NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Failure of Boric Acid Heat Trace Circuit Results in Plant Shutdown

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 3	1 9	9 2	9 2	— 0 0 4	— 0 1	1 0	1 6	9 2		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	N
POWER LEVEL (10)	1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
	20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Richard Bystrak, Supv. Eng.	AREA CODE 9 1 4 7 3 6 8 1 2 5

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
AF	F E										

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 19, 1992 at 1355 with the plant operating at 100 percent power, an NRC resident inspector identified boric acid system piping low temperature. Heat trace circuits are designed to maintain boric acid solution in the pipes greater than 145 degrees F. Technical Specifications require heat tracing be operable for a flowpath from the boric acid system. At 1725 the primary and redundant circuits for heat trace circuit 63 were declared inoperable. At the time it was thought that circuit 63 was common to all three boration paths. A plant shutdown was initiated at 1730 hours. Further evaluations determined that circuit 42A, not 63, serviced the emergency boration path. Because of concern about circuit 42A's reliability the shutdown continued. The plant was in the hot shutdown condition at 0420 hours on March 20, 1992. The cause of the failure was an electrical short and inadequate monitoring frequency. The failed heat trace circuit was replaced. Controls for increased monitoring frequency have been established. The plant was returned to 100 percent power on March 26, 1992.

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TEXT *(If more space is required, use additional NRC Form 366A's)* (17)

DESCRIPTION OF THE EVENT

Technical Specification 3.2.B.6 requires heat tracing be operable for one flowpath from the boric acid storage system to the reactor coolant system. Specification 3.2.B.3 requires the boric acid solution to be at least 145 degrees F. Circuit 63 provides heat tracing for the blended makeup and the blended bypass flowpaths of the chemical and volume control system (CVCS). Circuit 42A provides for part of the emergency boration flowpath (Reference Attachments I & II). Heat trace circuit 42B, although not part of the emergency boration flowpath, functions to mitigate the heat sink created at the system intertie between this system and the charging pump suction. The circuits compensate for temperature reduction from ambient and makeup flow to the reactor coolant system.

On March 19, 1992 at 1352 hours, with the plant operating at 100 percent power, an NRC resident inspector identified boric acid system piping low temperature conditions.

The inspector notified a non-licensed operator of this condition. Circuits 63 and 42A had indications of low temperatures. The non-licensed operator attempted to restore the temperature of the line served by circuit 63. The alarm for circuit 42A was indicating low but had a problem identification tag on the alarm indicator. At 1445 hours the non-licensed operator notified the shift supervisor (a senior reactor operator) that his efforts to restore the temperature of primary circuity (63) were not successful. Personnel were dispatched to place the redundant circuit for circuit 63 into service. The redundant circuit provided temperature recovery for a period of time and then failed. Circuit 63 was declared inoperable at 1725 hours.

Technical Specification 3.2.D requires the reactor to be brought to the hot shutdown condition utilizing normal operating procedures if heat trace on the boration path is not available. The plant shutdown was initiated on the assumption that circuit 63 affected all three boration paths. Investigations during the shutdown identified the circuit services two of the three paths. The third path is serviced by circuit 42A. Both the primary and redundant circuits for circuit 42A were determined to be functional.

With a preexisting problem identified on circuit number 42's alarm module, assurance of the proper heat trace on the emergency boration path was evaluated using a hand held pyrometer. The reading in the vicinity of the connection of this line to the charging pump suction was approximately 141 degrees F. It was determined that heat trace circuit 42B, although not part of the emergency boration flowpath, had failed.

The plant shutdown was initiated at 1730 hours. At 1822 hours a 10CFR50.72.b.i.A notification was made to the NRC. All plant systems and components operated as expected during the shutdown. The plant was in the hot shutdown condition at 0420 hours on March 20, 1992.

INVESTIGATION OF THE EVENT

System Description

The boric acid system is a subsystem of the chemical volume and control system (CVCS). It consists of a batching tank, two storage tanks, two transfer pumps, a blender with associated piping and heat tracing. The design of the system is such that the reactor can be shut down in sixteen minutes with one boric acid transfer pump and one charging pump. The system contains three flowpaths for delivering boric acid solution to the charging pumps, blended-makeup, blender bypass, and emergency boration.

The control settings for boric acid heat trace are 163-167 degrees F. Local panel alarm setpoints are 155-175 degrees F. A control room category alarm exists for high and low temperatures and is common to all boric acid heat trace circuits. An independent local temperature recorder provides trending indication from thermocouples attached to the piping. It is located in the vicinity of the alarm panel. The recorder was an addition to the system and not part of the original design.

Each circuit is equipped with dual heat trace, a primary cable and a secondary heating cable used in the event of primary cable failure. Each circuit contains a thermostatic device to maintain temperature between 163-167 degrees F by energizing and de-

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

energizing the heat trace cable. The "redundant" heat trace cable is placed in service by disconnecting the "primary" cable and reconnecting the "redundant" cable at the failed circuit control panel.

Investigation

On March 19, 1992 at 0030 hours the daily logs for all technical specification boric acid heat trace circuits were taken by the non-licensed nuclear plant operator. The status panel indicated that circuits 63 and 42A were in alarm condition. Both circuits were checked to be energized to ensure that heat was being supplied to the piping. The non-licensed operator informed the control room of the condition of the alarming circuits so the reason for the category alarm in the control room was understood by the licensed operators.

On March 19, 1992 at 1352 hours, the resident NRC inspector identified a low temperature condition of 90 degrees F on the temperature chart recorder for circuit 63. The inspector determined that the heat trace energized light was not lit for circuit 63. A non-licensed operator was informed by the inspector. Efforts to energize the primary circuit for 63 were unsuccessful and the shift supervisor was notified. The plant technical services and maintenance staff responded to restore circuit 63 to operation by placing the redundant circuit in service. The redundant circuit was functioning and elevated the temperature for a period of time then shorted out and its breaker opened. At 1725 hours circuit 63 was declared inoperable. The decision to shut down was based on the unavailability of circuit 63. At the time, the shift supervisor believed circuit 63 affected all three boration paths. Therefore, the shift supervisor ordered a plant shutdown using normal operating procedures.

Review of the temperature recorder charts identified that circuit 63 failed at approximately 0245 hours and exponentially decayed to 90 degrees F over the next several hours. The untimely recognition of the failure is attributed to log intervals too infrequent (24 hours) to provide adequate monitoring of the boric acid heat trace circuits.

In the course of the shutdown the staff determined that circuit 63 was not common to all three boron injection paths. It provided protection for the blender and the blender bypass paths, however, the emergency boration path is protected by circuit 42A.

The emergency boration line is connected to the common suction for all three charging pumps. For a section of the pipe in the vicinity of this system intertie there was a temperature gradient produced in the emergency boration line.

The temperature of the line at this location associated with circuit 42A was investigated. A hand-held pyrometer reading indicated that temperature was approximately 141 degrees F near the controller sensor. Circuit 42B was determined to have failed and was not maintaining the temperature at the intertie. Circuit 42 was declared inoperable at 2020 hours on March 20, 1992.

CAUSE OF THE EVENT

Equipment Failure - the failure of circuit 63 was due to an electrical short.

- the failure of circuit 42B was due to a short in the circuit.

Work Practices - logs were taken too infrequent to provide adequate monitoring of the boric acid heat trace circuits.

CORRECTIVE ACTIONS

* All technical specification required boric acid heat trace circuits were repaired or replaced and verified operable.

* The heat trace log sheet was revised to change the requirements from every 24 hours to every four hours and require temperatures to be recorded. Additionally, when an alarm is up, monitoring is required every 30 minutes.

* Control Room technical specification category alarms are now prioritized in the work control system to require that they be worked continuously until repaired. Frequent monitoring will be required until the alarming situation is corrected.

* A heat trace system engineer had been appointed on March 17, 1992 to investigate and resolve system recurring problems.

* Heat trace circuit 42B was replaced.

ANALYSIS OF THE EVENT

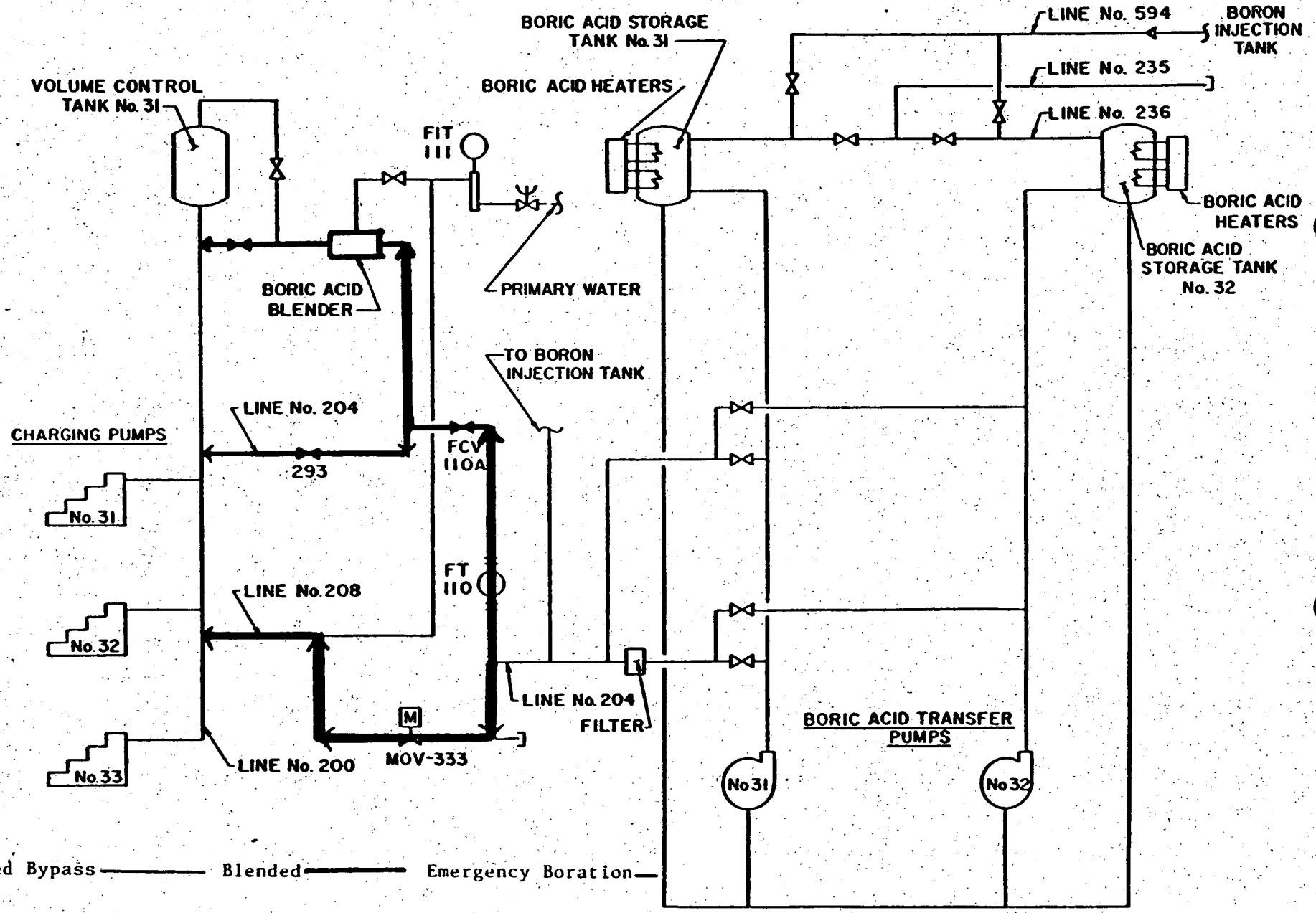
This event is reportable under 10CFR50.73.i.b.A, operation outside plant technical specification. Technical Specification 3.2.B.6 states, "Two channels of heat tracing shall be operable for the flow path from the boric acid storage system to the Reactor Coolant System" when the reactor is above cold shutdown conditions. Technical Specification 3.2.D.1 requires a plant shutdown if condition 3.2.B.6 above cannot be met.

Although circuit 42A heat trace was indicating low on the temperature chart recorder, a hand held pyrometer reading indicated that temperature was approximately 141 degrees F near the controller sensor.

Other boron injection paths were available to the core besides those used by the boric acid injection system. The refueling water storage tank, a source of borated water, can be lined up to either the suction of the charging pumps or to the suction of the safety injection pumps in an emergency. No consequences for the health and safety of the public resulted from this event. One similar LER was written in 1980, LER 80-002, regarding failure of a boric acid heat trace.

SECURING FROM THE EVENT

All Technical Specification-required boric acid heat trace circuits were tested and declared operable on March 24. The reactor was brought critical on March 25 at 0425 hours and reached 100% power on March 26 at 1400 hours.


BORIC ACID STORAGE TANK No. 31
LINE No. 594
BORON INJECTION TANK
LINE No. 235
LINE No. 236
VOLUME CONTROL TANK No. 31
BORIC ACID HEATERS
FIT 111
BORIC ACID HEATERS
BORIC ACID STORAGE TANK No. 32
PRIMARY WATER
BORIC ACID BLENDER
TO BORON INJECTION TANK
LINE No. 204
CHARGING PUMPS
293
FCV 110A
No. 31
FT 110
LINE No. 208
No. 32
LINE No. 204
FILTER
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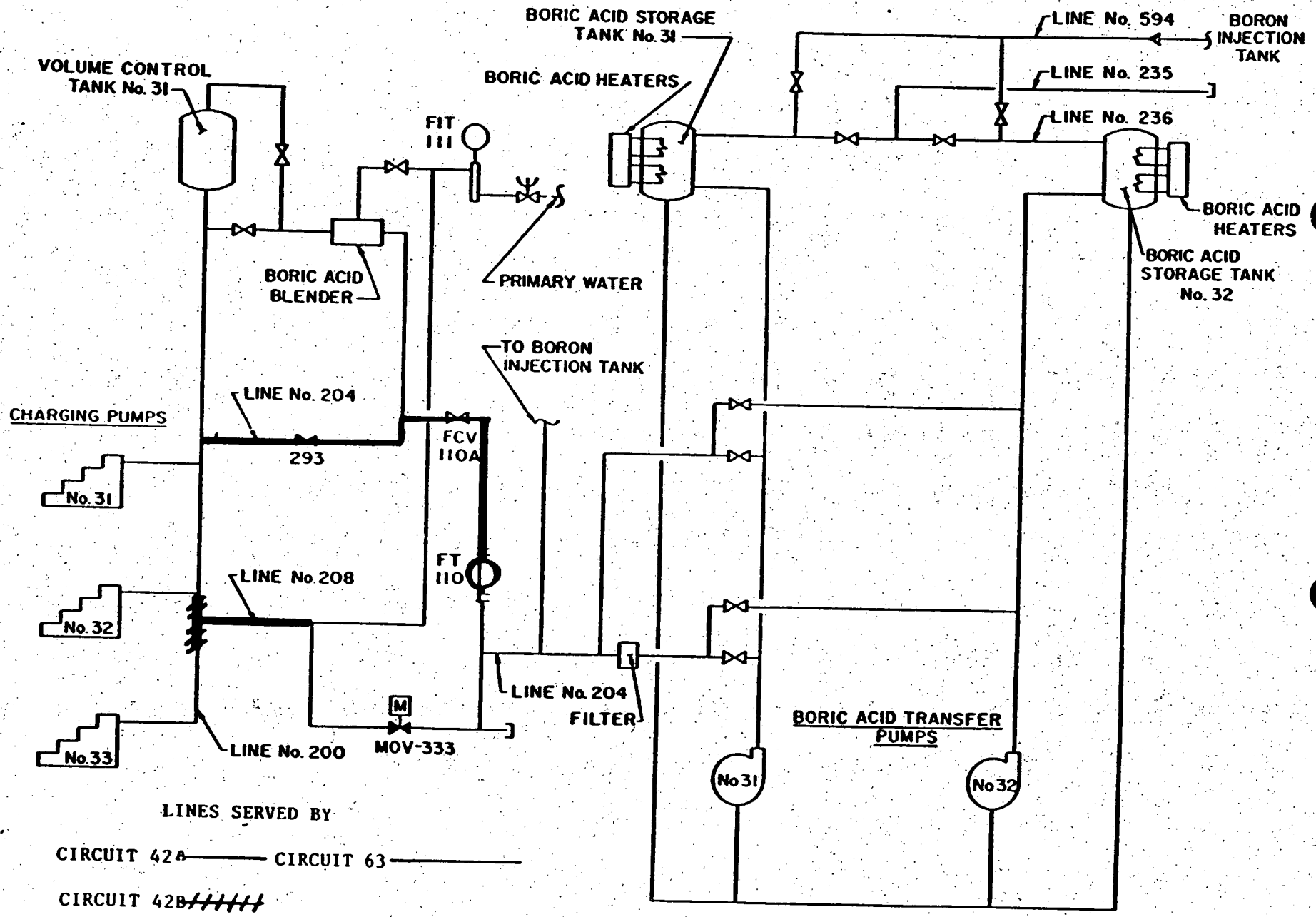
No. 33
LINE No. 200
MOV-333
No 31
No 32
Blended Bypass
Blended
Emergency Boration



ATTACHMENT II - IP3 BORIC ACID SYSTEM