

BLOWDOWN EVAPORATOR OPERATION

1.0 PURPOSE

To outline the operational modes of the blowdown evaporator.

2.0 PRECAUTIONS & LIMITATIONS

- 2.1 The unit can be shut down rapidly in emergency by closing the steam supply pressure control valve PCV-SA1. Rapid cooldown is available by opening the overhead condenser pressure control valve PRCK-LW5.
- 2.2 Steam supply can be taken from either unit but not both. Safety injection trip valves SA-9 and SA-10 are interlocked to prevent opening both valves at the same time. Opening the closed valve closes the valve previously open.
- 2.3 Steam supply condensate returns should be to the unit supplying steam.
- 2.4 Normal distillate discharge is to the "A" waste distillate tank. The "B" waste distillate tank is maintained as clean and normally only receives water which has passed through the polishing demineralizers.
- 2.5 During waste processing operations, FCV-LW1 will be approximately 75% open with a clean feed filter. As the filter plugs, the flow control valve will open to maintain the desired flow. Change the feed filter when the valve position exceeds 90% open.
- 2.6 Steam pressure control valve PCV-SA1 should not be used for isolation except for emergency shutdown. Cooldown with the valve fully closed causes severe binding.
- 2.7 The unit performs best if started on recirculating, then shifted to outside feed after several hours of operation.
- 2.8 Monitor evaporator bottoms temperature continuously during shutdown to insure boron solubility.
- 2.9 Antifoam will be added to the evaporator at the discretion of the Duty Shift Superintendent when excessive* foam is evident in the drumming loop sample. Additions will usually be made in one liter increments and given at least 30 minutes for reaction.

* Excessive foam depth >2" one minute after drawing the sample.

3.0 PROCEDURE

3.1 Perform initial valve lineup per CL-9F and applicable sections of component cooling, service water and condensate valve checklists.

3.1.1 Water will not be admitted to the waste distillate tanks (BE-71 & 72 shut) until samples with high clarity, low conductance and minimal olfactory stimulation have been received from drain valves BE-106 & 106A. Verify that the conductivity is less than 50 μ mhos/cm by other than installed indication.

3.2 Ensure temperature recorder TR-LW20 is in operation.

3.3 Line up evaporator feed from either the waste holdup tank or blowdown surge tank.

3.4 Perform the following automatic valve lineup:

FRCK-LW1	Waste feed control	Manual/Shut
LIC-LW2	Not used	-----
LRC-LW3	Evaporator/reboiler level control	Manual/Shut
PRCK-LW5	Overhead condenser pressure control	Manual/50% Open
LIC-LW8	Waste distillate accumulator level control	Auto/60% Level Setpoint

NOTE: THE CONDUCTIVITY INDICATOR MUST BE ENERGIZED (SWITCH ON SIDE) FOR DISTILLATE LEVEL CONTROL VALVE OPERATION. OPERATION OF THE DISTILLATE REJECT VALVE LW-8A REQUIRES ADDITIONALLY THAT A HIGH CONDUCTIVITY SIGNAL BE PRESENT. IF THE CONDUCTIVITY IS HIGHER THAN THE METER INDICATION (PEGGED UPSCALE), LEAVE THE METER SELECTOR IN ZERO AND REDUCE THE HIGH CONDUCTIVITY SETPOINT (LEFT KNOB TO ZERO) FOR REJECT VALVE OPERATION.

FCV-LW15	Waste distillate discharge overboard	Manual/Shut
LIC-LW19	Blowdown surge tank level control	Manual/Shut
LIC-CA2	Condensate receiver vacuum drag	Auto
LIC-CA3	Condensate receiver pump discharge	Auto
TV-LW61	Service water supply	Open
TV-LW62	Service water return	Open
TV-LW63	Component cooling water supply	Open
TV-LW64	Component cooling water return	Open
1LCV-CA3	Auxiliary condensate pump discharge	} Same as steam supply
2LCV-CA3	Auxiliary condensate pump discharge	
1LCV-CA2	Condensate vacuum drag	
2LCV-CA2	Condensate vacuum drag	

3.5 Ensure the distillate accumulator level is greater than 20% and start distillate pump P132 for seal water.

3.6 Establish a level in the evaporator.

3.6.1 Use the filling sources as outlined in Step 3.12 to fill to approximately 25" as indicated on level recorder LRC-LW3.

3.7 Start the evaporator circulating pump P133.

3.8 Place the radwaste steam pressure reducing station in operation.

3.8.1 Ensure the steam pressure control valve PCV-SA1 is approximately 10% open. Slowly open RS-3 to the pressure reducing station. At approximately 50 psig, null the auto and manual signals for controller PCV-SA1 and shift the controller to automatic. Open RS-3 fully.

3.9 Commence a slow heatup of the evaporator.

NOTE: IF THE REBOILER SHELL SIDE IS COMPLETELY FLOODED WITH CONDENSATE, REDUCING THIS LEVEL SLOWLY AFTER ADMITTING STEAM IS ONE OF THE BEST MEANS OF CONTROLLING THE HEATUP RATE.

3.9.1 Open all evaporator and evaporator distillate section vents.

3.9.2 Slowly open the evaporator steam supply isolation valve RS-15 and/or RS-21. Observe the pressure control of PCV-SA1 and the evaporator pressure/temperature.

3.9.3 Control evaporator pressure via the heatup rate by limiting direct steam admission or the reboiler condensate level decrease. Until all the noncondensable gases have been removed by heating and venting, evaporator pressure can not be controlled by overhead condenser service water flows.

3.10 Line up to vacuum drag the condensate drains to the main condenser of the steam supplying unit and operate the auxiliary condensate pump P137 as necessary.

3.11 With the evaporator now heating up to normal operating temperature and pressure, perform the following steps as conditions dictate.

3.11.1 Set overhead condenser pressure controller PRCK-LW5 to 10 psig. As overhead condenser pressure reaches 9 psig, shift the controller to auto. After pressure has stabilized, increase the setpoint on PRCK-LW5 to 15 psig in small increments.

3.11.2 When evaporator level reaches 20" null the reboiler level controller LRC-LW3 and shift to auto at that setpoint.

3.12 Establish Feed

3.12.1 Waste Holdup Tank

- a. Line up the waste evaporator feed pump P20 through the discharge filter via BE-115.
- b. Start the waste evaporator feed pump and establish feed flow to the evaporator by manual operation of feed flow controller FCV-LW1.
- c. When evaporator level indicates approximately 20", adjust FCV-LW1 to the desired flow rate and set the controller automatic setpoint to that value and shift to auto.

3.12.2 Steam Generator Blowdown

- a. Shut both steam generator blowdown throttle valves and have the control room shut the blowdown tank outlet valve.
- b. Open the blowdown surge tank feed valve, BE-1 or BE-2.
- c. Open the blowdown surge tank booster pump discharge valves, BE-11 and BE-12, and start one blowdown surge tank booster pump.
- d. Throttle open the steam generator blowdown valves equally or as directed by control until the desired evaporator feed rate is attained by manual operation of LIC-LW19 while maintaining the blowdown surge tank at 50% level.
- e. After the desired feed rate has been established, shift the blowdown surge tank level controller LIC-LW19 to auto at a 50% level setpoint.

3.12.3 Waste Distillate Tank Recirculation

- a. Open the blowdown surge tank booster pump discharge valves, BE-11 and BE-12, and start one blowdown booster pump.
- b. Throttle open the "A" waste distillate tank drain, BE-114, until the desired evaporator feed rate is attained by manual operation of LIC-LW19 while maintaining the blowdown surge tank at 50% level.
- c. After the desired flow rate has been established, shift the blowdown surge tank level controller LIC-LW19 to auto at a 50% level setpoint.

- 3.13 Open BE-39 and establish reflux at approximately 30 gpm for waste processing or approximately 15 gpm on blowdown and recirculation.
- 3.14 Close the vent. Vent periodically and anytime the overhead condenser temperature decreases below the saturation temperature for the evaporator operation pressure. Place the evaporator drumming loop in operation.
 - 3.14.1 Verify operation of three heat tracing circuits by operation of the test switch on the drumming area heat tracing panel.
 - 3.14.2 Start the bottoms cooler circulating pump P136 and energize the bottoms cooler preheater at a setpoint of 160°F.
 - 3.14.3 When the component cooling temperature for the bottoms cooler has stabilized, start the bottoms pump P134.

Interlocks and setpoints associated with the drumming loop are as follows:

P134 bottoms pump start requires greater than 150°F on bottoms cooler component cooling outlet temperature switch TIS-LW44 and distillate pump P132 operating and suction pressure greater than 2 psig on DISL-LW37. Starting P134 from MCC-B45 bypasses the temperature requirement.

BE-HCV-LW18 drumming valve opening requires less than 170°F on bottoms cooler outlet temperature switch TIS-LW43.

- 3.15 During any evaporator operation, add a mixture of Calgon deposit inhibitor CL-14 and water such that the amount of full strength Calgon added is equal to one gallon of Calgon per day for every eight gallons per minute boiling rate. Boiling rate equals reflux flow plus output flow. The Calgon mixture addition pump flow rate can be varied but is normally set at 20%. Less than a 20% setting produces erratic delivery.

4.0 MINI-DRUM OPERATION

- 4.1 Evaporator bottoms concentration is near the total dissolved solids (TDS) limit.
 - 4.1.1 Set the feed flow control valve controller to manual at the steady state feed rate for the existing level.
 - 4.1.2 Bypass bottoms loop temperature control valve TCV-LW14 by positioning relief valve PSV-LW12 override lever to the open position.
 - 4.1.3 Pump the bottoms to the desired tank.

- 4.1.4 Restore evaporator level to normal and shift the controller to automatic.
 - 4.1.5 Restore the bottoms loop temperature control to normal by repositioning the relief valve override to normal.
 - 4.2 Waste solidification is desired due to scheduling.
 - 4.2.1 Secure evaporator feed and boil down to the desired concentration as determined by sampling or volume reduction.
- CAUTION: WATCH THE EVAPORATOR LEVEL INDICATION CLOSELY DURING THE BOIL DOWN. THE INDICATED LEVEL RESPONSE SHOULD BE LINEAR.
- 4.2.2 When the desired concentration has been reached, proceed as in Step 4.1.

5.0 EVAPORATOR SHUTDOWN

5.1 Normal Shutdown

- 5.1.1 Secure reflux valve BE-39.
- 5.1.2 Secure steam supply.
 - a. If letdown gas strippers are operating, shut the evaporator steam supply valve RS-15. During freezing weather, shut valve RS-21 versus RS-15 to ensure the piping in the facade does not freeze.
 - b. If letdown gas strippers are not operating, shut the steam pressure reducing station isolation valves RS-3 and open pressure reducing valve PCV-SA1 to approximately 10% in manual to prevent valve binding during cooldown.
- 5.1.3 Secure feed and isolate as per CL-9F.
- 5.1.4 Place distillate accumulator level controller LW-8 in manual and shut LW-8.
- 5.1.5 Place evaporator/reboiler level controller LRC-LW3 in manual and shut LW-3.
- 5.1.6 Stop and pull out P137 auxiliary condensate pump and close CA-2 and CA-3.
- 5.1.7 Close waste distillate tank fill valves BE-71 and BE-72.

5.2 Drumming Shutdown

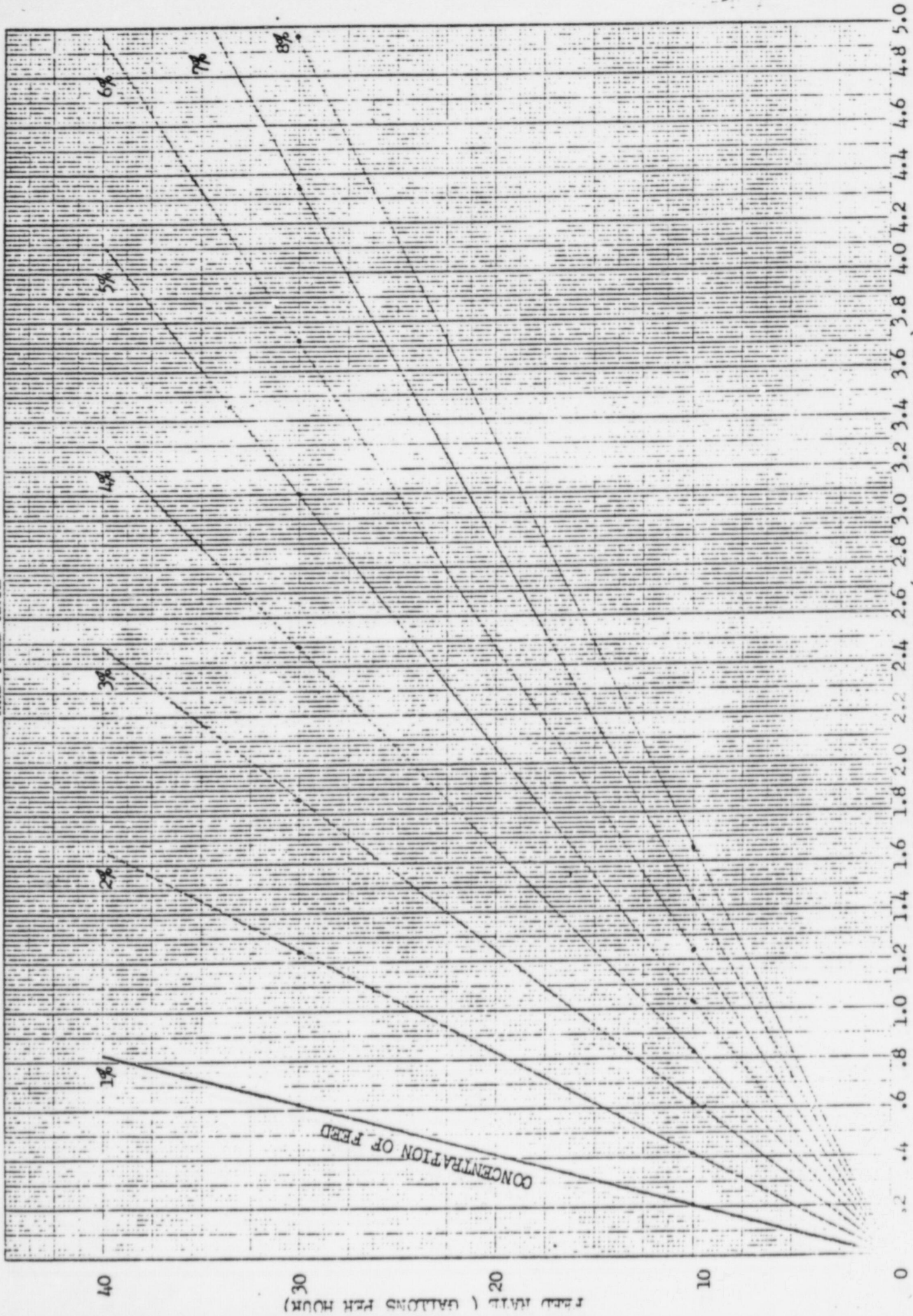
- 5.2.1 Bypass circulating pump P133 evaporator low level trip.
- 5.2.2 Secure feeding the evaporator and boil down to the desired level or concentration.
- 5.2.3 Secure steam to prevent further bottoms concentration.
- 5.2.4 Drum out the evaporator bottoms per OP-9B.

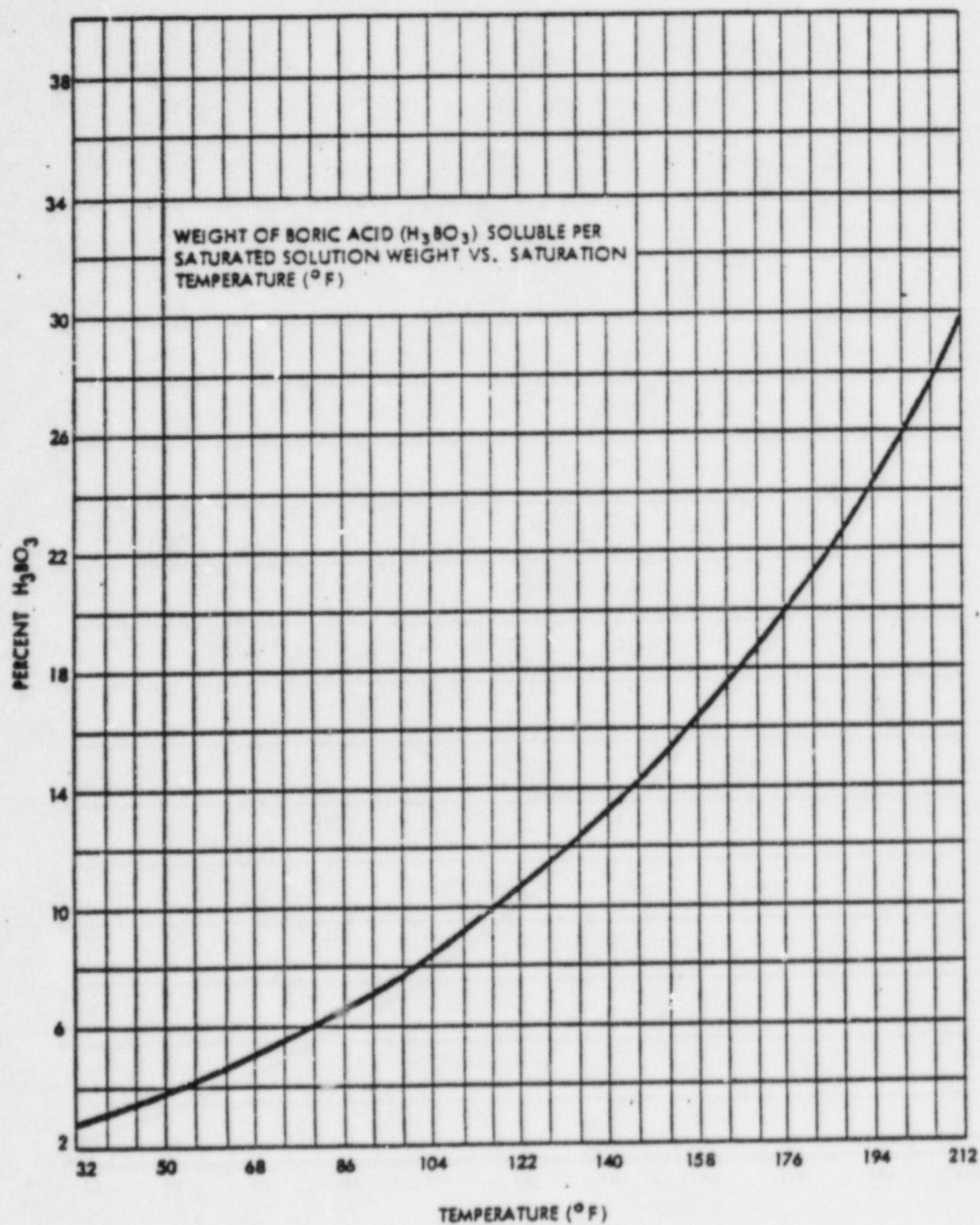
6.0 CONDUCTIVITY CELL REMOVAL/REPLACEMENT

- 6.1 Remove the packing nut locking pin. Some rotation of the packing nut or insertion of the cell shaft may be required to free the pin.
- 6.2 Hold the cell against pressure ejection and loosen the packing nut slightly.
- 6.3 Allow the pressure to force the cell outward until the clearance line comes into view and the mechanical stop is reached.
- 6.4 Close the isolation valve.
- 6.5 Remove the packing nut and withdraw the cell.
- 6.6 The cell can now be removed from the shaft by disconnecting at the two-prong plug.
- 6.7 Apply a reverse order for replacement.

**BORIC ACID ADDITION RATE (TO BOTTOMS)
BASED ON FEED CONCENTRATION
AND FEED RATE**

FIGURE 3





BORIC ACID SOLUBILITY

FIGURE 1