	110°F	95°F
D.	110°F	85°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P6516 (B6516)

Refer to the drawing of a heat exchanger (see figure below).

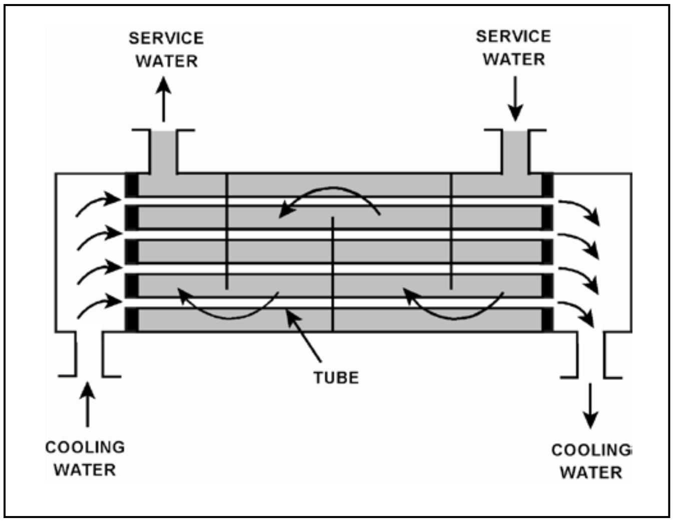
The heat exchanger is in service with the following inlet temperatures:

Service water inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assume that both fluids have the same specific heat, and that service water mass flow rate is greater than cooling water mass flow rate. Which one of the following pairs of heat exchanger outlet temperatures is possible?

	Service Water Outlet Temp.	Cooling Water Outlet Temp.
A.	120°F	82°F
B.	110°F	90°F
C.	100°F	98°F
D.	90°F	106°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P7516 (B7517)

Refer to the drawing of a heat exchanger (see figure below).

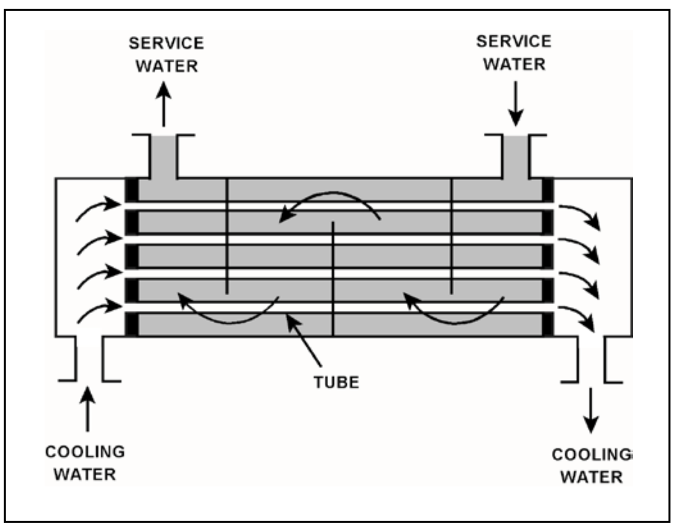
The heat exchanger is in service with the following inlet temperatures:

Cooling water inlet temperature = 70°F
Service water inlet temperature = 130°F

Assume that both fluids have the same specific heat, and that cooling water mass flow rate is greater than service water mass flow rate. Which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible?

	Cooling Water Outlet Temp.	Service Water Outlet Temp.
A.	78°F	120°F
B.	90°F	110°F
C.	98°F	100°F
D.	100°F	90°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.08 [2.4/2.4]
QID: P7725

Refer to the drawing of a heat exchanger (see figure below).

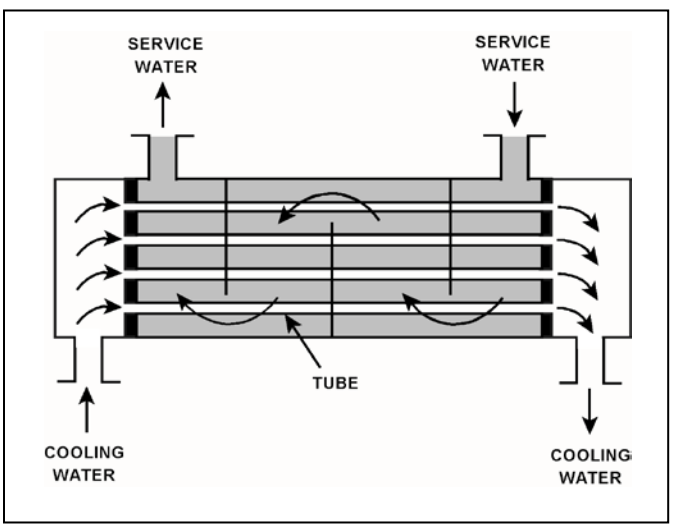
The heat exchanger is in service with the following inlet temperatures:

Service water inlet temperature = 130°F
Cooling water inlet temperature = 70°F

Assume that both fluids have the same specific heat, and that cooling water mass flow rate is greater than service water mass flow rate. Which one of the following pairs of heat exchanger outlet temperatures is possible?

	Service Water Outlet Temp.	Cooling Water Outlet Temp.
A.	120°F	90°F
B.	110°F	95°F
C.	100°F	100°F
D.	90°F	105°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P31

Severe stress in a mechanical component, induced by a sudden, unequally distributed temperature reduction is a description of...

A. fracture stress.

B. brittle fracture.

C. thermal shock.

D. pressurized thermal shock.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P233

The major thermodynamic concern resulting from rapidly cooling a reactor vessel is...

A. thermal shock.

B. stress corrosion.

C. loss of shutdown margin.

D. loss of subcooling margin.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P2832 (B633)

Steam has been admitted to a main condenser for 25 minutes with no cooling water flow. Initiating full cooling water flow rate at this time will...

A. reduce the stress on the condenser shell by rapidly cooling the shell.

B. reduce the stress on the condenser tubes by rapidly cooling the tubes.

C. induce large thermal stresses on the condenser shell.

D. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P32 (B1234)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If scaling occurs inside the cooling water tubes, cooling water outlet temperature will __________; and lube oil outlet temperature will __________. (Assume the lube oil and cooling water flow rates do not change.)

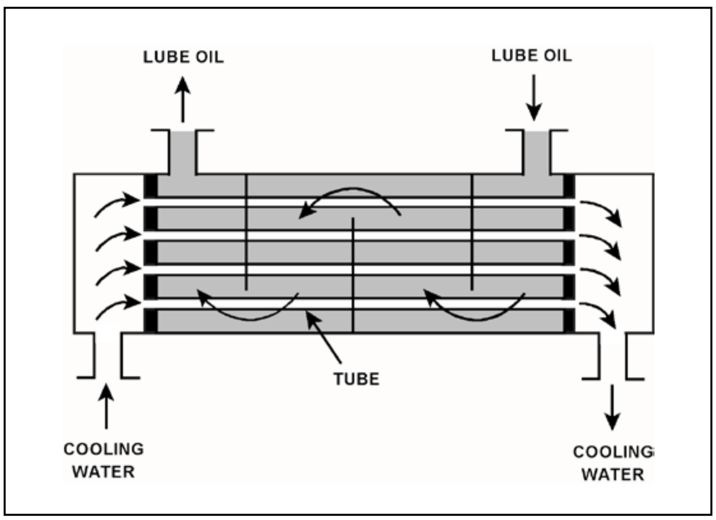
A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P105

Which one of the following will occur to reduce the heat transfer rate in a parallel-flow heat exchanger as scaling increases on the exterior surface of the tubes?

A. Flow rate through the tubes will decrease.

B. Surface area of the tubes will decrease.

C. Thermal conductivity of the tubes will decrease.

D. Delta-T across the tubes will decrease.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P331 (B332)

A nuclear power plant is operating at steady-state conditions with the main generator supplying 1,000 MW to the power grid. Assume main generator load remains constant.

If one percent of the tubes in the main condenser become plugged, condenser absolute pressure will __________; and condenser hotwell temperature will __________.

A. increase; increase

B. decrease; increase

C. increase; decrease

D. decrease; decrease

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P2233 (B1833)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If mineral deposits accumulate on the outside of the cooling water tubes, the cooling water outlet temperature will __________; and the lube oil outlet temperature will __________. (Assume the lube oil and cooling water inlet temperatures and mass flow rates do not change.)

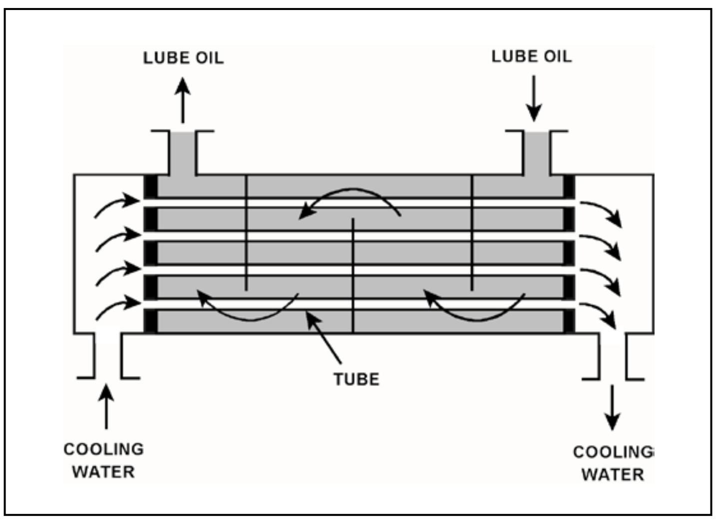
A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P3633 (B3635)

A main turbine-generator is operating at 80 percent load with the following initial steady-state temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

After six months of main turbine-generator operation, the following final steady-state lube oil heat exchanger temperatures are observed:

$T_{oil\ in}$ = 179°F
$T_{oil\ out}$ = 119°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume the final cooling water and lube oil flow rates are the same as the initial flow rates, and the specific heat values for the cooling water and lube oil do not change.

Which one of the following could be responsible for the differences between the initial and final heat exchanger steady-state temperatures?

A. The heat exchanger tubes have become fouled with scale.

B. The temperature of the cooling water source has increased.

C. The final main turbine-generator load is higher than the initial load.

D. The final main turbine-generator load is lower than the initial load.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P4617 (B4616)

Refer to the drawing of two system curves for a main condenser cooling water system (see figure below).

Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

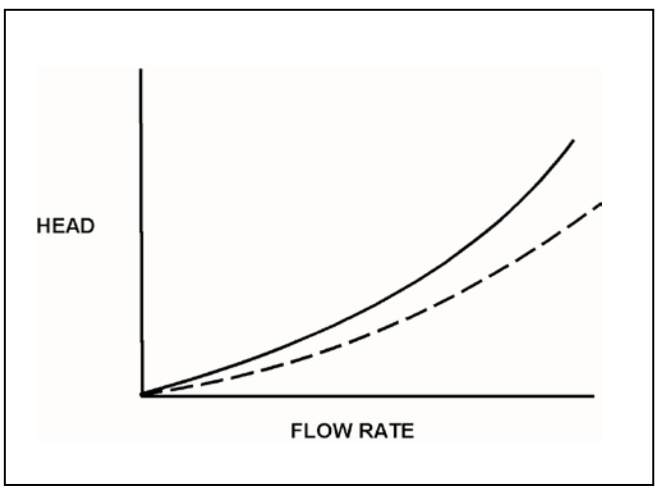
A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water flow rate is increased by 25 percent by starting an additional cooling water pump.

D. Cooling water flow rate is decreased by 25 percent by stopping one of the operating cooling water pumps.

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P5116 (B5117)

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

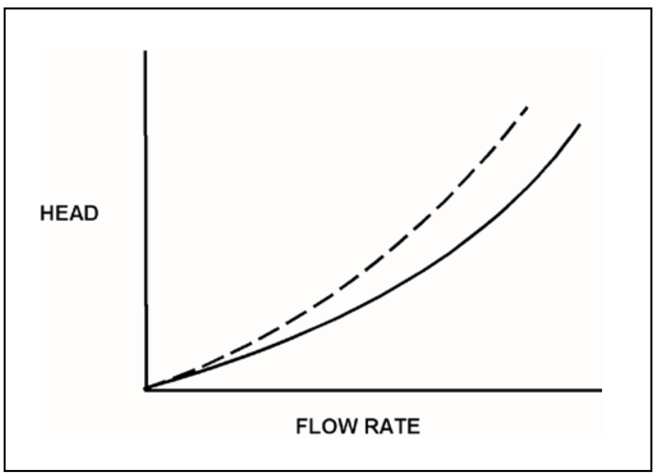
A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water system flow rate is increased by 25 percent by starting an additional cooling water pump.

D. Cooling water system flow rate is decreased by 25 percent by stopping one of the operating cooling water pumps.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P6616 (B6617)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If mineral deposits accumulate on the inside of the cooling water tubes, cooling water outlet temperature will __________; and lube oil outlet temperature will __________. (Assume the lube oil and cooling water inlet temperatures and flow rates do not change.)

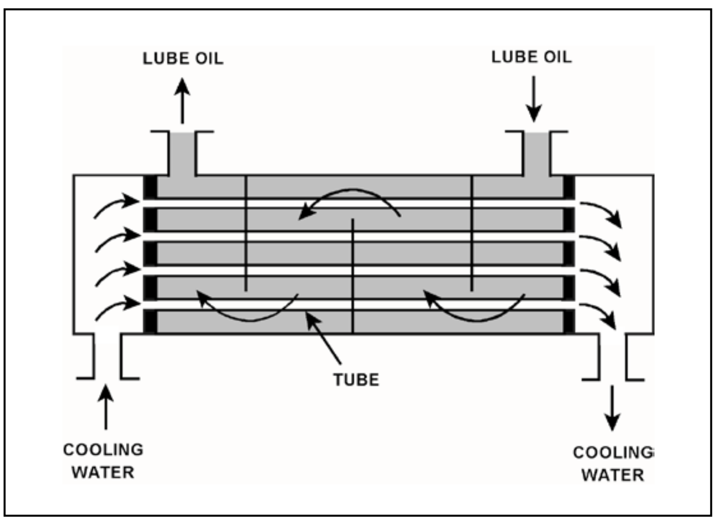
A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P7625 (B7625)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger was initially placed in continuous service 6 months ago. During the 6-month period of operation, mineral deposits have accumulated inside the heat exchanger tubes.

The following parameters are currently stable at their initial values:

- Lube oil mass flow rate
- Lube oil inlet temperature
- Lube oil outlet temperature
- Cooling water inlet temperature

Compared to their initial values, the current cooling water outlet temperature is __________; and the current cooling water mass flow rate is __________.

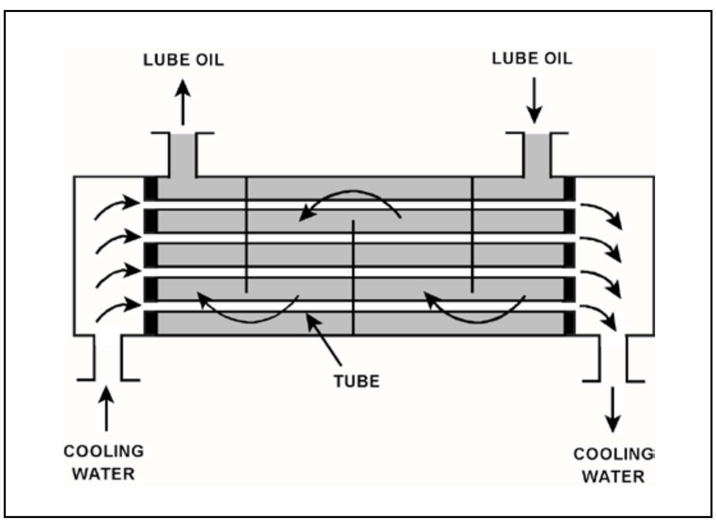
A. lower; greater

B. lower; smaller

C. higher; greater

D. higher; smaller

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P7736 (B7736)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger was initially placed in continuous service 6 months ago. During the 6-month period of operation, mineral deposits have accumulated inside the heat exchanger tubes.

The following parameters are currently stable at their initial values:

- Cooling water mass flow rate
- Cooling water inlet temperature
- Cooling water outlet temperature
- Lube oil mass flow rate

Compared to their initial values, the current lube oil inlet temperature is __________; and the current lube oil outlet temperature is __________.

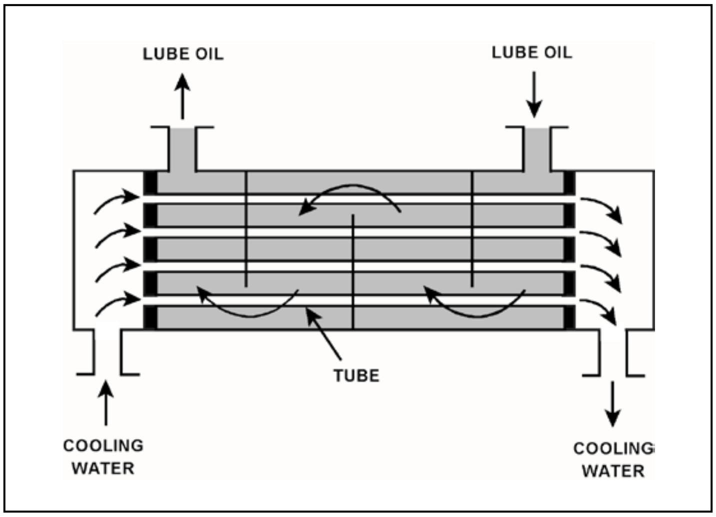
A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P33

Borated water is flowing through the tubes of a heat exchanger being cooled by fresh water. The shell side pressure is less than tube side pressure. What will occur as a result of a tube failure?

A. Shell side pressure will increase and the borated water system will be diluted.

B. Shell side pressure will decrease and the borated water inventory will be depleted.

C. Shell side pressure will increase and the borated water inventory will be depleted.

D. Shell side pressure will decrease and the borated water system will be diluted.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P234 (B3535)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following effects will occur because of the failed tube in the heat exchanger?

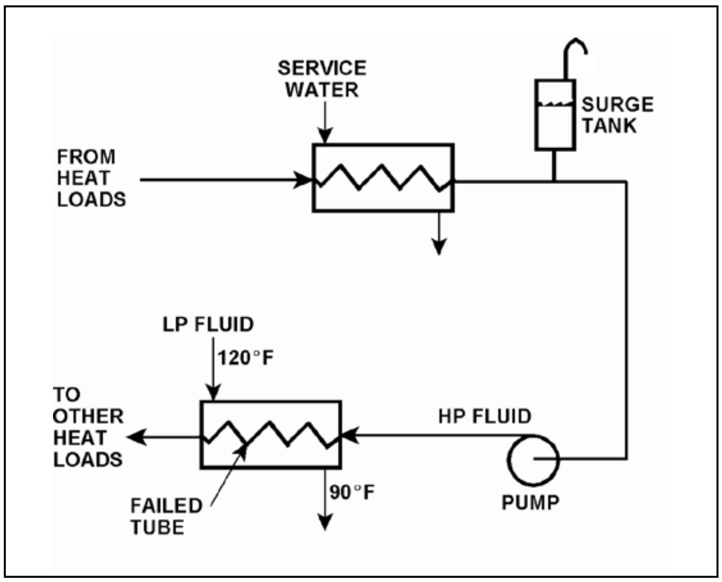
A. Level in the surge tank will increase.

B. Flow in the low pressure (LP) system will reverse.

C. Pressure in the low pressure (LP) system will decrease.

D. Low pressure (LP) fluid heat exchanger outlet temperature will decrease.

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P333 (B333)

A nuclear power plant is operating normally at 50 percent power. Which one of the following will result from a cooling water tube rupture in the main condenser?

A. Increased main condenser vacuum.

B. Increased conductivity of the condensate.

C. Decreased condensate pump available net positive suction head.

D. Decreased condensate pump flow rate.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1134 (B1931)

With a nuclear power plant operating at 50 percent power, which one of the following will occur as a result of multiple tube leaks in the main condenser? (Assume that main condenser vacuum does not change.)

A. Condensate depression will decrease.

B. Condensate conductivity will increase.

C. Condensate oxygen concentration will decrease.

D. Condenser inlet cooling water flow rate will decrease.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1234 (B1535)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will occur as a result of the indicated tube failure in the heat exchanger? (HP = high pressure; LP = low pressure)

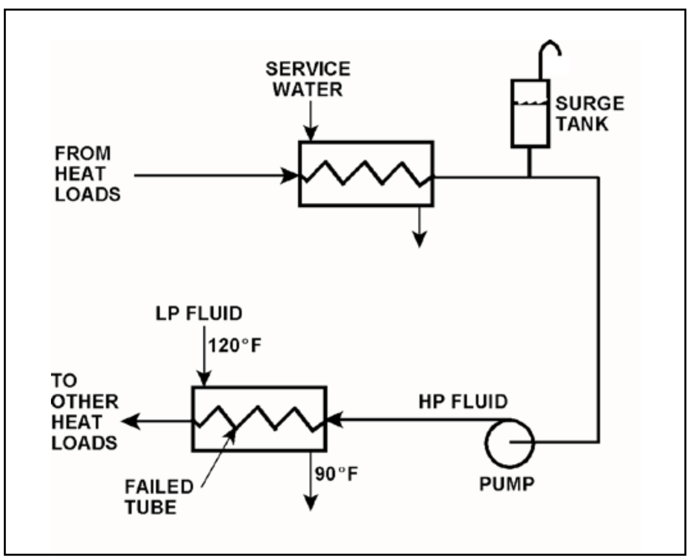
A. HP fluid inventory will increase.

B. Level in the surge tank will decrease.

C. Pressure in the LP system will decrease.

D. Temperature in the LP system will increase.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1285

Initially, a nuclear power plant was operating at steady-state 100 percent power with the following steam generator (SG) and reactor coolant system (RCS) parameters:

RCS average temperatures = 575°F
RCS hot leg temperatures = 600°F
RCS cold leg temperatures = 550°F
SG outlet steam pressures = 885 psig

Then, the reactor was shut down for a maintenance outage, during which multiple SG tube leaks were discovered and plugged. After the outage, a total of 7 percent of the tubes in each SG were plugged.

The reactor was restarted and power was ramped to 100 percent. To establish a SG pressure of 885 psig at 100 percent power, the RCS average coolant temperatures will have to be increased to...

A. 578°F.

B. 580°F.

C. 582°F.

D. 584°F.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1685

Initially, a nuclear power plant was operating at steady-state 80 percent power with the following steam generator (SG) and reactor coolant system (RCS) parameters:

RCS hot leg temperatures	= 600°F
RCS cold leg temperatures	= 550°F
RCS mass flow rate to each SG	= 100 percent

Then, the reactor was shut down for a maintenance outage, during which multiple SG tube leaks were discovered and then plugged. After the outage, the RCS mass flow rate to each SG was 98 percent.

When the reactor is once again operating at 80 percent power with RCS hot leg temperatures at 600°F, the RCS cold leg temperatures will be...

A. 548°F.

B. 549°F.

C. 551°F.

D. 552°F.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P4917 (B4918)

A nuclear power plant was initially operating at steady-state 50 percent power with 50 gpm of main condenser cooling water inleakage through a cooling water tube rupture. Power was then increased, and is currently stable at 60 percent.

Assume the size of the cooling water tube rupture does not change, and the main condenser cooling water inlet pressure and inlet temperature do not change.

When compared to the flow rate of main condenser cooling water inleakage at 50 percent power, the flow rate of cooling water inleakage at 60 percent power is __________ because the main condenser pressure at 60 percent power is __________.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P1834 (B111)

During normal nuclear power plant operation, a main condenser develops an air leak which decreases vacuum at a rate of 1.0 inch Hg/min. Which one of the following will increase because of this condition? (Assume that main turbine steam inlet valve position does not change.)

A. Steam cycle efficiency.

B. Main turbine work output.

C. Condenser hotwell temperature.

D. Low pressure turbine exhaust steam moisture content.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P1912 (B936)

During normal nuclear power plant operation, why does air entry into the main condenser reduce the thermodynamic efficiency of the steam cycle?

A. The rate of steam flow through the main turbine increases.

B. The condensate subcooling in the main condenser decreases.

C. The enthalpy of the low pressure turbine exhaust increases.

D. The air mixes with the steam and enters the condensate.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P2634 (B2633)

A nuclear power plant is operating at steady-state 100 percent power. Assume the main condenser cooling water inlet temperature and flow rate do not change.

If the main condenser vacuum slowly decreases, the temperature of the condensate falling into the hotwell will...

A. decrease, because the condensate saturation pressure has decreased.

B. decrease, because the amount of condensate subcooling has increased.

C. increase, because the condensate saturation pressure has increased.

D. increase, because the amount of condensate subcooling has decreased.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P3534 (B2736)

A nuclear power plant is operating at steady-state 100 percent power when air inleakage causes main condenser vacuum to decrease from 28 inches Hg vacuum to 27 inches Hg vacuum. Assume the main steam inlet pressure, inlet quality, and mass flow rate through the main turbine do not change, and the condenser cooling water inlet temperature and mass flow rate do not change.

When the plant stabilizes, turbine exhaust quality will be __________; and turbine exhaust temperature will be __________.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P3734 (B3777)

A nuclear power plant is operating near rated power with the following initial conditions:

Main steam pressure = 900 psia
Main steam quality = 100 percent, saturated vapor
Main condenser pressure = 1.0 psia

Air leakage into the main condenser results in the main condenser pressure increasing and stabilizing at 2.0 psia. Assume that all main steam parameters (e.g., pressure, quality, and mass flow rate) remain the same and that the main turbine efficiency remains at 100 percent.

Which one of the following is the percent by which the main generator MW output will decrease as a result of the main condenser pressure increase?

A. 5.0 percent

B. 6.3 percent

C. 7.5 percent

D. 8.8 percent

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4016 (B4018)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 120°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 91°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids do not change.

Which one of the following will be the resulting temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

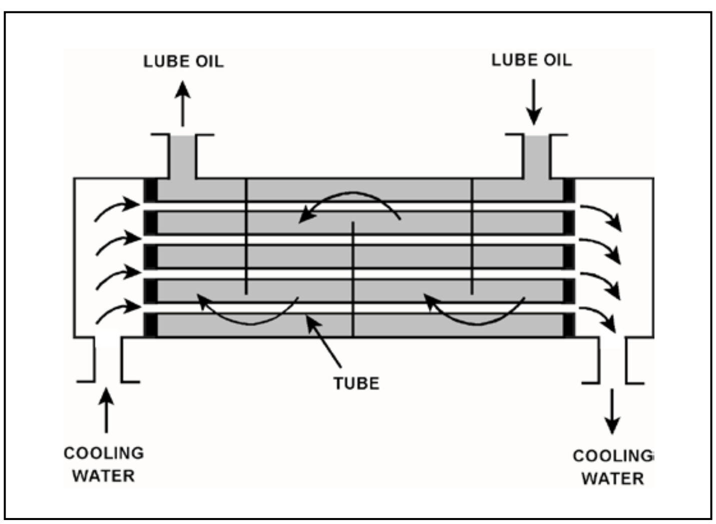
A. 126°F

B. 130°F

C. 134°F

D. 138°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4517 (B2832)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 105°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 140°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 100°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 99F. Assume that the mass flow rate and specific heat of both fluids remain the same, and that Toil-in does not change. Which one of the following will be the approximate temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

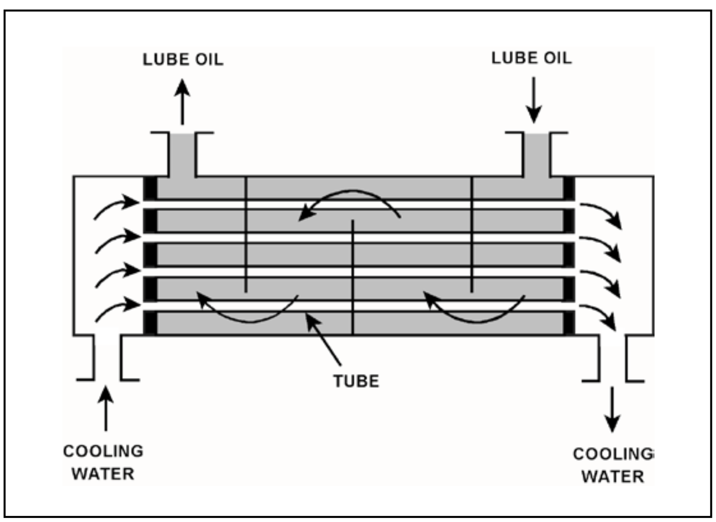
A. 99°F

B. 108°F

C. 116°F

D. 122°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4816 (B4817)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 110°F

Air leakage into the heat exchanger causes some of the heat exchanger tubes to become uncovered. As a result, $T_{cw\text{-}out}$ decreases to 89°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids do not change.

Which one of the following will be the resulting temperature of the lube oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

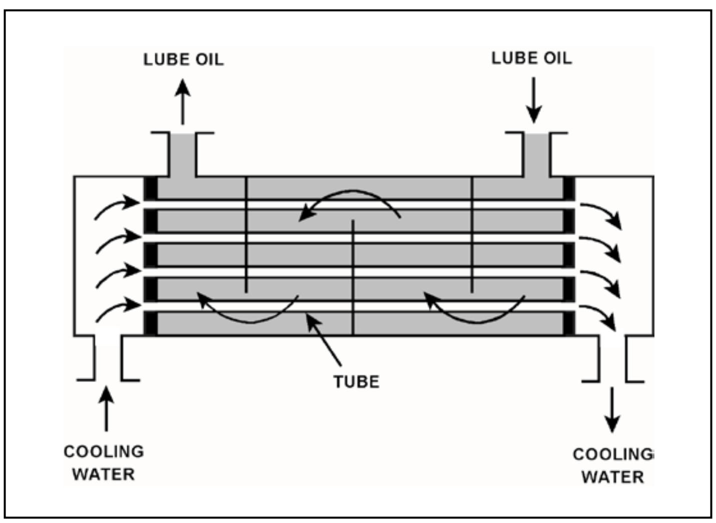
A. 116°F

B. 122°F

C. 130°F

D. 138°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P5417 (B5418)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger was operating with the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$)	=	71°F
Cooling water outlet temperature ($T_{cw\text{-}out}$)	=	91°F
Oil inlet temperature ($T_{oil\text{-}in}$)	=	175°F
Oil outlet temperature ($T_{oil\text{-}out}$)	=	125°F

The heat exchanger was vented, resulting in the following current parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$)	=	71°F
Cooling water outlet temperature ($T_{cw\text{-}out}$)	=	95°F
Oil inlet temperature ($T_{oil\text{-}in}$)	=	175°F
Oil outlet temperature ($T_{oil\text{-}out}$)	=	?

Assume that the mass flow rates and specific heats of both fluids were unchanged.

Which one of the following is the current lube oil outlet temperature ($T_{oil\text{-}out}$)?

A. 115°F

B. 120°F

C. 130°F

D. 135°F

ANSWER: A.