

## U.S.C.G. Merchant Marine Exam

DDE - 1000/4000 HP

Q631 Steam Plants

(Sample Examination)

**Choose the best answer to the following Multiple Choice Questions:**

1. Steam tables can be used to obtain the \_\_\_\_\_.
- (A) specific fuel consumption under steady steaming conditions
  - (B) mechanical efficiency of the main unit
  - (C) values for properties of water and steam vapor at various conditions
  - (D) steam generating capacity of a vessel's boilers

*If choice C is selected set score to 1.*

2. By which of the listed methods may heat be transferred from one body to another?
- (A) Conduction
  - (B) Radiation
  - (C) Convection
  - (D) All of the above.

*If choice D is selected set score to 1.*

3. Which of the following statements is correct concerning heat transfer?
- (A) Heat is given off from a high temperature region known as a heat sink.
  - (B) Heat transfer rate is affected most by the size of the heat sink involved.
  - (C) Heat transfer rate is affected most by the temperature difference between the heat source and the heat sink.
  - (D) Heat transfer by radiation will occur only by mass motion of a fluid substance.

*If choice C is selected set score to 1.*

4. The property of a fuel oil which is a measurement of its available energy, is known as its \_\_\_\_\_.
- (A) cetane number
  - (B) cetane index
  - (C) heating value
  - (D) viscosity index

*If choice C is selected set score to 1.*

5. The flash point of a residual fuel oil should be used to determine the highest temperature to which the oil may be heated \_\_\_\_\_.
- (A) in a storage tank
  - (B) for atomizing
  - (C) for centrifuging
  - (D) in the recirculating line

*If choice A is selected set score to 1.*

6. In terms of the diluting effect of excessive excess air, when viewing the flame through a peephole, what would be the indication of the greatest diluting effect with far too much excess air?
- (A) Golden yellow flame
  - (B) Dazzling white flame
  - (C) Orange flame
  - (D) Yellow flame

*If choice B is selected set score to 1.*

7. Control of the fuel oil metering valve in an automatically fired boiler is accomplished by a \_\_\_\_\_.
- (A) pressure magnifying device in the steam coil outlet
  - (B) steam pressure sensing device with linkage to the damper air vanes
  - (C) metering device in the air supply line
  - (D) signal from the feedwater electrode

*If choice B is selected set score to 1.*

8. The solenoid valves in the fuel oil supply line to a boiler are automatically closed by \_\_\_\_\_.
- (A) a decrease in feed temperature
  - (B) high furnace air pressure
  - (C) high steam pressure
  - (D) low steam pressure

*If choice C is selected set score to 1.*

9. When operating with the auxiliary feed line, feed water flow is controlled \_\_\_\_\_.
- (A) automatically by the eco by-pass
  - (B) manually by adjustment of the auxiliary feedwater regulator spring setting
  - (C) automatically by the main feedwater regulator
  - (D) manually by throttling the auxiliary feed stop-check valve

*If choice D is selected set score to 1.*

10. Under normal conditions, the rate of heat transfer in a feed water heater is most greatly affected by the \_\_\_\_\_.
- (A) speed of the feed pump
  - (B) pH of the feed water
  - (C) density of the feed water
  - (D) temperature differential between the steam and feed water

*If choice D is selected set score to 1.*

**11.** How many Curtis stages are contained in the turbine shown in the illustration? Illustration SE-0003

- (A) 1
- (B) 2
- (C) 3
- (D) only a reaction turbine stage is shown

*If choice A is selected set score to 1.*

**12.** Nozzle diaphragms are installed in pressure-compounded impulse turbines to \_\_\_\_\_.

- (A) support moving blades
- (B) hold the nozzles of the stage and admit steam to moving blades
- (C) support shrouding
- (D) eliminate blade and nozzle losses

*If choice B is selected set score to 1.*

**13.** What statement concerning the operation of a propulsion steam turbine turning (jacking) gear is true?

- (A) The turning gear is used to prevent turbine rotor distortion while warming-through or while cooling, since distortion is an issue when warming-through or cooling.
- (B) The turning gear is used to prevent turbine rotor distortion while warming-through only. The turning gear is never used while cooling since distortion is not an issue when cooling.
- (C) The turning gear is used to prevent turbine rotor distortion while cooling only. The turning gear is never used while warming-through since rotor distortion is not an issue when warming-through.
- (D) The turning gear is used to rotate the turbines, gearing, and shaft periodically when the main engines are secured only. The turning gear is never used to prevent turbine rotor distortion.

*If choice A is selected set score to 1.*

**14.** A turbine assembly in which steam flows in series through a high-pressure turbine and then on to a low-pressure turbine, with both turbines driving a common reduction gear through separate shafts, is classified as \_\_\_\_\_.

- (A) dual series
- (B) cross compound
- (C) tandem, double flow
- (D) tandem compound

*If choice B is selected set score to 1.*

**15.** As steam accomplishes work in an engine or turbine, the pressure of the steam is reduced because it \_\_\_\_\_.

- (A) expands in volume
- (B) becomes superheated again
- (C) diminishes in volume
- (D) becomes saturated again

*If choice A is selected set score to 1.*

**16.** Journal bearings used with turbine rotors are manufactured in two halves in order to \_\_\_\_\_.

- (A) provide for positive oil flow at all loads
- (B) permit removal of the bearing without removing the rotor from the turbine
- (C) maintain axial alignment and reduce thrust
- (D) facilitate interchanging with other bearing halves

*If choice B is selected set score to 1.*

**17.** Turbine casing flanges are sometimes provided with a system of joint grooving to \_\_\_\_\_.

- (A) increase contact pressure between the casing halves' flanges
- (B) inject sealing compound between the casing halves
- (C) ensure perfect alignment of casing halves
- (D) form a labyrinth seal between the casing halves

*If choice B is selected set score to 1.*

**18.** When the temperature of the main turbine lubricating oil is lowered, an increase will occur in the \_\_\_\_\_.

- (A) pour point
- (B) flash point
- (C) concentration of contaminants
- (D) viscosity

*If choice D is selected set score to 1.*

**19.** What type of strainer is used in a turbine lube oil system to remove metallic particles?

- (A) Simplex filter
- (B) Fuller's earth filter
- (C) Metal edge strainer
- (D) Magnetic basket strainer

*If choice D is selected set score to 1.*

**20.** Lube oil is preheated before centrifuging in order to \_\_\_\_\_.

- (A) reduce friction of the rotating components of the centrifuge
- (B) boil off water
- (C) prevent corrosion
- (D) improve purification

*If choice D is selected set score to 1.*

**21.** When monitoring a steam propulsion plant lubricating oil pressures, what pressure is the most critical to check regularly while underway?

- (A) The pressure immediately upstream of the variable orifice.
- (B) Lube oil service pump discharge pressure.
- (C) The pressure immediately downstream of the variable orifice.
- (D) The pressure at the most remote bearing.

*If choice D is selected set score to 1.*

**22.** Babbitt is a metal alloy commonly used for lining \_\_\_\_\_.

- (A) valve seats
- (B) precision bearings
- (C) salt water piping
- (D) shim stock

*If choice B is selected set score to 1.*

**23.** Which of the coupling types listed is shown in the illustration? Illustration SE-0001

- (A) Solid
- (B) Pin
- (C) Gear
- (D) Claw

*If choice C is selected set score to 1.*

**24.** In the diagrammatic arrangement of the thrust bearing, shown in the illustration, the direction of shaft rotation and the direction of thrust are indicated respectively by arrows \_\_\_\_\_. Illustration SE-0012

- (A) F and H
- (B) G and J
- (C) F and J
- (D) G and H

*If choice C is selected set score to 1.*

**25.** While your vessel is underway at normal speed, a steam drum safety valve develops a significant leak. Your first corrective action should be to \_\_\_\_\_.

- (A) secure the boiler and check the valve spring compression
- (B) attempt to reseat the valve using the hand releasing gear
- (C) secure the boiler and blank off the valve flange
- (D) inspect the escape piping for binding on the valve body

*If choice B is selected set score to 1.*

**26.** Where do fuel oil vapors tend to accumulate in an engine room?

- (A) At the point in the engine room where the vapors were initially formed.
- (B) In the lower engine room spaces, especially in the bilges.
- (C) Oil vapors tend to distribute throughout the engine room evenly.
- (D) In the upper engine room spaces, especially in the fidley.

*If choice B is selected set score to 1.*

**27.** If a boiler generates saturated steam at 125.3 psig, how much heat is required to change the water into steam if the feed water temperature is 240°F? Illustration SG-0004

- (A) 30.5 Btu/lb.
- (B) 116.5 Btu/lb.
- (C) 582.7 Btu/lb.
- (D) 983.4 Btu/lb.

*If choice D is selected set score to 1.*

**28.** The bottom blow valve on a water-tube boiler is usually attached to the \_\_\_\_\_.

- (A) external downcomers
- (B) steam and water drum
- (C) boiler mud drum
- (D) floor tubes

*If choice C is selected set score to 1.*

**29.** The purpose of the boiler drum air cock is to \_\_\_\_\_.

- (A) permit escape of air when the boiler is being filled
- (B) admit air when the boiler is being emptied
- (C) permit escape of air when steam is forming in the drum after lighting off
- (D) all of the above

*If choice D is selected set score to 1.*

**30.** Which type of energy conversion is associated with an operating steam boiler?

- (A) Specific
- (B) Thermal
- (C) Mechanical
- (D) Kinetic

*If choice B is selected set score to 1.*

**31.** Bottom blow valves are installed on water-tube boilers to \_\_\_\_\_.

- (A) completely drain the boiler in an emergency
- (B) prevent sludge from forming in the steam drum
- (C) remove floating impurities from the boiler water surface
- (D) remove settled solids from the water drum

*If choice D is selected set score to 1.*

**32.** The purpose of the separating nozzle in the accumulator of a water-tube, coil-type, steam generator is to separate \_\_\_\_\_.

- (A) dry steam from the steam and water mixture
- (B) condensate from feedwater
- (C) superheated steam from saturated steam
- (D) sludge accumulations from feedwater

*If choice A is selected set score to 1.*

**33.** Which of the following statements concerning fire-tube boilers is correct?

- (A) Combustion gases flow through the tubes.
- (B) Flames impinge on the tubes.
- (C) Combustion occurs in the tubes.
- (D) Water flows through the tubes.

*If choice A is selected set score to 1.*

**34.** A boiler pressuretrol senses steam pressure changes and \_\_\_\_\_.

- (A) controls the flow of feedwater to the boiler
- (B) monitors the boiler high water level
- (C) secures the fires when a fusible plug burns out
- (D) automatically regulates the quantity of oil and air flow to the burner

*If choice D is selected set score to 1.*



**35.** A photoelectric cell installed in a boiler burner management system \_\_\_\_\_.

- (A) opens the burner circuit upon sensing a flame failure
- (B) detects a flame failure by monitoring radiant heat from glowing refractory
- (C) requires mechanical linkage to secure the burner fuel supply
- (D) must be bypassed at low firing rates

*If choice A is selected set score to 1.*

**36.** The purpose of the mica used in a boiler water gauge glass assembly is to prevent \_\_\_\_\_.

- (A) overheating of the glass
- (B) light refraction in the glass
- (C) etching of the glass
- (D) leakage from the glass

*If choice C is selected set score to 1.*

**37.** On a boiler safety valve, the blowdown adjusting ring is locked in place by a \_\_\_\_\_.

- (A) cotter pin
- (B) locknut
- (C) wire seal
- (D) set screw

*If choice D is selected set score to 1.*

**38.** A secondary function of the refractory installed in a marine boiler is to \_\_\_\_\_.

- (A) support the burner distance piece
- (B) direct the flow of combustion gases
- (C) support the boiler casing
- (D) maintain air flow through the burner diffuser

*If choice B is selected set score to 1.*

**39.** When increasing the firing rate of a boiler, which of the following should be carried out FIRST?

- (A) Decreasing the steam pressure.
- (B) Increasing the feedwater flow.
- (C) Increasing the fuel pressure.
- (D) Increasing the forced draft air pressure.

*If choice D is selected set score to 1.*

**40.** Which of the following is the best reason for opening the air cock when draining a water-tube boiler?

- (A) With the air cock open, the boiler drains without producing a vacuum.
- (B) Air coming into the boiler will help dry out the boiler's surface.
- (C) Water flows out of the boiler too rapidly with the air cock closed.
- (D) Air mixed with the water will create a cleansing effect in the tubes.

*If choice A is selected set score to 1.*

**41.** When cleaning the inside surfaces of the boiler tubes of a water-tube boiler with a powered rotary brush, the brush should be kept in motion to \_\_\_\_\_.

- (A) prevent it from seizing
- (B) reduce wear to brush bristles
- (C) reduce tube pitting
- (D) avoid internal tube damage

*If choice D is selected set score to 1.*

**42.** To prevent a small plastic refractory wall patch repair from falling into the furnace of a boiler, you should \_\_\_\_\_.

- (A) reinforce the patch with fine mesh metal screen
- (B) undercut the existing brick around the area to be patched
- (C) mix the plastic with concrete prior to using
- (D) attach anchor bolts to the furnace casing

*If choice B is selected set score to 1.*

**43.** Which procedure should be followed to dry out the fireside of a boiler after water washing?

- (A) Open the furnace registers and run the forced draft fans for 3 hours.
- (B) Place trays of silica gel in the furnace.
- (C) Use a wire reinforced steam hose to put superheated steam in the furnace for 6 hours.
- (D) Alternately fire one burner for 15 minute intervals during a 5 hour period.

*If choice D is selected set score to 1.*

**44.** The boiler water gauge glasses should be blown down \_\_\_\_\_.

- (A) when you are in doubt about the water level
- (B) every 12 hours of steady boiler steaming operation
- (C) when the boiler water level changes in a steaming boiler
- (D) twice each day on the midnight and afternoon watches

*If choice A is selected set score to 1.*

**45.** Steam drum water level indicators must be calibrated to compensate for density differences between the indicated drum water level, and the actual drum water level. If no compensation is made, the indicator will show a \_\_\_\_\_.

- (A) higher level than exists in the drum with the error becoming greater as the drum pressure increases
- (B) lower level than exists in the drum with the error becoming greater as the drum pressure decreases
- (C) higher level than exists in the drum with the error becoming greater as the drum pressure decreases
- (D) lower level than exists in the drum with the error becoming greater as the drum pressure increases

*If choice D is selected set score to 1.*

**46.** Which color burner flame would indicate too much excess air?

- (A) Incandescent white
- (B) Yellowish orange
- (C) Bright red
- (D) Orange red

*If choice A is selected set score to 1.*

**47.** In a boiler equipped with an automatic feed water regulator, erratic variations in the steam drum water level could be caused by \_\_\_\_\_.

- (A) high feedwater temperature
- (B) ruptured feedwater control valve diaphragm
- (C) low feedwater temperature
- (D) high solids content and foaming in the drum

*If choice D is selected set score to 1.*

**48.** Boiler tube failures can result from \_\_\_\_\_.

- (A) overheating
- (B) corrosion
- (C) mechanical stress
- (D) all of the above

*If choice D is selected set score to 1.*

**49.** Treatment of boiler feedwater for the control of hardness is necessary to prevent \_\_\_\_\_.

- (A) foaming
- (B) carryover
- (C) waterside scale deposits
- (D) excessive feedwater alkalinity

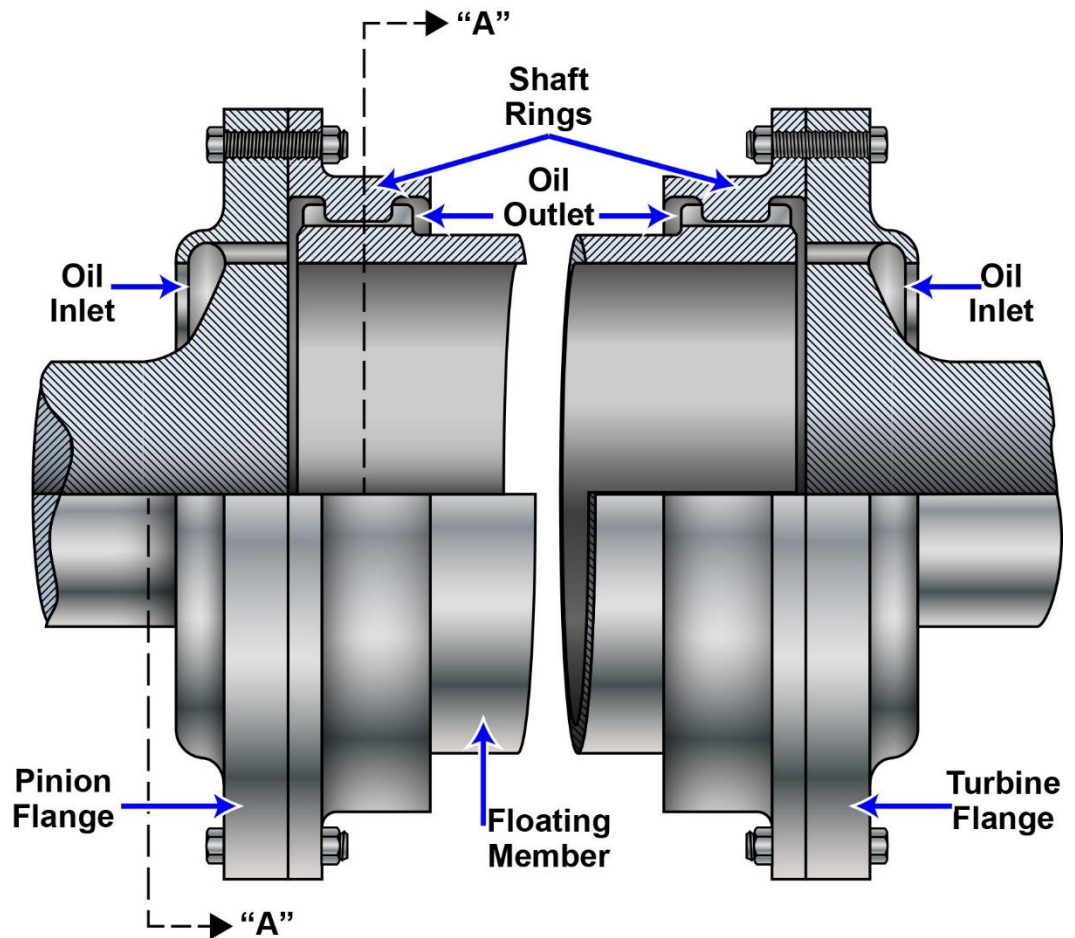
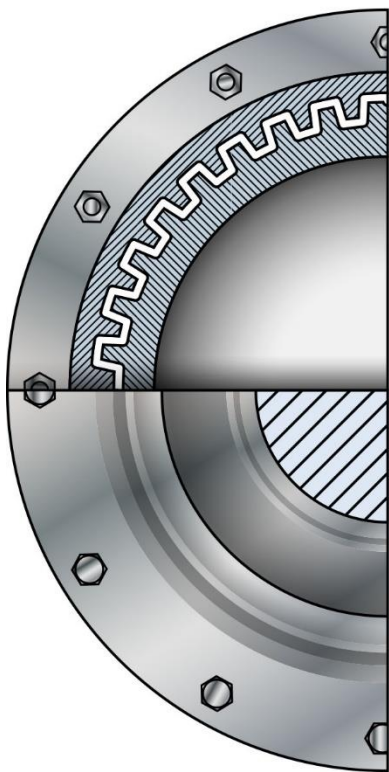
*If choice C is selected set score to 1.*

**50.** Normally a boiler water sample should be taken \_\_\_\_\_.

- (A) when the boiler has been refilled with makeup
- (B) before the boiler has been blown down or chemicals added
- (C) from the highest point in the feed system
- (D) after the boiler has been blown down

*If choice B is selected set score to 1.*

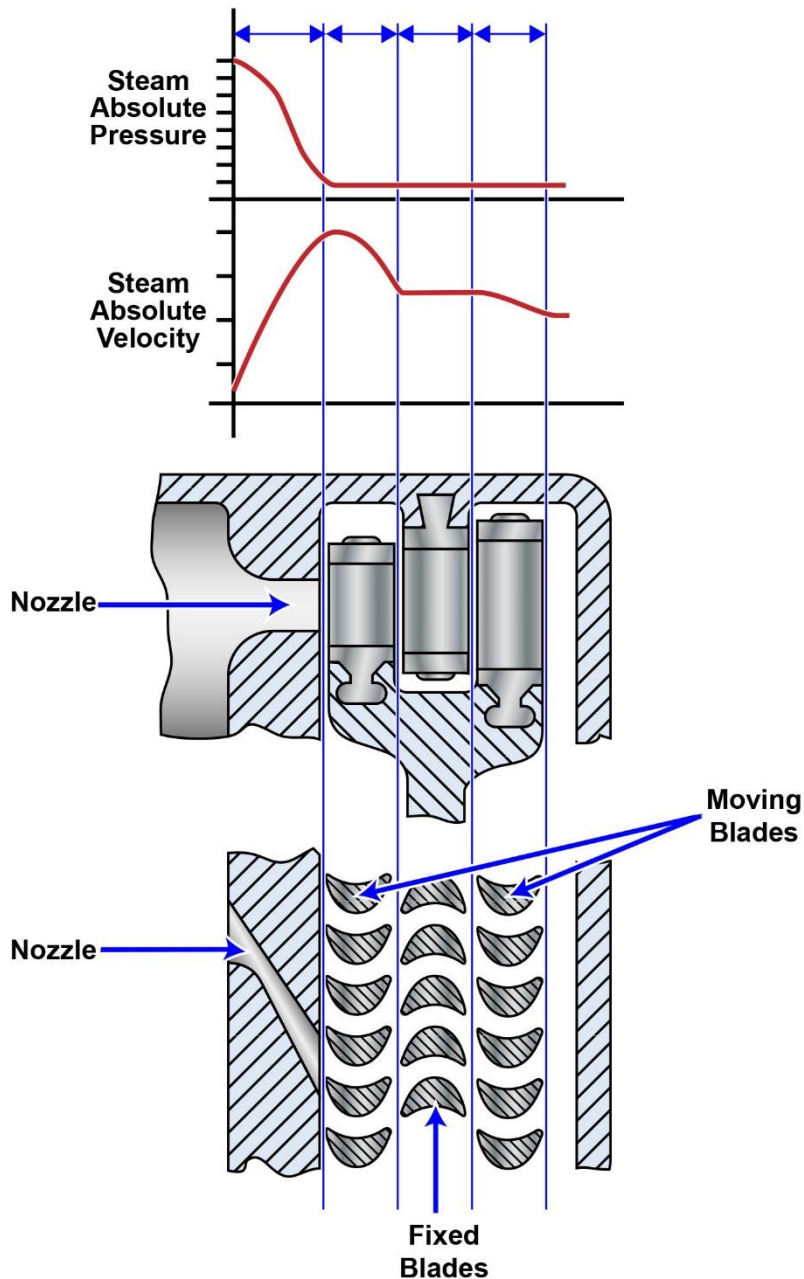
## SE-0001



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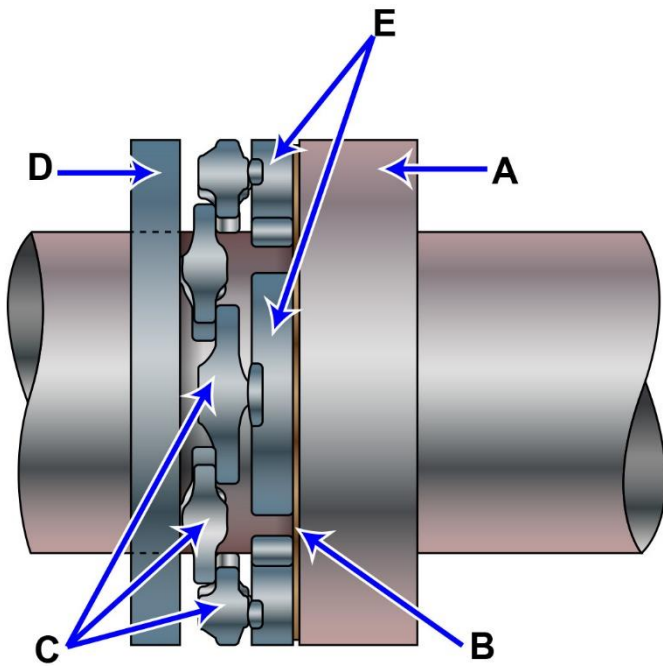
## SE-0003



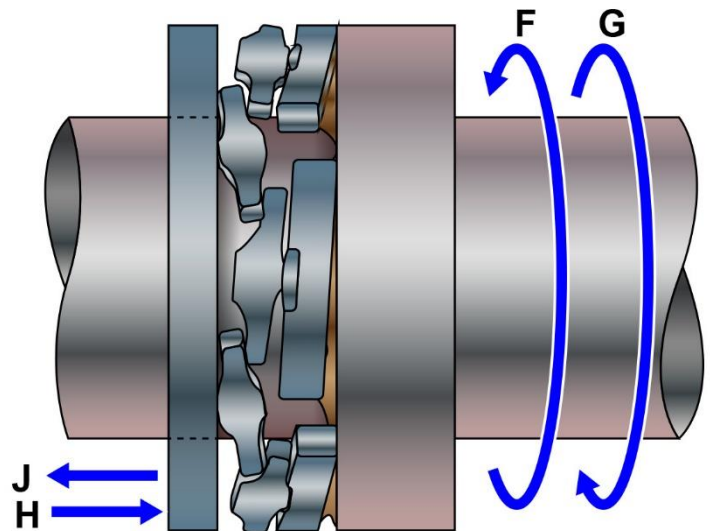
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## SE-0012



**Stationary View**



**Rotating View**

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## SG-0004

**Table 1**  
**Thermodynamic Properties of Saturated Steam (Temperature)**

Temp, °F	Absolute Pressure, psi	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
32	0.08859	0.01	1075.5	1075.5
40	0.12170	8.05	1071.3	1079.3
50	0.17811	18.07	1065.6	1083.7
60	0.25630	28.06	1059.9	1088.0
70	0.36310	38.04	1054.3	1092.3
80	0.50690	43.02	1048.6	1096.6
90	0.69820	57.99	1042.9	1100.9
100	0.94920	67.97	1037.2	1105.2
110	1.27480	77.94	1031.6	1109.5
120	1.69240	87.92	1025.8	1113.7
130	2.22250	97.90	1020.0	1117.9
140	2.88860	107.90	1014.1	1122.0
150	3.71800	117.90	1008.2	1126.1
160	4.74100	127.90	1002.3	1130.2
170	5.99200	137.90	996.3	1134.2
180	7.51000	147.90	990.2	1138.1
190	9.33900	157.90	984.1	1142.0
200	11.52600	168.00	977.9	1145.9
212	14.69600	180.00	970.4	1150.4
220	17.18600	188.10	965.2	1153.4
240	24.96900	208.30	952.2	1160.5
280	49.20300	249.10	924.7	1173.8
300	67.01300	269.60	910.1	1179.7
340	118.01000	311.10	879.0	1190.1
380	195.77000	353.50	844.6	1198.1
400	247.31000	375.00	826.0	1201.0

**Table 2**  
**Thermodynamic Properties of Saturated Steam (Pressure)**

Absolute Pressure, psi	Temp, °F	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
0.5	79.58	47.6	1048.8	1096.4
1.0	101.74	69.7	1036.3	1106.0
5.0	162.24	130.1	1001.0	1131.1
10.0	193.21	161.2	982.1	1143.3
14.7	212.00	180.0	970.4	1150.4
15.0	213.03	181.1	969.7	1150.8
20.0	227.96	196.2	960.1	1156.3
25.0	240.07	208.5	952.1	1160.6
30.0	250.33	218.8	945.3	1164.1
40.0	267.25	236.0	933.7	1169.7
50.0	281.01	250.1	924.0	1174.1
60.0	292.71	262.1	915.5	1177.6
70.0	302.92	272.6	907.9	1180.6
80.0	312.03	282.0	901.1	1183.1
90.0	320.27	290.6	894.7	1185.3
100.0	327.81	298.4	888.8	1187.2
110.0	334.77	305.7	883.2	1188.9
120.0	341.25	312.4	877.9	1190.4
130.0	347.32	318.8	872.9	1191.7
140.0	353.02	324.8	868.2	1193.0
150.0	358.42	330.5	863.6	1194.1
200.0	381.79	355.4	843.0	1198.4
250.0	400.95	376.0	825.1	1201.1
300.0	417.33	393.8	809.0	1202.8
350.0	431.72	409.7	794.2	1203.9
400.0	444.59	424.0	780.5	1204.5

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