UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406

OCT 26 1989

Docket No. 50-245

Northeast Nuclear Energy Company
ATTN:: Mr. R. Lueneberg
Supervisor - Operations
Training
P. O. Box 128
Waterford, Connecticut 06385

Dear Mr. Lueneberg:

On October 4, 1989, the NRC administered the Generic Fundamentals Examination Section (GFES) of the written operator licensing examination to employees of your facility. Enclosed with this letter are copies of both forms of the examination including answer keys, the grading results for your facility and copies of the individual answer sheets for each of the examinees from your facility who took the examination. Please forward the results and answer sheet to the examinees. A "P" in the column labeled Final Grade indicates a passing grade for this examination; passing grade for the GFES is 80%.

In accordance with 10 CFR 2.790 of the Commission's Regulations, a copy of this letter and enclosures (1) and (2) will be placed in the NRC's Public Document Room (PDR). The results for individual examinees are exempt from disclosure, therefore, enclosures (3) and (4) will not be placed in the PDR.

Should you have any questions concerning this examination, please contact Mr. Paul Doyle at (301) 492-1047.

Sincerely,

Robert M. Gallo, Chief
Operations Branch
Division of Reactor Safety

Enclosures:
1. Examination Form "A" with answers
2. Examination Form "B" with answers
3. Examination Results Summary for facility
4. Copies of Candidates individual answer sheets

OFFICIAL RECORD COPY

H005
1/1

cc w/o enclosures:
E. J. Mroczka, Senior Vice President - Nuclear
W. D. Romberg, Vice President, Nuclear Operations
S. E. Scace, Station Superintendent
D. O. Nordquist, Director of Quality Services
R. M. Kacich, Manager, Generation Facilities Licensing
D. B. Miller, Station Superintendent, Haddam Neck
Gerald Garfield, Esquire
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NRC Resident Inspector
State of Connecticut

bcc w/o enclosures:
Region I Docket Room (with concurrences)
Management Assistant, DRMA
P. Doyle, OLB
OL Facility File

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RI:DRS	RI:DRS	RI:DRS
Curley	Conte	Gallo
10/23/89	10/24/89	10/30/89

Enclosure A

BWR-GFE (FORM A)

1.	B	26.	B	51.	B	76.	A
2.	C	27.	C	52.	A	77.	C
3.	A	28.	D	53.	[illegible]	78.	A
4.	D	29.	B	54.	D	79.	C
5.	A	30.	B	55.	C	80.	B
6.	B	31.	A	56.	D	81.	C
7.	B	32.	A	57.	D	82.	A
8.	A	33.	D	58.	A	83.	C
9.	D	34.	C	59.	A	84.	A
10.	A	35.	D	60	D	85.	B
11.	D	36.	A	61.	B	86.	D
12.	D	37.	A	62.	B	87.	P
13.	D	38.	B	63.	C	88.	D
14.	C	39.	B	64.	B	89.	C
15.	D	40.	B	65.	A	90.	D
16.	B	41.	B	66.	B	91.	A
17.	C	42.	C	67.	B	92.	B
18.	C	43.	A	68.	C	93.	C
19.	B	44.	A	69.	A	94.	D
20.	B	45.	C	70.	A	95.	A
21.	A	46.	D	71.	D	96.	C
22.	D	47.	D	72.	C	97.	D
23.	C	48.	C	73.	A	98.	B
24.	C	49.	C	74.	C	99.	B
25.	D	50.	C	75.	A	100.	B

UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAM SECTION

Please Print:

Name: _____

Facility: _____

ID Number: _____

INSTRUCTIONS TO CANDIDATE

Use the answer sheet provided. Each question has equal point value. The passing grades require at least 80% on this part of the written licensing examination. All examination papers will be picked up 2.5 hours after the examination starts.

SECTION	Questions	% of Total	Score
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		
THERMODYNAMICS	73 - 100		
TOTALS	100		

All work done on this examination is my own. I have neither given nor received aid.

_____

Candidate's Signature

FORM A

NRC RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

(1) Print your name in the blank provided on the cover sheet of the examination.

(2) Fill in the name of the facility you are associated with.

(3) Fill in the ID-Number you were given at regirtration

(4) Three handouts are provided for your use during the examination, an Equations and Conversions sheet, instructions for filling out the answer sheet, and Steam Table booklets.

(5) Use only the answer sheet provided. Credit will only be given for answers marked on this sheet. Follow the instructions for filling out the answer sheet.

(6) Scrap paper will be provided for calculations.

(7) Any questions about an item on the examination should be directed to the examiner only.

(8) Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

(9) Restroom trips are limited. Only ONE examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

(10) After you have completed the examination, please sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.

(11) Please turn in your examination materials answer sheet on top followed by the exam booklet, then examination aids - steam table booklets, handouts and scrap paper used during the examination.

(12) After turning in your examination materials, leave the examination area, as defined by the examiner. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

EQUATION SHEET

$\dot{Q} = \dot{m} c_p \Delta T$

$\dot{Q} = \dot{m} \Delta h$

$\dot{Q} = UA \Delta T$

$SUR = 26.06/\tau$

$SUR = \dfrac{26.06\ (\lambda_{eff}\ \rho)}{(\bar{\beta} - \rho)}$

$P = P_0\ 10^{SUR(t)}$

$P = P_0\ e^{(t/\tau)}$

$\tau = (l^*/\rho) + [(\bar{\beta} - \rho)/\lambda_{eff}\rho]$

$\rho = (K_{eff} - 1)/K_{eff}$

$\rho = \Delta K_{eff}/K_{eff}$

Cycle Efficiency = $\dfrac{\text{Net Work (out)}}{\text{Energy (in)}}$

$SCR = S/(1 - K_{eff})$

$CR_1\ (1 - K_{eff})_1 = CR_2\ (1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = \dfrac{(1 - K_{eff})_0}{(1 - K_{eff})_1}$

$SDM = (1 - K_{eff})/K_{eff}$

$Pwr = W_f \dot{m}$

$\tau = l^*/(\rho - \bar{\beta})$

$l^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

---

1 Curie = 3.7×10^{10} dps

1 hp = 2.54×10^3 BTU/hr

1 BTU = 778 ft-lbf

°C = 5/9 (°F - 32)

1 kg = 2.21 lbm

1 Mw = 3.41×10^6 BTU/hr

°F = 9/5 °C + 32

QUESTION: 1.

Which ONE of the following correctly describes the operation of a safety valve installed on a high pressure steam system?

A. A safety valve is initially lifted off its seat by system pressure, then is forced fully open by an air-operated piston.

B. As system pressure increases to the safety set point, the pressure overcomes spring force on the valve operator, causing the valve to open.

C. A safety valve will remain open until system pressure has been reduced to the pilot valve actuation setpoint.

D. When the open safety valve has returned system pressure to the lifting set point, a combination of air and steam pressure above the valve disk closes the valve.

QUESTION: 2.

Which of the following correctly describes the relief mode of operation for a safety relief valve (SRV)?

A. The SRV must be manually opened and manually closed using the control switch.

B. The SRV will automatically open, but must be reset by the operator before it will close.

C. The SRV will automatically open and close to relieve excess system pressure.

D. The SRV must be manually opened but will automatically close to prevent system depressurization.

QUESTION: 3.

What precaution is applicable, when transferring a controller for a flow control valve from automatic to manual control?

A. Verify that both the automatic and manual controller outputs are the same prior to transfer.

B. Do not attempt to adjust the control signals, since the manual control system tracks the automatic signal and adjusting the signals could negate the automatic tracking.

C. Verify that the manual controller output is slightly less than the automatic controller's to prevent flow overshoot on the transfer.

D. Verify that the manual controller output is slightly higher than the automatic controller's to ensure that no loss of flow occurs on the transfer.

QUESTION: 4.

What may be damaged if an operator attempts to manually disengage the motor on a motor-operated valve while the motor is operating?

A. Limit switches

B. Valve seat

C. Torque switches

D. Clutch

QUESTION: 5.

Emergency core cooling systems (ECCS's) typically have testable check valves in the discharge lines from the pump to the vessel. How does the testable check valve operate?

A The valve is opened by flow and pressure from the discharge of the ECCS pump.

B. Instrument air is applied to the valve operator when the ECCS system is shut down to close the valve and ensure no leak across the seat.

C. The check valve cannot be opened unless the associated ECCS pump is running.

D. An air solenoid admits air to the valve on system initiation to ensure that the valve opens.

QUESTION: 6.

Which statement **BEST** describes the function and use of valve backseats?

A. Valve backseats are provided to remove pressure from the packing and stuffing box and are the normal method used to isolate the stuffing box for valve repacking.

B. Valve backseats are provided to remove pressure from the packing and stuffing box and are only used when needed to prevent packing leakage.

C. Valve backseats are provided as a back-up in case the primary seat leaks and are normally used during plant operations.

D. Valve backseats are provided as a back-up in case the primary seat leaks and are only used when needed to prevent valves from leaking excessively.

QUESTION: 7.

Given the equation for mass flow rate: $\dot{m} = \rho \times A \times v$

where $\dot{m}$ = mass flow rate (lbm/sec)
ρ = density of flowing fluid (lbm/ft3)
A = cross section of channel of fluid (ft2)
v = average velocity of flowing fluid (ft/sec)

What is the effect on indicated mass flow rate if the liquid being measured has air in solution?

A. Indicated flow would be greater than actual flow.

B. Indicated flow would be less than actual flow.

C. Indicated flow is not affected by air in solution.

D. The effect on indicated flow is unpredictable.

QUESTION: 8.

A leak develops in the high-pressure side of a flow detector. What effect does that leak have on the flow indication of the detector?

A. The measured delta-P will decrease, causing indicated flow to decrease.

B. The measured delta-P will decrease, causing indicated flow to increase.

C. The measured delta-P will increase, causing indicated flow to decrease.

D. The measured delta-P will increase, causing indicated flow to increase.

QUESTION: 9.

What happens to a fluid as it passes through a venturi?

A. Pressure remains constant, but the velocity increases as the diameter of the venturi decreases.

B. Pressure increases, but the velocity decreases as the diameter of the venturi decreases.

C. Pressure decreases, but the velocity remains constant as the diameter of the venturi increases.

D. Pressure increases, but the velocity decreases as the diameter of the venturi increases.

QUESTION: 10.

It is necessary to density-compensate the main steam line flow indication because the measured change in pressure across the flow elements is:

A. directly proportional to the volumetric flow rate.

B. inversely proportional to the volumetric flow rate.

C. directly proportional to the mass flow rate.

D. inversely proportional to the mass flow rate.

QUESTION: 11.

What is the reason for the reference leg being connected to the reactor pressure vessel (RPV) instead of being filled by a water source independent of the RPV?

A. To provide a vent path for the prevention of a reference leg rupture during a rapid RPV depressurization.

B. To alleviate the need for density compensation by keeping the reference leg at the same temperature as the variable leg.

C. To make the indicated level proportional to the square root of the differential pressure between the reference and variable legs for all reactor pressures.

D. To provide compensation for the RPV pressure exerted on the variable leg.

QUESTION: 12.

If the variable leg temperature of a differential pressure level cell is higher than the calibration conditions, what will the level instrument indicate?

A. Indicated reactor water level is higher than actual reactor water level.

B. Actual level if the reference leg temperature is at the calibration conditions

C. Actual level if the reference leg temperature is the same temperature as the variable leg

D. Indicated reactor water level is lower than actual reactor water level.

QUESTION: 13.

What will the indication be when a level D/P cell fails (D/P = 0)?

A. 0% of full range

B. 50% of full range

C. 75% of full range

D. 100% of full range

QUESTION: 14.

Which of the following correctly describes a characteristic of a thermocouple?

A. Indication will fail high offscale with an open circuit.

B. They are generally more accurate than resistance temperature detectors (RTDs).

C. A junction between two dissimilar metals will generate a voltage proportional to temperature.

D. A junction between two dissimilar metals will result in a change in electrical resistance proportional to temperature.

QUESTION: 15.

The difference between the setpoint and the measured parameter in an automatic flow controller is called:

A. gain.

B. bias.

C. feedback.

D. error.

QUESTION: 16.

Which of the following valves is **MOST LIKELY** to be used with a throttling positioner?

A. Stop valve

B. Globe valve

C. Gate valve

D. Butterfly valve

QUESTION: 17.

The governor on an emergency diesel generator regulates the amount of fuel supplied to the diesel engine to:

A. increase engine speed as load increases.

B. increase generator voltage as load increases.

C. maintain engine speed nearly constant as load changes.

D. maintain generator voltage nearly constant as load changes.

QUESTION: 18.

Venting a centrifugal pump prior to operating it ensures that:

A. pump [illegible] will not occur.

B. pump internal corrosion is reduced.

C. gas binding is reduced.

D. starting load is minimized.

QUESTION: 19.

What would result from operating a motor-driven centrifugal pump for extended periods of time with the discharge valve shut?

A. No damage, since the pump and motor are designed to operate with the discharge valve shut

B. Pump overheating, cavitating, and ultimately failure

C. Excessive motor current, damage to motor windings, and ultimately motor failure

D. Pump and motor speeding excessively and tripping on high motor current

QUESTION: 20.

A centrifugal pump is operating at rated speed with an output head of 240 psig. The speed of the pump is then decreased until the power consumption is 1/64 of its original value. What is the approximate new output head?

A. 3.75 psig

B. 15 psig

C. 30 psig

D. 60 psig

QUESTION: 21.

What will increase reactor recirculation pump available net positive suction head? (Assume all other parameters remain constant.)

A. Loss of feedwater heating while at 80% power

B. Increase in reactor coolant temperature from 100°F to 200°F during a reactor startup

C. Decrease in reactor pressure during a normal reactor shutdown

D. Decrease in reactor water from the normal level to just below the low-level alarm level

QUESTION: 22.

Which one of the following items is NOT a characteristic of centrifugal pumps operating in series?

A. The available net positive suction head (NPSH) of the second pump in the series is greater than the NPSH in a single-pump system.

B. The capacity for two pumps operating in series is limited by the capacity of the first pump in the series

C. The total head for two pumps operating in series is approximately twice the head for a single pump supplying the same capacity.

D. The power required to supply two centrifugal pumps operating in series is less than twice the power required for each of the individual pumps.

QUESTION: 23.

What is caused by operating a motor-driven centrifugal pump under runout conditions?

A. Pump failure due to excessive pump cavitation.

B. No damage, since the pump and motor are designed to operate without failure under pump runout conditions.

C. Motor failure due to excessive current being drawn through the motor windings.

D. Pump failure due to overheating, caused by the increased impellor-to-casing friction.

QUESTION: 24.

A single-speed centrifugal fire pump takes suction on a storage tank and discharges through a flexible fire hose. Which of the following correctly describes the response of the pump discharge flow rate?

A. Remain constant as the elevation of the pump discharge piping is raised

B. Increase as the elevation of the pump discharge piping is raised

C. Decrease as the level in the storage tank on the pump suction is lowered

D. Remain constant as the level in the storage tank on the pump suction is lowered

QUESTION: 25.

What will occur by operating a positive displacement pump with insufficient net positive suction head?

A. Slip

B. Decreased pump speed

C. Water hammer

D. Vapor binding

QUESTION: 26.

For large electric motors, why must the number of starts over a period of time be limited?

A. Protect the power supply cables from insulation breakdown due to high starting current

B. Protect the motor windings from overheating

C. Prevent motor thrust-bearing damage due to lack of lubrication

D. Prevent rotor seizure due to thermal expansion of the windings caused by high starting current

QUESTION: 27.

Given the following conditions for a variable-speed motor-driven centrifugal pump:

- Flow rate = 2000 gpm
- Motor current = 100 amperes

If the flow rate is increased to 4000 gpm, which one of the following motor current values MOST CLOSELY approximates the actual value?

A. 200 amperes

B. 400 amperes

C. 800 amperes

D. 1600 amperes

QUESTION: 28.

Which of the following best describes the motor current indications that would be observed during the start of a large A.C. motor at full load?

A. Amps slowly increase to the full-load value.

B. Amps immediately increase to the full-load value.

C. Amps immediately increase to approximately three times the full-load value and then decrease to the full-load value.

D. Amps immediately increase to approximately six times the full-load value and then decrease to the full-load value.

QUESTION: 29.

Which of the following correctly describes the effects on generator excitation with the generator paralleled to the grid?

A. Increasing field current increases excitation and shifts power factor from lagging toward leading.

B. Increasing field current increases excitation and shifts power factor from leading toward lagging.

C. Decreasing field current increases excitation and shifts power factor from leading toward lagging.

D. Decreasing field current increases excitation and shifts power factor from leading toward lagging.

QUESTION: 30.

As steam (shell) and liquid (tube) heat exchangers are put into service, the:

A. steam side is valved in before the water side to minimize scale buildup on the heat exchanger tubes.

B. water side is valved in before the steam side to prevent thermal shock from occurring.

water side is valved in before the steam side to ensure adequate venting.

D. steam side is valved in before the water side to ensure that the cooldown rate does not exceed 100 °F/hr.

QUESTION: 31.

Decreasing the temperature of a cooled system using a shell-and-tube heat exchanger is NORMALLY accomplished by:

A. increasing the cooling system flow.

B. increasing the cooled system flow.

C. decreasing the cooling system flow.

D. decreasing the cooled system flow.

QUESTION: 32.

Which of the following changes will DECREASE subcooling of the condensate water?

A. Isolate one bay of the condenser circulating water system.

B. Decrease circulating water temperature.

C. Increase circulating water flow.

D. Decrease the main turbine generator Megawatt load.

QUESTION: 33.

During normal reactor operation, a main condenser develops an air leak which decreases vacuum at a rate of 1 in Hg/min. Which of the following plant parameters would be the **FIRST** to show an **INCREASE** because of this condition?

A. Extraction steam flow

B. Generator megawatt output

C. Circulating water outlet temperature

D. Condensate temperature

QUESTION: 34.

What is the saturation temperature for a boiling water reactor (BWR) operating at 920 psig.? [Use steam tables.]

A. 532.6 °F

B. 533.9 °F

C. 536.5 °F

D. 538.4 °F

QUESTION: 35.

Why should fouling of heat exchanger tubes in closed cooling water systems be **MINIMIZED**?

A. To prevent excessive heat transfer rates.

B. To prevent the cooling water outlet temperature from exceeding design limits.

C. To maximize the pressure drop across the heat exchanger.

D. To maximize the heat transfer rate.

QUESTION: 36.

Why is proper venting of a shell-and-tube heat exchanger important?

A. An air bubble reduces the heat transfer coefficient of the heat exchanger.

B. An air bubble causes pressure transients within the tubes as heat load changes.

C. An air bubble will cause thermal shock as it moves through the heat exchanger.

D. An air bubble will cause corrosion in the heat exchanger.

QUESTION: 37.

What is the purpose of a mixed-bed demineralizer?

A. To remove both positively and negatively charged ions.

B. To reduce the conductivity without affecting the pH of the water.

C. To increase pH by reducing the number of positively charged ions in the water.

D. To increase the conductivity of the water to greater than 1.0 micromhos.

QUESTION: 38.

In a demineralizer, what adverse effect occurs due to channeling?

A. Reduction of delta-P across the demineralizer because the resin is essentially bypassed

B. Reduction in demineralization efficiency because the resin is essentially bypassed

C. Loss of resin due to agitation as a result of increased velocity through the demineralizer

D. Resin damage due to the increased velocity of fluid through the demineralizer

QUESTION: 39.

The first indication of resin depletion in the effluent of a demineralizer is:

A. a decrease in suspended solids.

B. an increase in the conductivity.

C. a decrease in chlorides.

D. an increase in resin fines.

QUESTION: 40.

If the breaker control power is lost to a supply breaker for an operating pump motor, the breaker:

A. will trip on undervoltage.

B. will remain closed until tripped locally by an operator.

C. will remain closed unless a fault trip occurred.

D. will remain closed until tripped remotely by an operator.

QUESTION: 41.

What is the definition of a thermal overload device?

A. A balanced circuit that compares actual current to a fixed overcurrent signal which, when exceeded, trips a relay.

B. An in-line thermal coil that, when subjected to a high current, overheats and actuates a circuit-interrupting device.

C. A temperature monitor that senses the temperature of the operating equipment and trips the circuit breaker if the temperature exceeds preset limits.

D. An induction coil that generates a secondary current proportional to the primary current, closing the trip circuit contacts.

QUESTION: 42.

Never open or close a high voltage (greater than 750 volts) air break disconnect unless:

A. the current flowing through it is approximately zero.

B. the current flowing through it is less than its design current carrying capability.

C. the circuit it is in is already open.

D. a parallel path exists for current flow.

QUESTION: 43.

If a generator output breaker is closed with generator frequency lower than grid frequency, what will result? (Assume that no generator relay protection is actuated.)

A. The generator will motorize.

B. The voltage of the generator will decrease to compensate for the lower frequency.

C. The generator will accept too much load.

D. The entire connected system will operate at the frequency of the lowest frequency (the oncoming) generator.

QUESTION: 44.

For a circuit breaker placed in the test position, which of the following statements is correct?

A. Control power is available to the breaker and functions normally to open and close the breaker.

B. The test position can only be used to test a circuit breaker on a dead bus.

C. The main power contacts remain connected to the load, but the breaker trips free when tested.

D. The test position disables the overload devices, allowing them to be set during normal operation.

QUESTION: 45.

The term neutron generation time is **MOST ACCURATELY** defined as the average time between:

A. neutron absorption and subsequent fission.

B. the production of a delayed neutron and subsequent neutron absorption.

C. fission and subsequent production of a neutron.

D. neutron thermalization and subsequent neutron absorption.

QUESTION: 46.

K_{eff} is **NOT** dependent on:

A. core dimensions.

B. core burnout.

C. moderator-to-fuel ratio.

D. installed neutron sources.

QUESTION: 47.

The fractional change in neutron population from one generation to the next is called:

A. beta.

B. K_{eff}.

C. lambda.

D. reactivity.

QUESTION: 48.

What is the definition for **DELAYED NEUTRON FRACTION**?

A. Fraction of the total number of delayed neutrons produced from fission, born from delayed neutron precursors

B. Fraction of the total number of fast neutrons produced from fission, born from delayed neutron precursors

C. Fraction of the total number of neutrons produced from fission, born from delayed neutron precursors

D. Fraction of the total number of thermal neutrons produced from fission, born from delayed neutron precursors.

QUESTION: 49.

After initial criticality, the reactor period is stabilized. The source range channels are repositioned so that the count rate is 100 cps. Sufficient positive reactivity is added to establish a 120-second period. How much time will it take for the count rate to increase to 10,000 cps with no additional operator action?

A. 1.2 minutes

B. 4 minutes

C. 9.21 minutes

D. 15.82 minutes

QUESTION: 50.

During a reactor startup, the reactor is critical at 3000 counts per second. A control rod is notched out, resulting in a doubling time of 85 seconds. How much time is required for the reactor to reach 888,000 cps?

A. 483 seconds

B. 612 seconds

C. 697 seconds

D. 965 seconds

QUESTION: 51.

The change in reactivity produced by a unit change in reactor coolant temperature, defines which reactivity coefficient?

A. Void

B. Moderator

C. Power

D. Doppler

QUESTION: 52.

Assume a reactor had been shut down for a shift, and shutdown cooling is in service. Which of the following coefficients of reactivity will act FIRST to change core reactivity upon a loss of shutdown cooling?

A. Moderator temperature coefficient

B. Doppler coefficient

C. Void coefficient

D. Pressure coefficient

QUESTION: 53.

In regard to core parameters that affect control-rod worth, which ONE of the following statements is correct?

A. control rod worth decreases in areas of increased flux due to rod shadowing.

B. control rod worth increases with an increase in voids.

C. control rod worth increases with an increase in fast neutron flux.

D. control rod worth decreases when approaching end of core life (EOL).

QUESTION: 54.

The reverse power effect or reverse reactivity effect occasionally observed when a shallow control rod is withdrawn one or two notches is due to relatively:

A. large local power increase being offset by a moderator temperature-related power decrease.

B. small local power decrease due to the shadowing effect of nearby control rods.

C. small local power decrease due to increased local Doppler effects.

D. large local power increase being offset by a void-related power decrease.

QUESTION: 55.

What are the substances in the correct order, from LARGEST TO SMALLEST, of microscopic cross section (Thermal Neutrons) for capture?

A. U-235, H2O, Xe-135

B. U-235, Xe-135, H2O

C. Xe-135, U-235, H2O

D. Xe-135, H2O, U-235

QUESTION: 56.

A reactor has been shut down for 2 weeks after extended power operation. What control rod movement is required to maintain 10 percent stable power immediately after startup?

A. Small amounts of rod insertion to compensate for LPRM chamber depletion.

B. Small amounts of rod withdrawal to compensate for Samarium buildup.

C. Small amounts of rod insertion to compensate for installed poison burnout.

D. Small amounts of rod withdrawal to compensate for Xenon buildup.

QUESTION: 57.

Following a reactor trip from a long-term, steady-state, 100 percent power run, the reactor is to be taken critical. The calculated estimated critical conditions (position) are based on a XENON-FREE core. What is the shortest time after the initial trip that this condition would exist?

A. 8 to 10 hours

B. 24 hours

C. 40 to 50 hours

D. 70 to 80 hours

QUESTION: 58.

If equilibrium reactor power level is increased from 50 percent to 100 percent, equilibrium xenon concentration will increase to a level that is:

A. less than twice the 50 percent power concentration.

B. equal to twice the 50 percent power concentration.

C. more than twice the 50 percent power concentration.

D. unpredictable unless the exact duration of operation at the two power levels is known.

QUESTION: 59.

A reactor has been operating at 50 percent power for one week when power is quickly ramped (over four hours) to 100 percent power. How would the Xenon concentration in the core respond?

A. Decrease, then build up to a new equilibrium concentration in 40 to 50 hours

B. Increase to a new equilibrium concentration in 40 to 50 hours

C. Decrease, then quickly build up to a new equilibrium concentration in eight to 10 hours

D. Remain the same because Xenon concentration is independent of flux level

QUESTION: 60.

What is the difference in peak xenon concentration following a reactor scram after 1 week at 100 percent power as compared to a scram after 1 week at 50 percent power?

A. The time to reach the peak is shorter after 100 percent power than after 50 percent power due to the higher iodine decay rate.

B. The peak from 50 percent is of a smaller magnitude due to the lower Xenon burnout rate.

C. The peaks are equal because the decay rate of iodine remains constant.

D. The peak from 100 percent power is of a larger magnitude, due to the larger initial iodine concentration.

QUESTION: 61.

When comparing control rod worths during a reactor startup from 100 percent peak xenon and a reactor startup from xenon-free conditions:

A. center control rod worth will be higher during the peak xenon startup than during the xenon-free startup.

B. peripheral control rod worth will be higher during the peak xenon startup than during the xenon-free startup.

C. both control rod worths will be the same regardless of core xenon conditions.

D. it is impossible to determine how xenon will affect the worth of center and peripheral control rods.

QUESTION: 62.

A reactor has been operating at 100 percent power for about two weeks when power is reduced to 50 percent. What is going to happen to the Xenon-135 concentration in the core?

A. There will be no change because Iodine concentration is constant.

B. Initially Xenon will increase, then decrease to a new lower equilibrium value.

C. Initially Xenon will decrease, then increase to a new higher equilibrium value.

D. Xenon will decrease to a new equilibrium value.

QUESTION: 63.

If a reactor that has operated at 100 percent power for ten days is shut down rapidly, xenon concentration will:

A. slowly decay away to almost zero in three days.

B. increase to a new equilibrium in three days.

C. peak in about a half day, then decay to almost zero in three days.

D. ramp down with reactor power.

QUESTION: 64.

What is the definition of the term BURNABLE POISON?

A. Isotopes manufactured into the fuel with large-scatter macroscopic cross sections.

B. Thermal neutron absorbing material added to the fuel, during the manufacturing process.

C. Neutron-absorber materials produced in the fuel by fast neutron absorption.

D. Fast neutron absorbing material loaded into the upper third of the core to aid in slowing down neutrons.

QUESTION: 65.

During a reactor startup, as K_{eff} approaches unity, which of the following statements is correct for <u>EQUAL POSITIVE REACTIVITY ADDITIONS</u>?

A. The changes in neutron population are larger.

B. As the neutron population increases, the number of neutrons lost per generation decreases.

C. The number of fast neutrons gained per generation increases more slowly.

D. A step increase in K_{eff} increases the neutron population and therefore decreases the number of neutrons lost per generation.

QUESTION: 66.

During reactor startup, critical rod position is **NOT** affected by:

A. control-rod worth.

B source range initial count rate.

C. fuel temperature.

D. core age.

QUESTION: 67.

During a reactor startup, as K_{eff} approaches 1.0, it takes longer to reach an equilibrium neutron count rate due to the increased effect of:

A. prompt neutrons.

B. delayed neutrons.

C. fast neutrons.

D. slow neutrons.

QUESTION: 68.

Assume a reactor is critical at a power level below the point of adding heat. For an equal positive reactivity insertion, the reactor period would be:

A. shorter if the core were xenon-free.

B. longer at EOL than at BOL.

C. shorter at EOL than at BOL.

D. longer at higher moderator temperature.

QUESTION: 69.

For which one of the following events will the Doppler coefficient act FIRST to counteract the reactivity addition to the core?

A. A control-rod drop during reactor power operation

B. The loss of one feedwater heater (extraction steam isolated) during reactor power operation

C. Tripping of the main turbine at 45 percent reactor power

D. A safety relief valve opening during reactor power operation

QUESTION: 70.

A reactor is operating at 100 percent power and flow. Reactor power is reduced by driving control rods in. (Recirculating pump speed remains constant.) What is the effect on core flow?

A. Core flow will increase, due to the decrease in two-phase flow resistance.

B. Core flow will remain constant, since reactor power does not affect core flow.

C. Core flow will decrease, due to an increase in two-phase flow resistance.

D. Core flow will increase, due to the increase in recirculation ratio.

QUESTION: 71.

What is the effect of isolating extraction steam to a high-pressure feedwater heater while at 90 percent of rated power?

A. The core inlet subcooling remains the same while the turbine generator MWe output decreases.

B. The core inlet subcooling and the reactor power (MWt) decrease.

C. The reactor power (MWt) and the turbine generator MWe output remain the same.

D. The core inlet subcooling increases and the turbine generator MWe output increases.

QUESTION 72.

Shortly after a reactor trip, reactor power indicates 0.5% when a stable negative startup rate (SUR) is attained. Reactor power will be reduced to 0.05% in approximately _____ seconds.

A. 360

B. 270

C. 180

D. 90

QUESTION: 73.

A differential pressure manometer filled with water is installed across an orifice in a ventilation duct to determine the direction of airflow, as shown in the figure below. What are the conditions in the ventilation duct?

A. P1 is greater than P2, and airflow is to the right.

B. P1 is greater than P2, and airflow is to the left.

C. P1 is less than P2, and airflow is to the right.

D. P1 is less than P2, and airflow is to the left.

QUESTION: 74.

Given an operating reactor at 985 psig and a feedwater inlet temperature of 400 °F, what will be feedwater subcooling?

A. 136.6 °F

B. 140.6 °F

C. 144.6 °F

D. 148.6 °F

QUESTION: 75.

The saturation pressure corresponding to 400 °F is:

A. 247.3 psia

B. 262.0 psia

C. 335.3 psia

D. 350.0 psia

QUESTION: 76.

The area of a steam jet air ejector (SJAE) where the LOWEST pressure exists is located at the:

A. throat of the nozzle.

B. inlet to the nozzle.

C. outlet of the nozzle.

D. suction piping from the condenser to the SJAE.

QUESTION: 77.

Condensate depression (subcooling) is increased by increasing:

A. main turbine load.

B. the circulating water temperature.

C. circulating water flow through the condenser.

D. air leakage into the condenser.

QUESTION: 78.

The thermodynamic cycle efficiency of a power plant is increased by:

A. decreasing the amount of condensate depression (subcooling).

B. removing a high-pressure feedwater heater from service.

C. lowering condenser vacuum from 29 inches to 25 inches.

D. decreasing power from 100% to 25%.

QUESTION: 79.

If a valve closure suddenly stops fluid flow, the resulting piping system pressure change is referred to as:

A. cavitation.

B. shutoff head.

C. water hammer.

D. valve chatter.

QUESTION: 80.

The condition that would most likely cause cavitation of an operating pump is:

A. lowering the suction temperature.

B. throttling the pump suction valve.

C. throttling the pump discharge valve.

D. decreasing the pump speed.

QUESTION: 81.

If two identical centrifugal pumps are operating in PARALLEL, then:

A. the total brake horsepower for the system is more than twice the horsepower of an individual pump.

B. the total head for the system is the sum of the two individual pump capacities.

C. the total capacity of the system is the sum of the two individual pump capacities.

D. the total brake horsepower for the system is the sum of the individual pump brake horsepowers.

QUESTION: 82.

Net positive suction head (NPSH) is:

A. the difference between pump suction pressure and the saturation pressure of the fluid being pumped.

B. the difference between the total suction head and the pressure at the eye of the pump.

C. the amount of suction pressure required to prevent cavitation.

D. the difference between the pump suction pressure and the pump discharge pressure.

QUESTION: 83.

A boiling water reactor (BWR) is operating at a pressure of 1025 psia. It has a temperature of 530 °F in the suction of the recirculating pump and an elevation head of 25 psia. Neglecting line losses, what is the net positive suction head (NPSH)?

A. 148 psia

B. 154 psia

C. 165 psia

D. 171 psia

QUESTION: 84.

An acceptable method to reduce water hammer in emergency core cooling systems is to:

A. maintain the system full of liquid (vented).

B. ensure minimum flow paths are maintained.

C. maintain minimum NPSH requirements.

D. start pumps against shut-off head.

QUESTION: 85.

The heat-transfer mechanism using direct contact transfer of kinetic energy from molecular motion is:

A. convection.

B. conduction.

C. radiation.

D. transmission.

QUESTION: 86.

The correct order of boiling heat transfer mechanisms, from the MOST EFFICIENT to the LEAST EFFICIENT, is:

A. stable film boiling, transition boiling, nucleate boiling.

B. nucleate boiling, stable film boiling, transition boiling.

C. transition boiling, nucleate boiling, stable film boiling.

D. nucleate boiling, transition boiling, stable film boiling.

QUESTION: 87.

The dominant heat transfer mechanism that occurs when film boiling is present is:

A. convection.

B. radiation.

C. conduction.

D. induction.

QUESTION: 88.

The HIGHEST heat transfer from the fuel-cladding surface to the coolant channel is provided by:

A. forced convection with subcooled coolant (no boiling).

B. natural convection with subcooled coolant (no boiling).

C. natural convection with bulk boiling of coolant.

D. forced convection with nucleate boiling.

QUESTION: 89.

The correct order of the heat-transfer mechanisms existing in the boiling water reactor (BWR) core (consider inlet-to-outlet flow) is:

A. subcooled nucleate boiling, single-phase convection, slug flow, annular flow.

B. annular flow, single-phase convection, subcooled nucleate boiling, slug flow.

C. single-phase convection, subcooled nucleate boiling, slug flow, annular flow.

D. single-phase convection, subcooled nucleate boiling, annular flow, slug flow.

QUESTION: 90.

Boiling improves heat transfer because:

A. it increases the effective thickness of the fluid film surrounding the heat transfer surface.

B. it increases the fluid velocity past the heated surface, which offsets the reduction in fluid film thickness at the heated surface.

C. it increases the heat transfer from the heated surface due to the latent heat of condensation, as the steam bubbles collapse at the heated surface.

D. it produces agitation, which reduces the thickness of the fluid film and results in the latent heat of vaporization being removed, as the bubbles move away from the heated surface.

QUESTION: 91.

Select the statement which best describes transition (partial film) boiling.

A. A small increase in delta-T (at the heat transfer and coolant interface) causes increased steam blanketing and a reduction in heat flux.

B. The temperature of the heat transfer surface is so high that thermal radiative heat transfer becomes significant and heat flux increases.

C. As the delta-T increases, the increasing number of bubbles causes increased agitation and turbulence of the boundary layer consequently increasing heat flux.

D. As the delta-T increases a few vapor bubbles are formed which may collapse when they enter into the bulk of the fluid.

QUESTION: 92.

The onset of transition boiling (OTB) is:

A. the area on a heat transfer curve where the most energy is added to the coolant.

B. the period when clad temperature fluctuates as the heat transfer coefficient alternates between a high value and a much lower value

C. the most effective means of heat transfer.

D. the period when clad temperature remains constant as the heat transfer coefficient becomes negative.

QUESTION: 93.

The relationship between <u>BUNDLE POWER</u> and <u>BUNDLE FLOW RESISTANCE</u> characteristics is:

A. flow resistance decreases as the quality and two-phase flow increase.

B. prior to boiling, as bundle power increases, bundle flow decreases.

C. flow resistance increases as the quality and void fraction increase.

D. flow orifices minimize the undesirable effects that quality decrease produces on bundle flow.

QUESTION: 94.

Linear Heat Generation Rate (LHGR):

A. is the ratio of the power produced in a given fuel bundle divided by total core thermal power.

B. is the ratio of the average power per rod divided by the rod power at 100% power.

C. is the sum of the power produced by all fuel rods in a given fuel bundle at a specific planar cross section.

D. is the sum of the power per unit area for each unit area of the fuel cladding for a unit length of a fuel rod.

QUESTION: 95.

The fraction of the limiting power density (FLPD) is equal to:

A. $\frac{\text{LHGR (actual)}}{\text{LHGR (design)}}$

B. ATPF + RPF

C. $\frac{\text{TPF}}{\text{APF}}$

D. $\frac{\text{LHGR limit}}{\text{CPR}}$

QUESTION: 96.

Which one of the following parameter changes will cause an increase in the critical power of a fuel bundle?

A. The subcooling of the coolant entering the bundle decreases.

B. The local peaking factor increases.

C. The coolant flow through the bundle increases.

D. The axial power peak shifts from the bottom to the top of the bundle.

QUESTION: 97.

Operating the reactor within limits defined by the maximum average planar linear heat generation rate (MAPLHGR) prevents:

A. exceeding 1 percent plastic strain in the cladding.

B. exceeding peak fuel temperature of 2200 °F.

C. the onset of transition boiling in the upper core.

D. exceeding a peak clad temperature of 2200 °F.

QUESTION: 98.

The fuel bundle power that would cause the onset of transition boiling at some point in the fuel bundle is the:

A. technical specification limit.

B. critical power.

C. maximum fraction of limiting power density.

D. maximum power density.

QUESTION: 99.

The threshold power for Pellet Clad Interaction (PCI) decreases as fuel exposure increases because:

A. heat-transfer capability is reduced by buildup of fission products and crud layers.

B. chemical embrittlement of cladding occurs due to fission product gases.

C. pellet densification occurs due to fuel burnout.

D. zirconium hydriding is reduced with fuel burnup .

QUESTION: 100.

The likelihood of brittle fracture failure of the reactor vessel is reduced by:

A. increasing vessel age.

B. reducing vessel pressure.

C. reducing vessel temperature.

D. reducing gamma flux exposure.

Enclosure B

BWR-GFE (FORM B)

1.	A	26.	B	51.	C	76.	C
2.	C	27.	B	52.	C	77.	C
3.	A	28.	B	53.	D	78.	C
4.	A	29.	B	54.	B	79.	B
5.	C	30.	C	55.	C	80.	A
6.	A	31.	A	56.	D	81.	D
7.	C	32.	D	57.	B	82.	D
8.	B	33.	A	58.	B	83.	C
9.	C	34.	B	59.	A	84.	D
10.	A	~~35.~~	~~B~~	60.	A	85.	D
11.	C	36.	A	61.	D	86.	A
12.	A	37.	D	62.	C	87.	A
13.	B	38.	A	63.	D	88.	D
14.	D	39.	D	64.	A	89.	B
15.	B	40.	D	65.	A	90.	B
16.	D	41.	D	66.	B	91.	C
17.	C	42.	C	67.	B	92.	B
18.	D	43.	D	68.	B	93.	A
19.	A	44.	D	69.	B	94.	B
20.	B	45.	C	70.	C	95.	B
21.	C	46.	C	71.	A	96.	C
22.	D	47.	B	72.	A	97.	A
23.	A	48.	B	73.	C	98.	A
24.	C	49.	A	74.	D	99.	D
25.	D	50.	D	75.	D	100.	C

UNITED STATES NUCLEAR REGULATORY COMMISSION
BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAM SECTION

Please Print:

Name: _____

Facility: _____

ID Number: _____

INSTRUCTIONS TO CANDIDATE

Use the answer sheet provided. Each question has equal point value. The passing grades require at least 80% on this part of the written licensing examination. All examination papers will be picked up 2.5 hours after the examination starts.

SECTION	Questions	% of Total	Score
THERMODYNAMICS	1 - 28		
COMPONENTS	29 - 72		
REACTOR THEORY	73 - 100		
TOTALS	100		

All work done on this examination is my own. I have neither given nor received aid.

_____

Candidate's Signature

FORM B

NRC RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

(1) Print your name in the blank provided on the cover sheet of the examination.

(2) Fill in the name of the facility you are associated with.

(3) Fill in the ID-Number you were given at registration.

(4) Three handouts are provided for your use during the examination, an Equations and Conversions sheet, instructions for filling out the answer sheet, and Steam Table booklets.

(5) Use only the answer sheet provided. Credit will only be given for answers marked on this sheet. Follow the instructions for filling out the answer sheet.

(6) Scrap paper will be provided for calculations.

(7) Any questions about an item on the examination should be directed to the examiner only.

(8) Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

(9) Restroom trips are limited. Only ONE examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

(10) After you have completed the examination, please sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.

(11) Please turn in your examination materials answer sheet on top followed by the exam booklet, then examination aids - steam table booklets, handouts and scrap paper used during the examination.

(12) After turning in your examination materials, leave the examination area, as defined by the examiner. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

EQUATION SHEET

$\dot{Q} = \dot{m} c_p \Delta T$

$\dot{Q} = \dot{m} \Delta h$

$\dot{Q} = U A \Delta T$

$SUR = 26.06/\tau$

$SUR = \dfrac{26.06 (\lambda_{eff} \rho)}{(\bar{\beta} - \rho)}$

$P = P_0 \, 10^{SUR(t)}$

$P = P_0 \, e^{(t/\tau)}$

$\tau = (l^*/\rho) + [(\bar{\beta} - \rho)/\lambda_{eff}\rho]$

$\rho = (K_{eff} - 1)/K_{eff}$

$\rho = \Delta K_{eff}/K_{eff}$

Cycle Efficiency = $\dfrac{\text{Net Work (out)}}{\text{Energy (in)}}$

$SCR = S/(1 - K_{eff})$

$CR_1 (1 - K_{eff})_1 = CR_2 (1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = \dfrac{(1 - K_{eff})_0}{(1 - K_{eff})_1}$

$SDM = (\lambda - K_{eff})/K_{eff}$

$Pwr = W_f \dot{m}$

$\tau = l^*/(\rho - \bar{\beta})$

$l^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ neconds^{-1}

---

1 Curie = 3.7×10^{10} dps

1 hp = 2.54×10^3 BTU/hr

1 BTU = 778 ft-lbf

°C = 5/9 (°F - 32)

1 kg = 2.21 lbm

1 Mw = 3.41×10^6 BTU/hr

°F = 9/5 °C + 32

QUESTION: 1.

A differential pressure manometer filled with water is installed across an orifice in a ventilation duct to determine the direction of airflow, as shown in the figure below. What are the conditions in the ventilation duct?

A. P1 is greater than P2, and airflow is to the right

B. P1 is greater than P2, and airflow is to the left.

C. P1 is less than P2, and airflow is to the right.

D. P1 is less than P2, and airflow is to the left.

QUESTION: 2.

Given an operating reactor at 985 psig and a feedwater inlet temperature of 400 °F, what will be feedwater subcooling?

A. 136.6 °F

B. 140.6 °F

C. 144.6 °F

D. 148.6 °F

QUESTION: 3.
The saturation pressure corresponding to 400 °F is:

A. 247.3 psia

B. 262.0 psia

C. 335.3 psia

D. 350.0 psia

QUESTION: 4.

The area of a steam jet air ejector (SJAE) where the LOWEST pressure exists is located at the:

A. throat of the nozzle.

B. inlet to the nozzle.

C. outlet of the nozzle.

D. suction piping from the condenser to the SJAE.

QUESTION: 5.

Condensate depression (subcooling) is increased by increasing:

A. main turbine load.

B. the circulating water temperature.

C. circulating water flow through the condenser.

D. air leakage into the condenser.

QUESTION: 6.

The thermodynamic cycle efficiency of a power plant is increased by:

A. decreasing the amount of condensate depression (subcooling).

B. removing a high-pressure feedwater heater from service.

C. lowering condenser vacuum from 29 inches to 25 inches.

D. decreasing power from 100% to 25%.

QUESTION: 7.

If a valve closure suddenly stops fluid flow, the resulting piping system pressure change is referred to as:

A. cavitation.

B. shutoff head.

C. water hammer.

D. valve chatter.

QUESTION: 8.

The condition that would most likely cause cavitation of an operating pump is:

A. lowering the suction temperature.

B. throttling the pump suction valve.

C. throttling the pump discharge valve.

D. decreasing the pump speed.

QUESTION: 9.

If two identical centrifugal pumps are operating in **PARALLEL**, then:

A. the total brake horsepower for the system is more than twice the horsepower of an individual pump.

B. the total head for the system is the sum of the two individual pump capacities.

C. the total capacity of the system is the sum of the two individual pump capacities.

D. the total brake horsepower for the system is the sum of the individual pump brake horsepowers.

QUESTION: 10.

Net positive suction head (NPSH) is:

A. the difference between pump suction pressure and the saturation pressure of the fluid being pumped.

B. the difference between the total suction head and the pressure at the eye of the pump.

C. the amount of suction pressure required to prevent cavitation.

D. the difference between the pump suction pressure and the pump discharge pressure.

QUESTION: 11.

A boiling water reactor (BWR) is operating at a pressure of 1025 psia. It has a temperature of 530°F in the suction of the recirculating pump and an elevation head of 25 psia. Neglecting line losses, what is the net positive suction head (NPSH)?

A. 148 psia

B. 154 psia

C. 165 psia

D. 171 psia

QUESTION: 12.

An acceptable method to reduce water hammer in emergency core cooling systems is to:

A. maintain the system liquid full (vented).

B. ensure minimum flow paths are maintained.

C. maintain minimum NPSH requirements.

D. start pumps against shut-off head.

QUESTION: 13.

The heat-transfer mechanism using direct contact transfer of kinetic energy from molecular motion is:

A. convection.

B. conduction.

C. radiation.

D. transmission.

QUESTION: 14.

The correct order of boiling heat transfer mechanisms, from the **MOST EFFICIENT** to the **LEAST EFFICIENT**, is:

A. stable film boiling, transition boiling, nucleate boiling.

B. nucleate boiling, stable film boiling, transition boiling.

C. transition boiling, nucleate boiling, stable film boiling.

D. nucleate boiling, transition boiling, stable film boiling.

QUESTION: 15.

The dominant heat transfer mechanism that occurs when film boiling is present is:

A. convection.

B. radiation.

C. conduction.

D. induction.

QUESTION: 16.

The **HIGHEST** heat transfer from the fuel-cladding surface to the coolant channel is provided by:

A. forced convection with subcooled coolant (no boiling).

B. natural convection with subcooled coolant (no boiling).

C. natural convection with bulk boiling of coolant.

D. forced convection with nucleate boiling.

QUESTION: 17.

The correct order of the heat-transfer mechanisms existing in the boiling water reactor (BWR) core (consider inlet-to-outlet flow) is:

A. subcooled nucleate boiling, single-phase convection, slug flow, annular flow.

B. annular flow, single-phase convection, subcooled nucleate boiling, slug flow.

C. single-phase convection, subcooled nucleate boiling, slug flow, annular flow.

D. single-phase convection, subcooled nucleate boiling, annular flow, slug flow.

QUESTION: 18.

Boiling improves heat transfer because:

A. it increases the effective thickness of the fluid film surrounding the heat transfer surface.

B. it increases the fluid velocity past the heated surface, which offsets the reduction in fluid film thickness at the heated surface.

C. it increases the heat transfer from the heated surface due to the latent heat of condensation, as the steam bubbles collapse at the heated surface.

D. it produces agitation, which reduces the thickness of the fluid film and results in the latent heat of vaporization being removed, as the bubbles move away from the heated surface.

QUESTION: 19.

Select the statement which best describes transition (partial film) boiling.

A. A small increase in delta-T (at the heat transfer and coolant interface) causes increased steam blanketing and a reduction in heat flux.

B. The temperature of the heat transfer surface is so high that thermal radiative heat transfer becomes significant and heat flux increases.

C. As the delta-T increases, the increasing number of bubbles causes increased agitation and turbulence of the boundary layer consequently increasing heat flux.

D. As the delta-T increases a few vapor bubbles are formed which may collapse when they enter into the bulk of the fluid.

QUESTION: 20.

The onset of transition boiling (OTB) is:

A. the area on a heat transfer curve where the most energy is added to the coolant.

B. the period when clad temperature fluctuates as the heat transfer coefficient alternates between a high value and a much lower value.

C. the most effective means of heat transfer.

D. the period when clad temperature remains constant as the heat transfer coefficient becomes negative.

QUESTION: 21.

The relationship between **BUNDLE POWER** and **BUNDLE FLOW RESISTANCE** characteristics is:

A. flow resistance decreases as the quality and two-phase flow increase.

B. prior to boiling, as bundle power increases, bundle flow decreases.

C. flow resistance increases as the quality and void fraction increase.

D. flow orifices minimize the undesirable effects that quality decrease produces on bundle flow.

QUESTION: 22.

Linear Heat Generation Rate (LHGR):

A. is the ratio of the power produced in a given fuel bundle divided by total core thermal power.

B. is the ratio of the average power per rod divided by the rod power at 100% power.

C. is the sum of the power produced by all fuel rods in a given fuel bundle at a specific planar cross section.

D. is the sum of the power per unit area for each unit area of the fuel cladding for a unit length of a fuel rod.

QUESTION: 23.

The fraction of the limiting power density (FLPD) is equal to.

A. $\frac{\text{LHGR (actual)}}{\text{LHGR (design)}}$

B. ATPF + RPF

C. $\frac{\text{TPF}}{\text{APF}}$

D. $\frac{\text{LHGR limit}}{\text{CPR}}$

QUESTION: 24.

Which one of the following parameter changes will cause an increase in the critical power of a fuel bundle?

A. The subcooling of the coolant entering the bundle decreases.

B. The local peaking factor increases.

C. The coolant flow through the bundle increases.

D. The axial power peak shifts from the bottom to the top of the bundle.

QUESTION: 25.

Operating the reactor within limits defined by the maximum average planar linear heat generation rate (MAPLHGR) prevents:

A. exceeding 1 percent plastic strain in the cladding.

B. exceeding peak fuel temperature of 2200 °F.

C. the onset of transition boiling in the upper core.

D. exceeding a peak clad temperature of 2200 °F.

QUESTION: 26.

The fuel bundle power that would cause the onset of transition boiling at some point in the fuel bundle is the:

A. technical specification limit.

B. critical power.

C. maximum fraction of limiting power density.

D. maximum power density.

QUESTION: 27.

The threshold power for Pellet Clad Interaction (PCI) decreases as fuel exposure increases because:

A. heat-transfer capability is reduced by buildup of fission products and crud layers.

B. chemical embrittlement of cladding occurs due to fission product gases.

C. pellet densification occurs due to fuel burnout.

D. zirconium hydriding is reduced with fuel burnup .

QUESTION: 28.

The likelihood of brittle fracture failure of the reactor vessel is reduced by:

A. increasing vessel age.

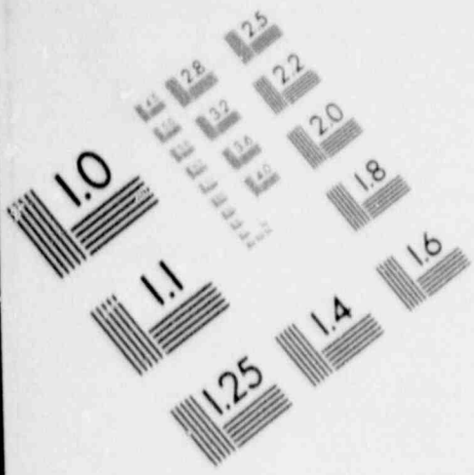
B. reducing vessel pressure.

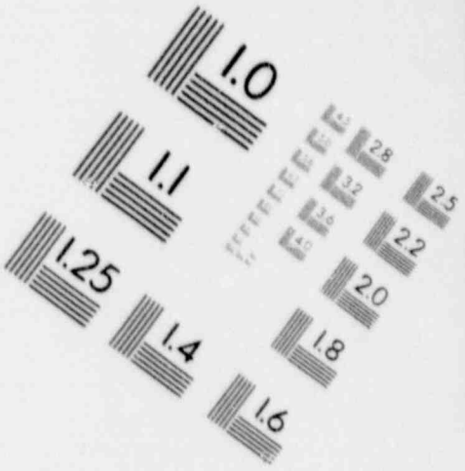
C. reducing vessel temperature.

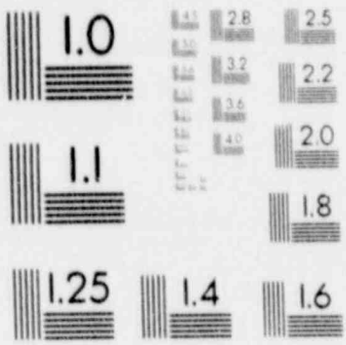
D. reducing gamma flux exposure.

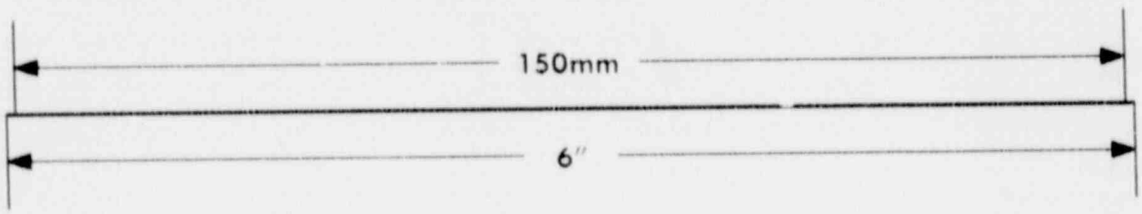
1

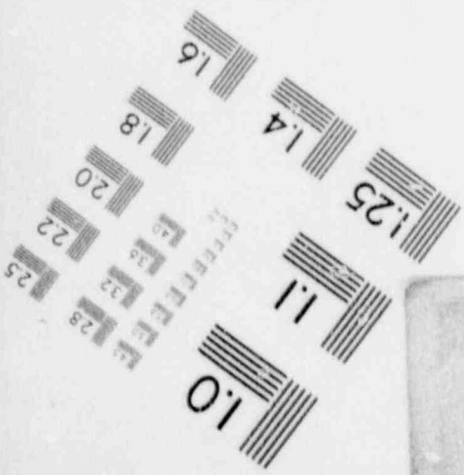
IMAGE EVALUATION TEST TARGET (MT-3)

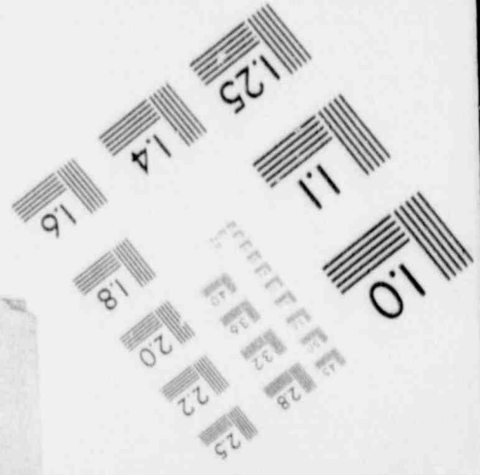


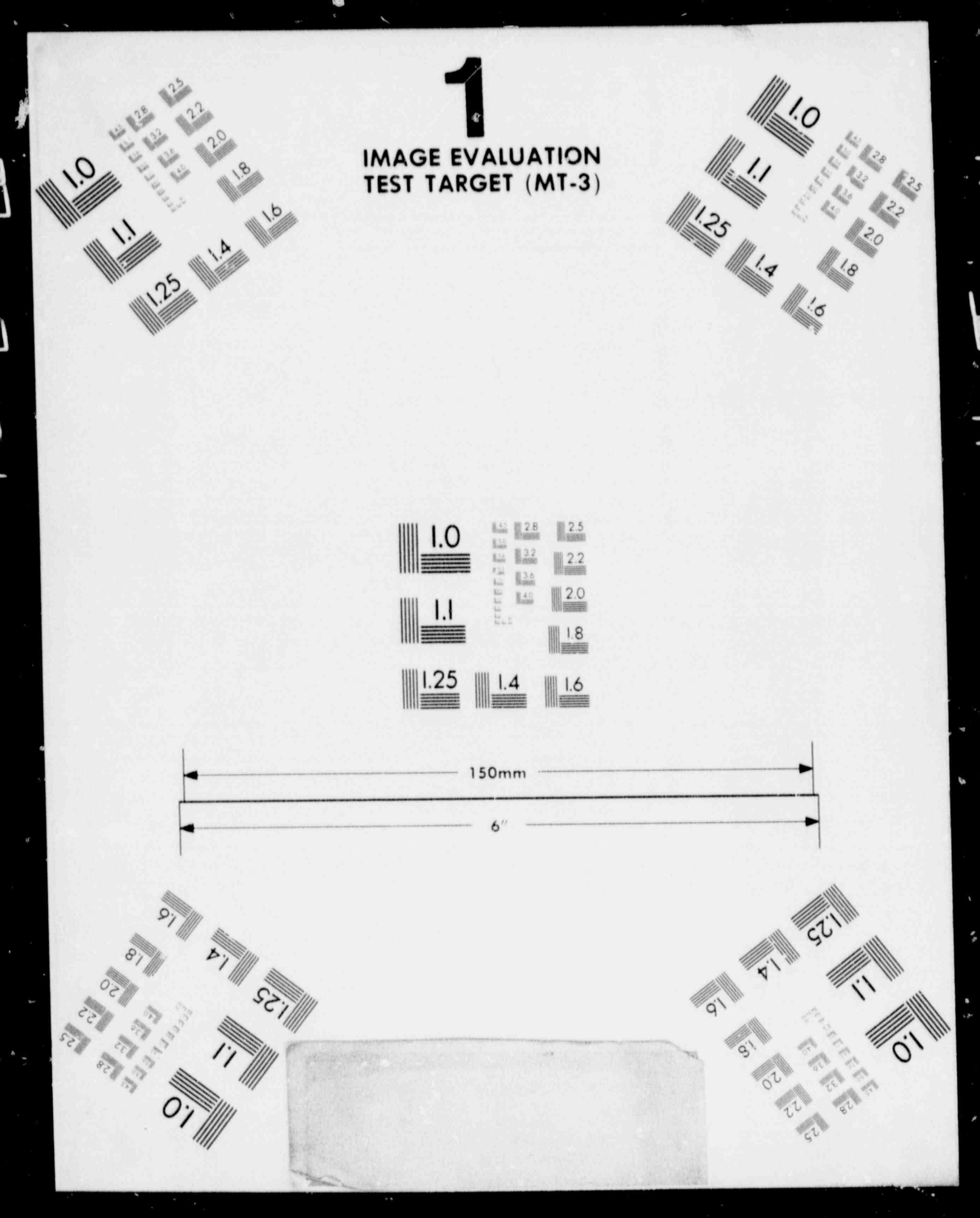








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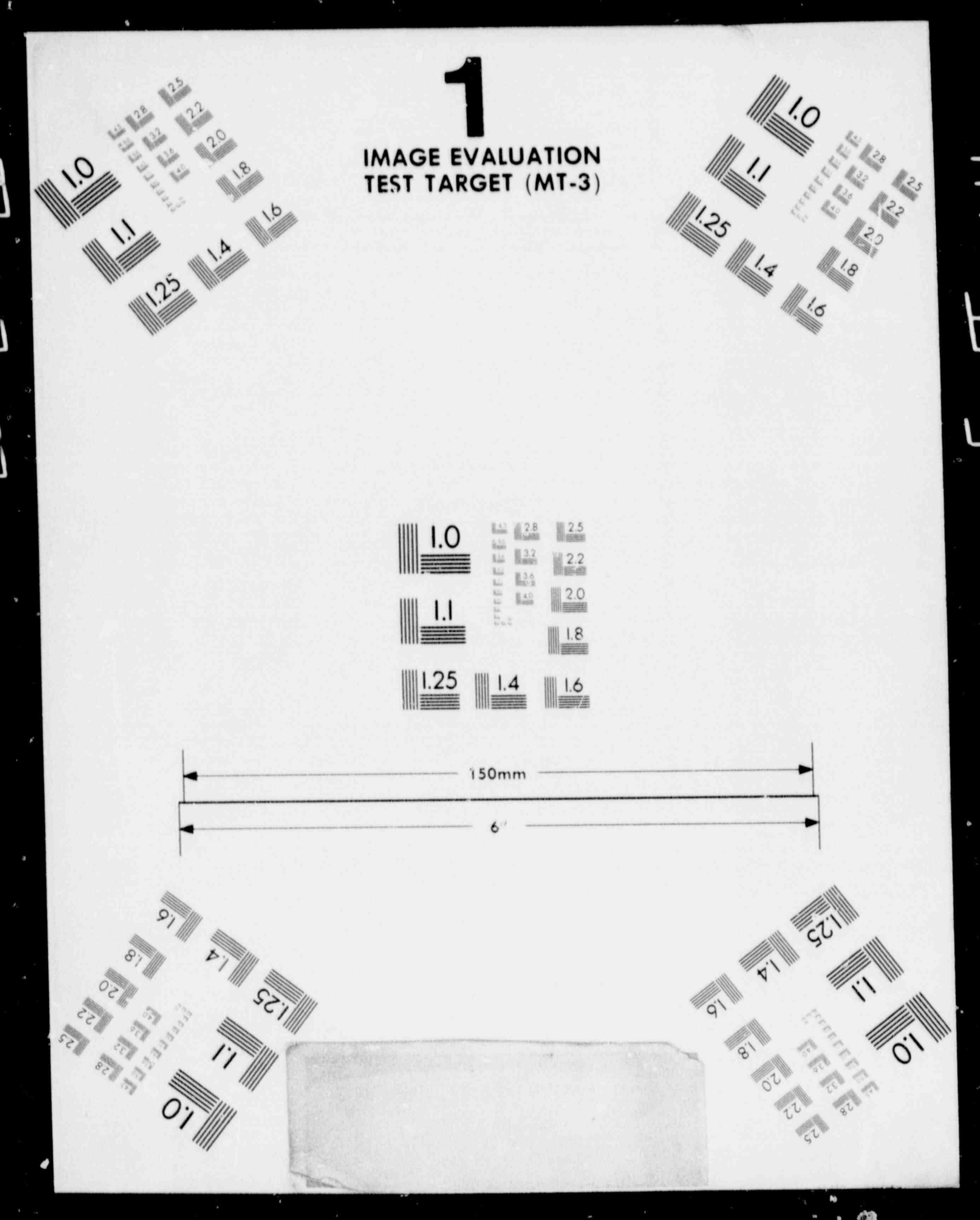
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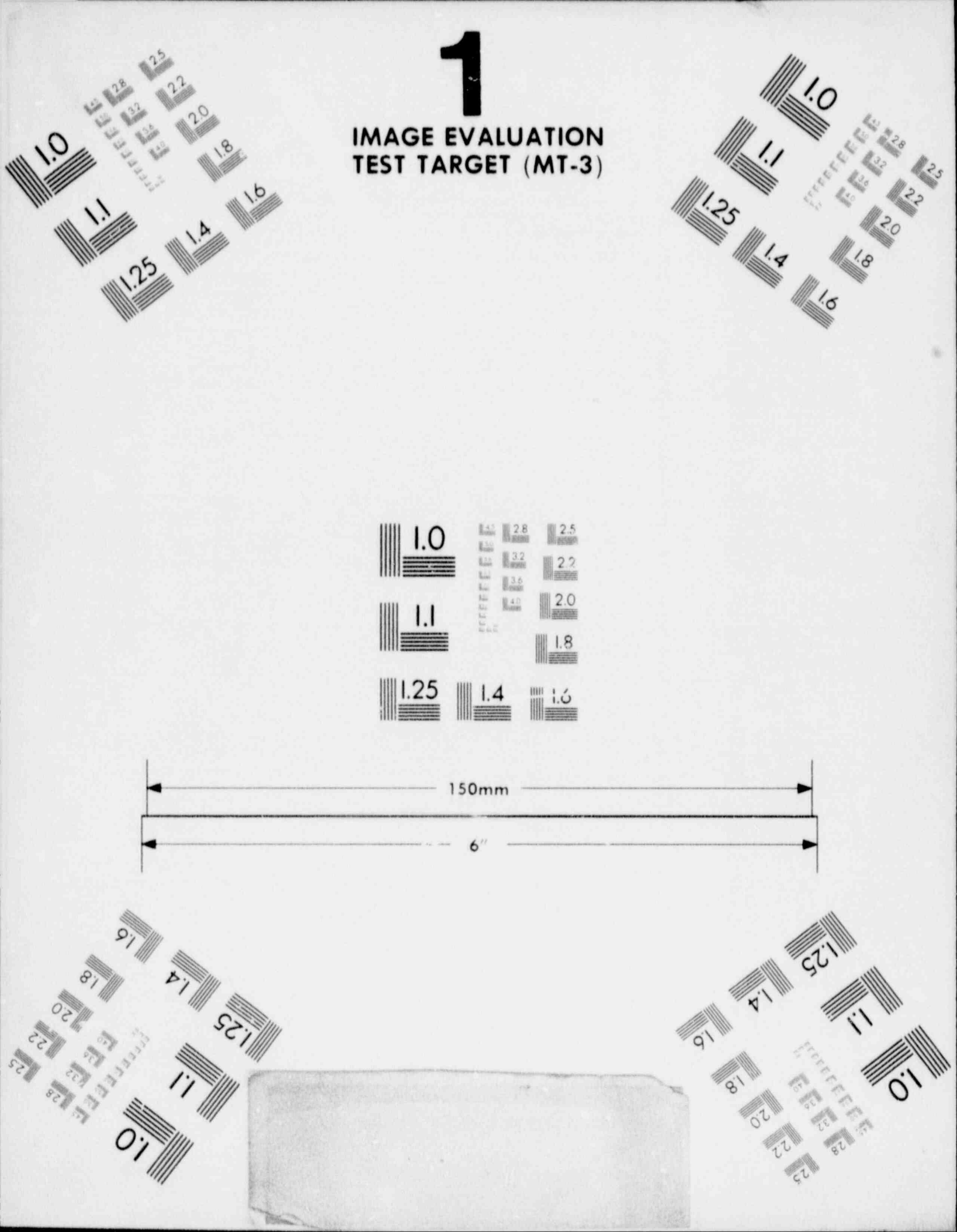
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3.6
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150mm
6"

QUESTION: 29.

Which **ONE** of the following correctly describes the operation of a safety valve installed on a high pressure steam system?

A. A safety valve is initially lifted off its seat by system pressure, then is forced fully open by an air-operated piston.

B. As system pressure increases to the safety set point, the pressure overcomes spring force on the valve operator, causing the valve to open.

C. A safety valve will remain open until system pressure has been reduced to the pilot valve actuation setpoint.

D. When the open safety valve has returned system pressure to the lifting set point, a combination of air and steam pressure above the valve disk closes the valve.

QUESTION: 30.

Which of the following correctly describes the relief mode of operation for a safety relief valve (SRV)?

A. The SRV must be manually opened and manually closed using the control switch.

B. The SRV will automatically open, but must be reset by the operator before it will close.

C. The SRV will automatically open and close to relieve excess system pressure.

D. The SRV must be manually opened but will automatically close to prevent system depressurization.

QUESTION: 31.

What precautions is applicable, when transferring a controller for a flow control valve from automatic to manual control?

A. Verify that both the automatic and manual controller outputs are the same prior to transfer.

B. Do not attempt to adjust the control signals, since the manual control system tracks the automatic signal and adjusting the signals could negate the automatic tracking.

C. Verify that the manual controller output is slightly less than the automatic controller's to prevent flow overshoot on the transfer.

D. Verify that the manual controller output is slightly higher than the automatic controller's to ensure that no loss of flow occurs on the transfer.

QUESTION: 32.

What may be damaged if an operator attempts to manually disengage the motor on a motor-operated valve while the motor is operating?

A. Limit switches

B. Valve seat

C. Torque switches

D. Clutch

QUESTION: 33.

Emergency core cooling systems (ECCS's) typically have testable check valves in the discharge lines from the pump to the vessel. How does the testable check valve operate?

A. The valve is opened by flow and pressure from the discharge of the ECCS pump.

B. Instrument air is applied to the valve operator when the ECCS system is shut down to close the valve and ensure no leak across the seat.

C. The check valve cannot be opened unless the associated ECCS pump is running.

D. An air solenoid admits air to the valve on system initiation to ensure that the valve opens.

QUESTION: 34.

Which statement best describes the function and use of valve backseats?

A. Valve backseats are provided to remove pressure from the packing and stuffing box and are the normal method used to isolate the stuffing box for valve repacking.

B. Valve backseats are provided to remove pressure from the packing and stuffing box and are only used when needed to prevent packing leakage.

C. Valve backseats are provided as a back-up in case the primary seat leaks and are normally used during plant operations.

D. Valve backseats are provided as a back-up in case the primary seat leaks and are only used when needed to prevent valves from leaking excessively.

QUESTION: 35.

Given the equation for mass flow rate: $\dot{m} = \rho \times A \times v$

where $\dot{m}$ = mass flow rate (lbm/sec)
ρ = density of flowing fluid (lbm/ft3)
A = cross section of channel of fluid (ft2)
v = average velocity of flowing fluid (ft/sec)

What is the effect on indicated mass flow rate if the liquid being measured has air in solution?

A. Indicated flow would be greater than actual flow.

B. Indicated flow would be less than actual flow.

C. Indicated flow is not affected by air in solution.

D. The effect on indicated flow is unpredictable.

QUESTION: 36.

A leak develops in the high-pressure side of a flow detector. What effect does that leak have on the flow indication of the detector?

A. The measured delta-P will decrease, causing indicated flow to decrease.

B. The measured delta-P will decrease, causing indicated flow to increase.

C. The measured delta-P will increase, causing indicated flow to decrease.

D. The measured delta-P will increase, causing indicated flow to increase.

QUESTION: 37.

What happens to a fluid as it passes through a venturi?

A. Pressure remains constant, but the velocity increases as the diameter of the venturi decreases.

B. Pressure increases, but the velocity decreases as the diameter of the venturi decreases.

C. Pressure decreases, but the velocity remains constant as the diameter of the venturi increases.

D. Pressure increases, but the velocity decreases as the diameter of the venturi increases.

QUESTION: 38.

It is necessary to density-compensate the main steam line flow indication because the measured change in pressure across the flow elements is:

A. directly proportional to the volumetric flow rate.

B. inversely proportional to the volumetric flow rate.

C. directly proportional to the mass flow rate.

D. inversely proportional to the mass flow rate.

QUESTION: 39.

What is the reason for the reference leg being connected to the reactor pressure vessel (RPV) instead of being filled by a water source independent of the RPV?

A. To provide a vent path for the prevention of a reference leg rupture during a rapid RPV depressurization.

B. To alleviate the need for density [illegible]tion by keeping the reference leg at the same temperature as the [illegible]e leg.

C. To make the indicated level proportional to the square root of the differential pressure between the reference and variable legs for all reactor pressures.

D. To provide compensation for the RPV pressure exerted on the variable leg.

QUESTION: 40.

If the variable leg temperature of a differential pressure level cell is higher than the calibration conditions, what will the level instrument indicate?

A. Indicated reactor water level is higher than actual reactor water level.

B. Actual level if the reference leg temperature is at the calibration conditions

C. Actual level if the reference leg temperature is the same temperature as the variable leg

D. Indicated reactor water level is lower than actual reactor water level.

QUESTION: 41.

What will the indication be when a level D/P cell fails (D/P = 0)?

A. 0 of full range

B. 50% of full range

C. 75% of full range

D. 100% of full range

QUESTION: 42.

Which of the following correctly describes a characteristic of a thermocouple?

A. Indication will fail high offscale with an open circuit.

B. They are generally more accurate than resistance temperature detectors (RTDs).

C. A junction between two dissimilar metals will generate a voltage proportional to temperature.

D. A junction between two dissimilar metals will result in a change in electrical resistance proportional to temperature.

QUESTION: 43.

The difference between the setpoint and the measured parameter in an automatic flow controller is called:

A. gain.

B bias.

C. feedback

D. error.

QUESTION: 44.

Which of the following valves is **MOST LIKELY** to be used with a throttling positioner?

A. Stop valve

B. Globe valve

C. Gate valve

D. Butterfly valve

QUESTION: 45.

The governor on an emergency diesel generator regulates the amount of fuel supplied to the diesel engine to:

A. increase engine speed as load increases.

B. increase generator voltage as load increases.

C. maintain engine speed nearly constant as load changes.

D. maintain generator voltage nearly constant as load changes.

QUESTION: 46.

Venting a centrifugal pump prior to operating it ensures that:

A. pump runout will not occur.

B. pump internal corrosion is reduced.

C. gas binding is reduced.

D. starting load is minimized.

QUESTION: 47.

What would result from operating a motor-driven centrifugal pump for extended periods of time with the discharge valve shut?

A. No damage, since the pump and motor are designed to operate with the discharge valve shut

B. Pump overheating, cavitating, and ultimately pump failure

C. Excessive motor current, damage to motor windings, and ultimately motor failure

D. Pump and motor speeding excessively and tripping on high motor current

QUESTION: 48.

A centrifugal pump is operating at rated speed with an output head of 240 psig. The speed of the pump is then decreased until the power consumption is 1/64 of its original value. What is the approximate new output head?

A. 3.75 psig

B. 15 psig

C. 30 psig

D. 60 psig

QUESTION: 49.

What will increase reactor recirculation pump available net positive suction head? (Assume all other parameters remain constant.)

A. Loss of feedwater heating while at 80% power

B. Increase in reactor coolant temperature from 100 °F to 200 °F during a reactor startup

C. Decrease in reactor pressure during a normal reactor shutdown

D. Decrease in reactor water from the normal level to just below the low-level alarm level

QUESTION: 50.

Which one of the following items is **NOT** a characteristic of centrifugal pumps operating in series?

A. The available net positive suction head (NPSH) of the second pump in the series is greater than the NPSH in a single-pump system.

B. The capacity for two pumps operating in series is limited by the capacity of the first pump in the series.

C. The total head for two pumps operating in series is approximatley twice the head for a single pump supplying the same capacity.

D. The power required to supply two centrifugal pumps operating in series is less than twice the power required for each of the individual pumps.

QUESTION: 51.

What is caused by operating a motor-driven centrifugal pump under runout conditions?

A. Pump failure due to excessive pump cavitation.

B. No damage, since the pump and motor are designed to operate without failure under pump runout conditions.

C. Motor failure due to excessive current being drawn through the motor windings.

D. Pump failure due to overheating, caused by the increased impellor-to-casing friction.

QUESTION: 52.

A single-speed centrifugal fire pump takes suction on a storage tank and discharges through a flexible fire hose. Which of the following correctly describes the response of the pump discharge flow rate?

A. Remain constant as the elevation of the pump discharge piping is raised

B. Increase as the elevation of the pump discharge piping is raised

C. Decrease as the level in the storage tank on the pump suction is lowered

D. Remain constant as the level in the storage tank on the pump suction is lowered

QUESTION: 53.

What will occur by operating a positive displacement pump with insufficient net positive suction head?

A. Slip

B. Decreased pump speed

C. Water hammer

D. Vapor binding

QUESTION: 54.

For large electric motors, why must the number of starts over a period of time be limited?

A. Protect the power supply cables from insulation breakdown due to high starting current

B. Protect the motor windings from overheating

C. Prevent motor thrust-bearing damage due to lack of lubrication

D. Prevent rotor seizure due to thermal expansion of the windings caused by high starting current

QUESTION: 55.

Given the following conditions for a variable-speed motor-driven centrifugal pump:

- Flow rate = 2000 gpm
- Motor current = 100 amperes

If the flow rate is increased to 4000 gpm, which one of the following motor current values **MOST CLOSELY** approximates the actual value?

A. 200 amperes

B. 400 amperes

C. 800 amperes

D. 1600 amperes

QUESTION: 56.

Which of the following best describes the motor current indications that would be observed during the start of a large A.C. motor at full load?

A. Amps slowly increase to the full-load value.

B. Amps immediately increase to the full-load value.

C. Amps immediately increase to approximately three times the full-load value and then decrease to the full-load value.

D. Amps immediately increase to approximately six times the full-load value and then decrease to the full-load value.

QUESTION: 57.

Which of the following correctly describes the effects on generator excitation with the generator paralleled to the grid?

A. Increasing field current increases excitation and shifts power factor from lagging toward leading.

B. Increasing field current increases excitation and shifts power factor from leading toward lagging.

C. Decreasing field current increases excitation and shifts power factor from leading toward lagging.

D. Decreasing field current increases excitation and shifts power factor from leading toward lagging.

QUESTION: 58.

As steam (shell) and liquid (tube) heat exchangers are put into service, the:

A. steam side is valved in before the water side to minimize scale buildup on the heat exchanger tubes.

B. water side is valved in before the steam side to prevent thermal shock from occurring.

C. water side is valved in before the steam side to ensure adequate venting.

D. steam side is valved in before the water side to ensure that the cooldown rate does not exceed 100 °F/hr.

QUESTION: 59.

Decreasing the temperature of a cooled system using a shell-and-tube heat exchanger is NORMALLY accomplished by:

A. increasing the cooling system flow.

B. increasing the cooled system flow.

C. decreasing the cooling system flow.

D. decreasing the cooled system flow.

QUESTION: 60.

Which of the following changes will DECREASE subcooling of the condensate water?

A. Isolate one bay of the condenser circulating water system.

B. Decrease circulating water temperature.

C. Increase circulating water flow.

D. Decrease the main turbine generator Megawatt load.

QUESTION: 61.

During normal reactor operation, a main condenser develops an air leak which decreases vacuum at a rate of 1 in Hg/min. Which of the following plant parameters would be the **FIRST** to show an **INCREASE** because of this condition?

A. Extraction steam flow

B. Generator megawatt output

C. Circulating water outlet temperature

D. Condensate temperature

QUESTION: 62.

What is the saturation temperature for a boiling water reactor (BWR) operating at 920 psig.? [Use steam tables.]

A. 532.6 °F

B. 533.9 °F

C. 536.5 °F

D. 538.4 °F

QUESTION: 63.

Why should fouling of heat exchanger tubes in closed cooling water systems be **MINIMIZED**?

A. To prevent excessive heat transfer rates.

B. To prevent the cooling water outlet temperature from exceeding design limits.

C. To maximize the pressure the drop across the heat exchanger.

D. To maximize the heat transfer rate.

QUESTION: 64.

Why is proper venting of a shell-and-tube heat exchanger important?

A. An air bubble reduces the heat transfer coefficient of the heat exchanger.

B. An air bubble causes pressure transients within the tubes as heat load changes.

C. An air bubble will cause thermal shock as it moves through the heat exchanger.

D. An air bubble will cause corrosion in the heat exchanger.

QUESTION: 65.

What is the purpose of a mixed-bed demineralizer?

A. To remove both positively and negatively charged ions.

B. To reduce the conductivity without affecting the pH of the water.

C. To increase pH by reducing the number of positively charged ions in the water.

D. To increase the conductivity of the water to greater than 1.0 micromhos.

QUESTION: 66.

In a demineralizer, what adverse effect occurs due to channeling?

A. Reduction of delta-P across the demineralizer because the resin is essentially bypassed

B. Reduction in demineralization efficiency because the resin is essentially bypassed

C. Loss of resin due to agitation as a result of increased velocity through the demineralizer

D. Resin damage due to the increased velocity of fluid through the demineralizer

QUESTION: 67.

The first indication of resin depletion in the effluent of a demineralizer is:

A. a decrease in suspended solids.

B. an increase in the conductivity.

C. a decrease in chlorides.

D. an increase in resin fines.

QUESTION: 68.

If the breaker control power is lost to a supply breaker for an operating pump motor, the breaker:

A. will trip on undervoltage.

B. will remain closed until tripped locally by an operator.

C. will remain closed unless a fault trip occurred.

D. will remain closed until tripped remotely by an operator.

QUESTION: 69.

What is the definition of a thermal overload device?

A. A balanced circuit that compares actual current to a fixed overcurrent signal which, when exceeded, trips a relay.

B. An in-line thermal coil that, when subjected to a high current, overheats and actuates a circuit-interrupting device.

C. A temperature monitor that senses the temperature of the operating equipment and trips the circuit breaker if the temperature exceeds preset limits.

D. An induction coil that generates a secondary current proportional to the primary current, closing the trip circuit contacts.

QUESTION: 70.

Never open or close a high voltage (greater than 750 volts) air break disconnect unless:

A. the current flowing through it is approximately zero.

B. the current flowing through it is less than its design current carrying capability.

C. the circuit it is in is already open.

D. a parallel path exists for current flow.

QUESTION: 71.

If a generator output breaker is closed with generator frequency lower than grid frequency, what will result? (Assume that no generator relay protection is actuated.)

A. The generator will motorize.

B. The voltage of the generator will decrease to compensate for the lower frequency.

C. The generator will accept too much load.

D. The entire connected system will operate at the frequency of the lowest frequency (the oncoming) generator.

QUESTION: 72.

For a circuit breaker placed in the test position, which of the following statements is correct?

A. Control power is available to the breaker and functions normally to open and close the breaker.

B. The test position can only be used to test a circuit breaker on a dead bus.

C. The main power contacts remain connected to the load, but the breaker trips free when tested.

D. The test position disables the overload devices, allowing them to be set during normal operation.

QUESTION: 73.

The term neutron generation time is **MOST ACCURATELY** defined as the average time between:

A. neutron absorption and subsequent fission.

B. the production of a delayed neutron and subsequent neutron absorption.

C. fission and subsequent production of a neutron.

D. neutron thermalization and subsequent neutron absorption.

QUESTION: 74.

K_{eff} is **NOT** dependent on:

A. core dimensions.

B. core burnout.

C. moderator-to-fuel ratio.

D. installed neutron sources.

QUESTION: 75.

The fractional change in neutron population from one generation to the next is called:

A. beta.

B. K_{eff}.

C. lambda.

D. reactivity.

QUESTION: 76.

What is the definition for DELAYED NEUTRON FRACTION?

A. Fraction of the total number of delayed neutrons produced from fission, born from delayed neutron precursors

B. Fraction of the total number of fast neutrons produced from fission, born from delayed neutron precursors

C. Fraction of the total number of neutrons produced from fission, born from delayed neutron precursors

D. Fraction of the total number of thermal neutrons produced from fission, born from delayed neutron precursors.

QUESTION: 77.

After initial criticality, the reactor period is stabilized. The source range channels are repositioned so that the count rate is 100 cps. Sufficient positive reactivity is added to establish a 120-second period. How much time will it take for the count rate to increase to 10,000 cps with no additional operator action?

A 1.2 minutes

B. 4 minutes

C. 9.21 minutes

D. 15.82 minutes

QUESTION: 78.

During a reactor startup, the reactor is critical at 3000 counts per second. A control rod is notched out, resulting in a doubling time of 85 seconds. How much time is required for the reactor to reach 888,000 cps?

A. 483 seconds

B. 612 seconds

C. 697 seconds

D. 965 seconds

QUESTION: 79.

The change in reactivity produced by a unit change in reactor coolant temperature, defines which reactivity coefficient?

A. Void

B. Moderator

C. Power

D. Doppler

QUESTION: 80.

Assume a reactor had been shut down for a shift, and shutdown cooling is in service. Which of the following coefficients of reactivity will act FIRST to change core reactivity upon a loss of shutdown cooling?

A. Moderator temperature coefficient

B. Doppler coefficient

C. Void coefficient

D. Pressure coefficient

QUESTION: 81.

In regard to core parameters that affect control-rod worth, which one of the following statements is correct?

A. control rod worth decreases in areas of increased flux due to rod shadowing.

B. control rod worth increases with an increase in voids .

C. control rod worth increases witn an increase in fast neutron flux.

D. control rod worth decreases when approaching end of core life (EOL) .

QUESTION: 82.

The reverse power effect or reverse reactivity effect occasionally observed when a shallow control rod is withdrawn one or two notches is due to relatively:

A. large local power increase being offset by a moderator temperature-related power decrease.

B. small local power decrease due to the shadowing effect of nearby control rods.

C. small local power decrease due to increased local Doppler effects.

D. large local power increase being offset by a void-related power decrease.

QUESTION: 83.

What are the substances in the correct order, from LARGEST TO SMALLEST, of microscopic cross section (thermal neutrons) for capture?

A. U-235, H2O, Xe-135

B. U-235, Xe-135, H2O

C. Xe-135, U-235, H2O

D. Xe-135, H2O, U-235

QUESTION: 84.

A reactor has been shut down for 2 weeks after extended power operation. What control rod movement is required to maintain 10 percent stable power immediately after startup?

A. Small amounts of rod insertion to compensate for LPRM chamber depletion.

B. Small amounts of rod withdrawal to compensate for Samarium buildup.

C. Small amounts of rod insertion to compensate for installed poison burnout.

D. Small amounts of rod withdrawal to compensate for Xenon buildup.

QUESTION: 85.

Following a reactor trip from a long-term, steady-state, 100 percent power run, the reactor is to be taken critical. The calculated estimated critical conditions (position) are based on a **XENON-FREE** core. What is the shortest time after the initial trip that this condition would exist?

A. 8 to 10 hours

B. 24 hours

C. 40 to 50 hours

D. 70 to 80 hours

QUESTION: 86.

If equilibrium reactor power level is increased from 50 percent to 100 percent, equilibrium xenon concentration will increase to a level that is:

A. less than twice the 50 percent power concentration.

B. equal to twice the 50 percent power concentration.

C. more than twice the 50 percent power concentration.

D. unpredictable unless the exact duration of operation at the two power levels is known.

QUESTION: 87.

A reactor has been operating at 50 percent power for a week when power is quickly ramped (over four hours) to 100 percent power. How would the Xenon concentration in the core respond?

A. Decrease, then build up to a new equilibrium concentration in 40 to 50 hours

B. Increase to a new equilibrium concentration in 40 to 50 hours

C. Decrease, then quickly build up to a new equilibrium concentration in eight to 10 hours

D. Remain the same because Xenon concentration is independent of flux level

QUESTION: 88.

What is the difference in peak xenon concentration following a reactor scram after 1 week at 100 percent power as compared to a scram after 1 week at 50 percent power?

A. The time to reach the peak is shorter after 100 percent power than after 50 percent power, due to the higher iodine decay rate.

B. The peak from 50 percent is of a smaller magnitude due to the lower Xenon burnout rate.

C. The peaks are equal because the decay rate of iodine remains constant.

D. The peak from 100 percent power is of a larger magnitude, due to the larger initial Iodine concentration.

QUESTION: 89.

When comparing control rod worths during a reactor startup from 100 percent peak xenon and a reactor startup from xenon-free conditions:

A. center control rod worth will be higher during the peak xenon startup than during the xenon-free startup.

B. peripheral control rod worth will be higher during the peak xenon startup than during the xenon-free startup.

C. both control rod worths will be the same regardless of core xenon conditions.

D. it is impossible to determine how xenon will affect the worth of center and peripheral control rods.

QUESTION: 90.

A reactor has been operating at 100 percent power for about two weeks when power is reduced to 50 percent. What is going to happen to the Xenon-135 concentration in the core?

A. There will be no change because Iodine concentration is constant.

B. Initially Xenon will increase, then decrease to a new lower equilibrium value.

C. Initially Xenon will decrease, then increase to a new higher equilibrium value.

D. Xenon will decrease to a new equilibrium value.

QUESTION: 91.

If a reactor that has operated at 100 percent power for ten days is shut down rapidly, xenon concentration will:

A. slowly decay away to almost zero in three days.

B. increase to a new equilibrium in three days.

C. peak in about a half day, then decay to almost zero in three days.

D. ramp down with reactor power.

QUESTION: 92.

What is the definition of the term **BURNABLE POISON**?

A. Isotopes manufactured into the fuel with large-scatter macroscopic cross sections.

B. Thermal neutron absorbing material added to the fuel, during the manufacturing process.

C. Neutron-absorber materials produced in the fuel by fast neutron absorption.

D. Fast neutron absorbing material loaded into the upper third of the core to aid in slowing down neutrons.

QUESTION: 93.

During a reactor startup, as K_{eff} approaches unity, which of the following statements is correct for **EQUAL POSITIVE REACTIVITY ADDITIONS**?

A. The changes in neutron population are larger as K_{eff} approaches unity.

B. As the neutron population increases, the number of neutrons lost per generation decreases.

C. The number of fast neutrons gained per generation increases more slowly as Keff approaches unity.

D. A step increase in Keff increases the neutron population and therefore decreases the number of neutrons lost per generation.

QUESTION: 94.

During reactor startup, critical rod position is NOT affected by:

A. control-rod worth.

B source range initial count rate.

C. fuel temperature.

D. core age.

QUESTION: 95.

During a reactor startup, as Keff approaches 1.0, it takes longer to reach an equilibrium neutron count rate due to the increased effect of:

A. prompt neutrons.

B. delayed neutrons.

C. fast neutrons.

D. slow neutrons.

QUESTION: 96.

Assume a reactor is critical at a power level below the point of adding heat. For an equal positive reactivity insertion, the reactor period would be:

A. shorter if the core were xenon-free.

B. longer at EOL than at BOL.

C. shorter at EOL than at BOL.

D. longer at higher moderator temperature.

QUESTION: 97.

For which one of the following events will the Doppler coefficient act **FIRST** to counteract the reactivity addition to the core?

A. A control-rod drop during reactor power operation

B. The loss of one feedwater heater (extraction steam isolated) during reactor power operation

C. Tripping of the main turbine at 45 percent reactor power

D. A safety relief valve opening during reactor power operation

QUESTION: 98.

A reactor is operating at 100 percent power and flow. Reactor power is reduced by driving control rods in. (Recirculating pump speed remains constant.) What is the effect on core flow?

A. Core flow will increase, due to the decrease in two-phase flow resistance.

B. Core flow will remain constant, since reactor power does not affect core flow.

C. Core flow will decrease, due to an increase in two-phase flow resistance.

D. Core flow will increase, due to the increase in recirculation ratio.

QUESTION: 99.

What is the effect of isolating extraction steam to a high-pressure feedwater heater while at 90 percent of rated power?

A. The core inlet subcooling remains the same while the turbine generator MWe output decreases.

B. The core inlet subcooling and the reactor power (MWt) decrease.

C. The reactor power (MWt) and the turbine generator MWe output remain the same.

D. The core inlet subcooling increases and the turbine generator MWe output increases.

QUESTION: 100.
Shortly after a reactor trip, reactor power indicates 0.5% when a stable negarive startup rate (SUR) is attained. Reactor power will be reduced to 0.05% in approximately _____ seconds.

A. 360

B. 270

C. 180

D. 90