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9.3 PROCESS AUXILIARIES

9.3.1 COMPRESSED AIR SYSTEM

9.3.1.1 Design Bases

9.3.1.1.1 Safety Design Basis

The VEGP is designed such that no plant equipment relies upon the compressed air system to perform its safety function; thus there is no safety design basis for the system. The service air system contains connections for allowing dilution of the post-loss-of-coolant accident containment environment. See subsection 6.2.5 for further discussion of this function.

9.3.1.1.2 Power Generation Design Basis

The compressed air system is designed to provide normally filtered and dried compressed air for service outlets located throughout the plant and a continuous supply of filtered, dried, and essentially oil-free air for pneumatic instruments.

A total of seven compressors are powered from a combination of seven switchgear, with four switchgear associated with Unit 1 and three switchgear associated with Unit 2.

An independent breathing air system provides clean, oil-free, low pressure air to various locations in the containment building for breathing protection against airborne contamination while performing certain maintenance and cleaning operations.

9.3.1.2 System Description

9.3.1.2.1 General Description

Codes and standards applicable to the compressed air system are listed in table 3.2.2-1. The compressed air system for Units 1 and 2 includes a total of seven air compressors, four rotary compressors and three reciprocating compressors. Each rotary compressor train consists of an air intake filter, the compressor, an air/coolant receiver separator, an aftercooler, a moisture separator, a contaminant filter, and an air receiver. Each reciprocating compressor train consists of an air intake filter, the compressor, an aftercooler, a moisture separator, and an air receiver.

There are two rotary compressor trains and one reciprocating compressor train located in each plant unit. The outlets from the air receivers of these three trains are connected to a common line which is the compressed air supply line for that unit. The Unit 1 air compressors operate independently of the Unit 2 air compressors. The third reciprocating compressor train, which is located in Unit 1, is piped so that it can be aligned to either the Unit 1 or Unit 2 compressed air supply line.

The compressed air supply line in each unit branches to supply both the service air system and the instrument air system for that unit. The service air system consists of a prefilter, a dryer, and an afterfilter, from which the air flows to the various service air loops. A bypass line around the dryer and filters allows for maintenance and also provides overflow protection during periods of high plant maintenance activity, such as refueling. The instrument air system consists of two dryers in parallel, each having a prefilter and afterfilter. The air from the system flows to the various instrument air loops in the plant unit.

The instrument air line to the containment is normally open; however, airflow to the containment shall be monitored with an excess flow element with associated alarm in the event of branch rupture inside containment.

The compressed air system is shown schematically in figure 9.3.1-1. Major system components are described in table 9.3.1-1. Safety-related air-operated valves that are supplied by the system are identified in table 9.3.1-2. As shown in the table, none of these devices require a source of air in order to perform their safety-related function.

The air breathing system is shown in figure 9.3.1-1. Breathing air is supplied by portable rotary, dry-type compressors. A backup air supply is provided by portable air bottles which will be located at the user stations when the system is in use.

9.3.1.2.2 Component Description

The rotary compressors are rated at 750 sf^3/min with a discharge pressure of 117 psig. The reciprocating compressors are rated at 885 sf^3/min with a discharge pressure of 125 psig. All of the compressors are driven by 200-hp motors.

The service air dryer is procured with a rated capacity of 1200 sf^3/min at -60°F dewpoint at 120 psig. The test acceptance criteria shall be -15°F dewpoint at line pressure, per Regulatory Guide 1.68.3 recommendations.

Each of the two instrument air dryers are procured with a rated capacity of 740 sf^3/min at 120 psig and -60°F dewpoint.

The test acceptance criteria shall be -15°F dewpoint at line pressure, per Regulatory Guide 1.68.3 recommendations.

The breathing air system is sized on the basis of 20-man usage at 15 sf^3/min each, a total of 300 sf^3/min. This system is normally supplied at a minimum of 80 psig at the user station. A portable bottle backup supply is activated on low pressure or on high carbon monoxide levels.

9.3.1.2.3 System Operation

The compressors are operated by a locally mounted master controller which can be programmed for various sequences of operation. Normally one rotary compressor will be run continuously, with the reciprocating compressor starting and stopping as required by the fluctuations in demand for compressed air. The second rotary compressor serves as a backup and will start automatically if either the first rotary or the reciprocating unit fails or if demand exceeds the capacity of the operating compressors. Starting and stopping of the compressors are annunciated in the control room.

The air from the compressors flows through aftercoolers and moisture separators to the receivers and into the supply line as required by usage in either the service air or instrument air subsystem. Air flows through the service air dryer to the various service air outlets throughout the plant. The instrument air subsystem, which supplies air to the pneumatic spring-loaded valves and pneumatically operated instruments, also takes its supply from this common supply line through the instrument air dryers and filters, which process the air to the required cleanliness and dewpoint. Instrument air then passes through a separate instrument air header for distribution to the instrument air piping system. Instrument air pressure is then reduced by pressure regulators as required, and its quality can be maintained by branch line filters, if required.

A pressure switch installed in the service air supply line provides the actuation signal for an isolation valve in the service air supply line and stops service air supply whenever service air pressure falls below approximately 80 psig. Manual control of the isolation valve is also possible. This arrangement provides for the conservation of compressed air in the event of excessive service air demand.

When the breathing air pressure drops below the minimum supply pressure, the portable bottle supply is automatically opened and a local alarm is activated to enable the respirator wearer to escape the containment. The portable supply is also activated on high carbon monoxide levels.

9.3.1.3 Safety Evaluation

The compressed air system is required for normal operation and startup of the plant; however, pneumatically operated valves in the plant which are essential for safe shutdown and accident mitigation are designed to assume a fail-safe position upon loss of air pressure. Therefore, a supply of compressed air is not essential following a design basis event or for safe shutdown of the plant. The compressed air system is not designed to meet Seismic Category 1 requirements or the single failure criterion, except for the containment penetration piping and isolation valves.

The compressed air system is classified as a moderate-energy system since system operating pressure is less than 275 psig. There are no adverse environmental effects associated with a crack in the system piping. Therefore, a crack in the compressed air piping will not compromise the integrity of any safety-related component.

The breathing air system is not essential following a design basis accident or for safe shutdown of the plant.

9.3.1.4 Tests and Inspections

The compressors, aftercoolers, receivers, prefilters, desiccant chambers, afterfilters, and the control panel are inspected, or tested, prior to installation. The complete, installed compressed air system is inspected, tested, and then operated to verify its performance requirements, including operational sequences and alarm functions. The preoperational testing is described in chapter 14.

Air compressors and associated components on standby are checked and operated periodically. Air filters are inspected for cleanliness, and the desiccant is changed when it no longer performs according to the manufacturer's specifications.

During the initial plant testing prior to reactor startup, all engineered safety features systems utilizing compressed air will be tested to ensure fail-safe operation upon loss of compressed air or reduction of air pressure as described in Instrument Society of America (ISA)-S7.3. Section 1.9 summarizes conformance with Regulatory Guide 1.68.3.

The breathing air system is inspected, tested, and then operated to verify its performance requirements.

9.3.1.5 Instrumentation Applications

An instrumentation package accompanies each of the air compressors. Each package consists of locally mounted temperature and pressure switches, indicators, and automatic protection devices. The temperature and pressure switches support the automatic control modes of compressor operation. A manual mode of operation is also provided for each control system. Remote control and indication are provided in the control room. The compressed air system also includes additional local instrumentation and controls necessary to ensure the ability of the system to perform its design functions.

The breathing air system includes pressure and carbon monoxide instrumentation to ensure the ability of the system to perform its design functions.

TABLE 9.3.1-1 (SHEET 1 OF 2)

COMPONENT DESCRIPTION COMPRESSED AIR SYSTEM

Air Compressors	
Type	Reciprocating
Capacity, each (sf^3/min)	885
Motor (hp)	200
Operating pressure (psig)	125
Design pressure (psig)	132
Type	Rotary
Capacity, each (sf^3/min)	750
Motor (hp)	200
Operating pressure (psig)	117
Design pressure (psig)	125
Air Receivers	
Capacity, each (ft^3)	150
Operating pressure (psig)	117
Design pressure (psig)	150
Stored energy, each (ft-lb)	7
Design code	ASME Section VIII
Prefilters and Afterfilters	
Type	Coalescing (prefilter) Particulate (after-filter)
Operating pressure (psig)	120
Design pressure (psig)	150
Design code	ASME Section VIII
Aftercooler Moisture Separators	
Type	Mechanical
Operating pressure (psig)	125
Design pressure (psig)	132
Design code	ASME Section VIII

TABLE 9.3.1-1 (SHEET 2 OF 2)

Service Air Dryers

Type	Regenerative
Capacity, each (sf^3/min)	1200
Operating pressure (psig)	120
Design pressure (psig)	150
Dewpoint design code	ASME Section VIII

Instrument Air Dryer

Type	Regenerative
Capacity, each (sf^3/min)	740
Operating pressure (psig)	120
Design pressure (psig)	150
Design code	ASME Section VIII

TABLE 9.3.1-2 (SHEET 1 OF 3)

SAFETY-RELATED PNEUMATICALLY OPERATED VALVES

System	Quantity	Location	Design Function	Safe Position	Failure Mode on Loss of Air Supply	Comments
Containment fluid penetration isolation (table 6.2.4-1)	39	Various	Terminate process flow and/or isolate containment	Closed	Closed	
Safety injection system (SIS) (Note 1)	1 HV8882	SIS injection line from boron injection tank	Isolates SIS injection from SIS test header	Closed	Closed	
	8 HV8877A HV8877B HV8877C HV8877D HV8879A HV8879B HV8879C HV8879D	Accumulator test line	Isolates accumulators from SIS test header	Closed	Closed	
	4 HV8878A HV8878B HV8878C HV8878D	Accumulator fill line	Isolates accumulators from fill line	Closed	Closed	
	4 HV8889A HV8889B HV8889C HV8889D	SIS test lines	Isolates SIS lines from SIS test header	Closed	Closed	
Main feedwater system	8 FV510 FV520 FV530 FV540 LV5242 LV5243 LV5244 LV5245	Feedwater line to steam generators	Feedwater line and steam generator isolation	Closed	Closed	

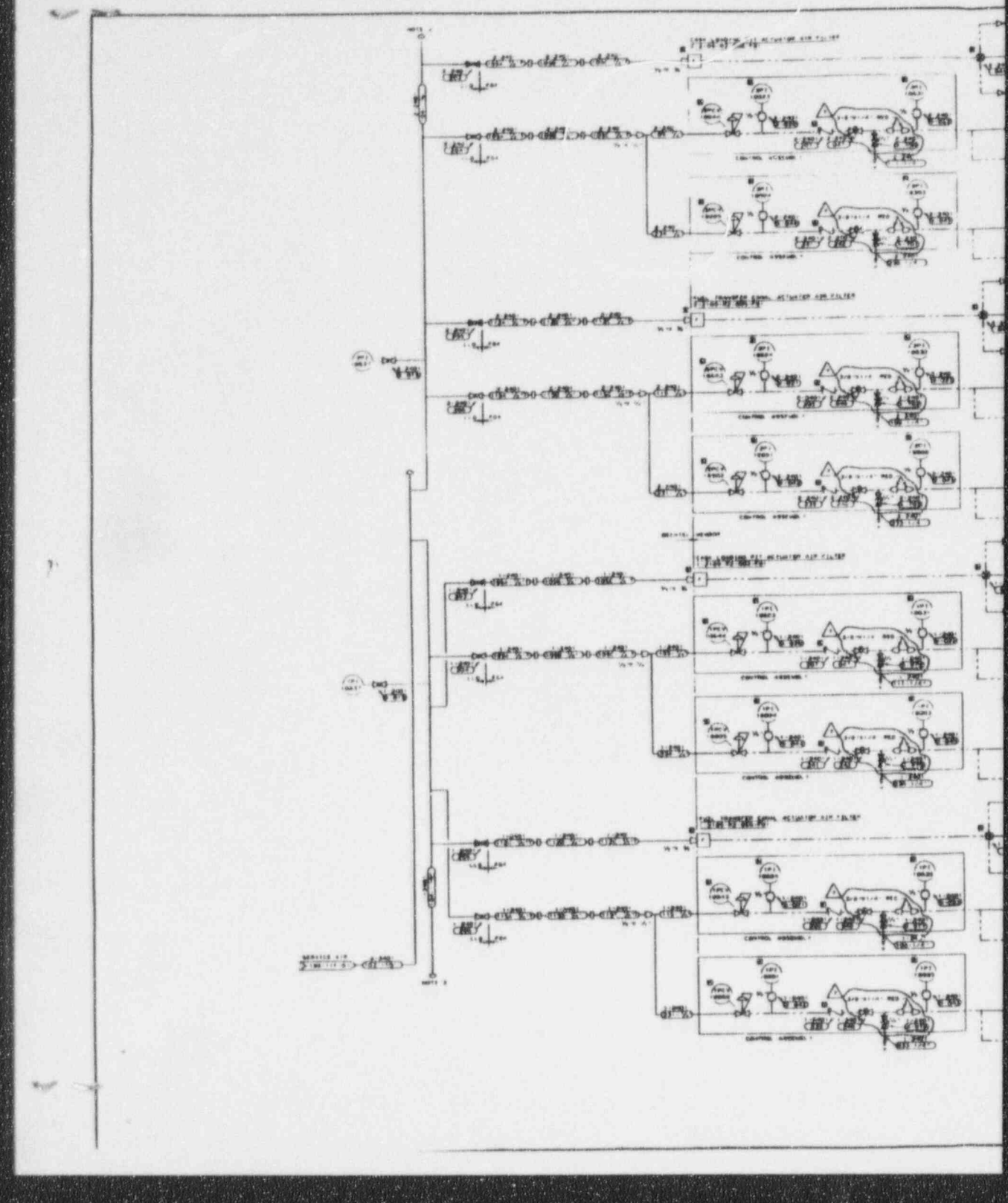
TABLE 9.3.1-2 (SHEET 2 OF 3)

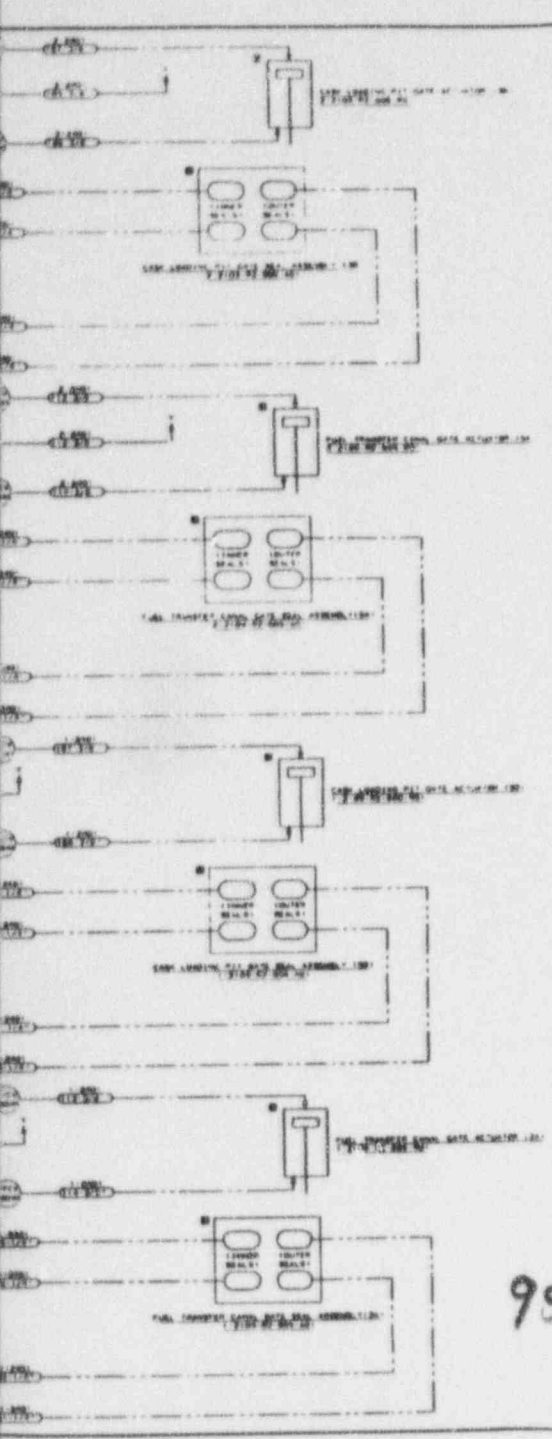
System	Quantity	Location	Design Function	Safe Position	Failure Mode on Loss of Air Supply	Comments
Nuclear service cooling water system	2 CV9446 CV9447	Nuclear service cooling water blowdown line	Secures blowdown on receipt of safety injection signal	Closed	Closed	
Residual heat removal (RHR) system	2 HV606 HV607	RHR heat exchanger outlet	Controls reactor coolant flow through RHR heat exchanger	Open	Open	
	2 FV618 FV619	RHR heat exchanger bypass	Ensures all RHR flow through RHR heat exchanger	Closed	Closed	
Chemical and volume control system (CVCS)	1 HV8145	Pressurizer aux spray line	Provide pressurizer spray when RCPs tripped	Closed	Closed	
	1 HV15214	Letdown line in containment upstream of the penetration isolation valve	Stop letdown in event of line rupture in aux building	Closed	Closed	
Safety injection (SI) system	2 HV10957 HV10958	RWST sludge mixing system inlet	Isolate sludge mixing system on RWST low level alarm	Closed	Closed	
Steam generator blowdown process (SGBP) system	8 HV15212A HV15212B HV15212C HV15212D HV15216A HV15216B HV15216C HV15216D	Blowdown lines upstream of the containment penetration	Stop blowdown in event of line rupture in aux building	Closed	Closed	

TABLE 9.3.1-2 (SHEET 3 OF 3)

System	Quantity	Location	Design Function	Safe Position	Failure Mode on Loss of Air Supply	Comments
Electric steam boiler system	2 AHV19722 AHV19723	Steam header out of boiler	Stop steam flow in event of line rupture in aux building	Closed	Closed	
Boron recycle system	2 HV12596 HV12597	Recycle holdup tank ventilation inlet	Serve as negative pressure boundary for piping penetration ventilation for containment isolation	Closed	Closed	

Note: Valves serve as pressure boundary devices.





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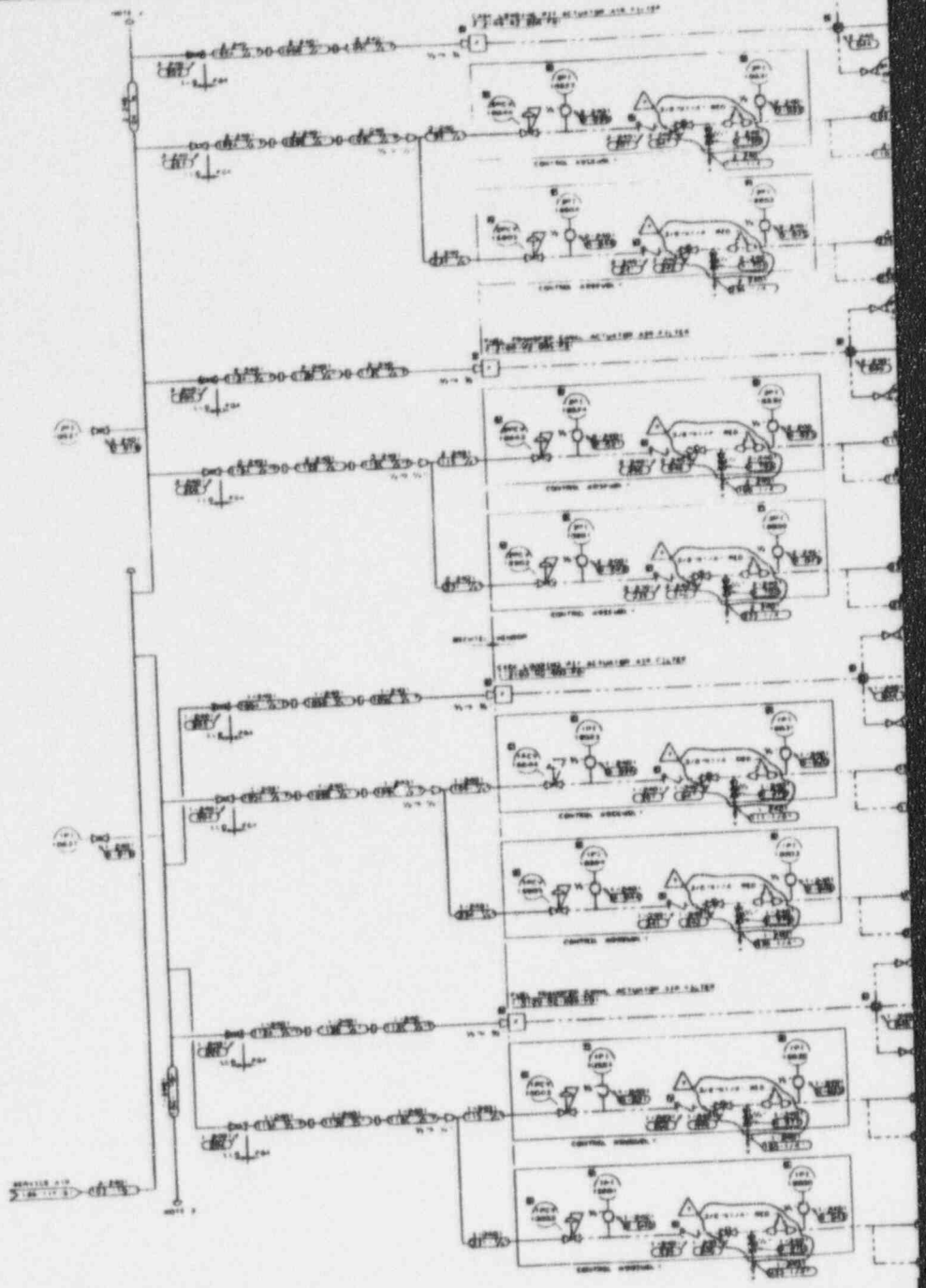
INSTRUMENT AND
SERVICE AIR SYSTEM

FIGURE 9.3.1-1 (SHEET 8 OF 9)



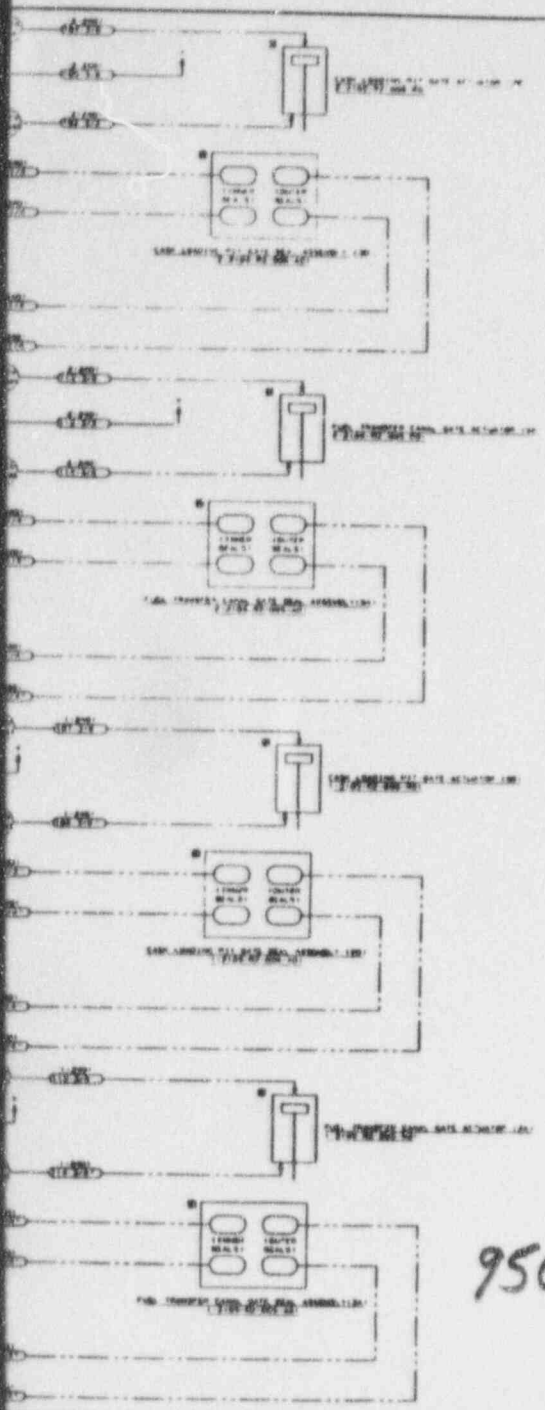


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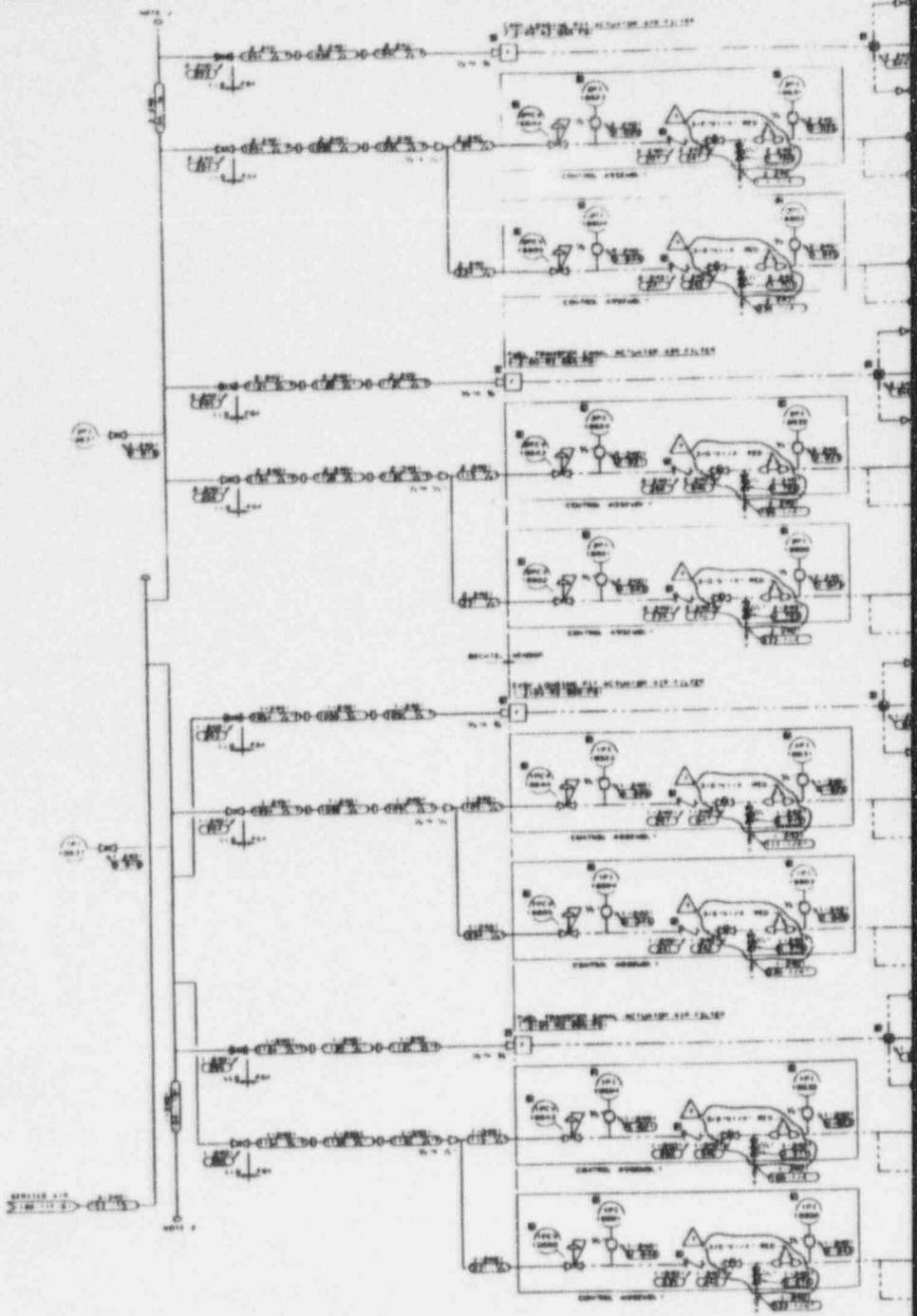
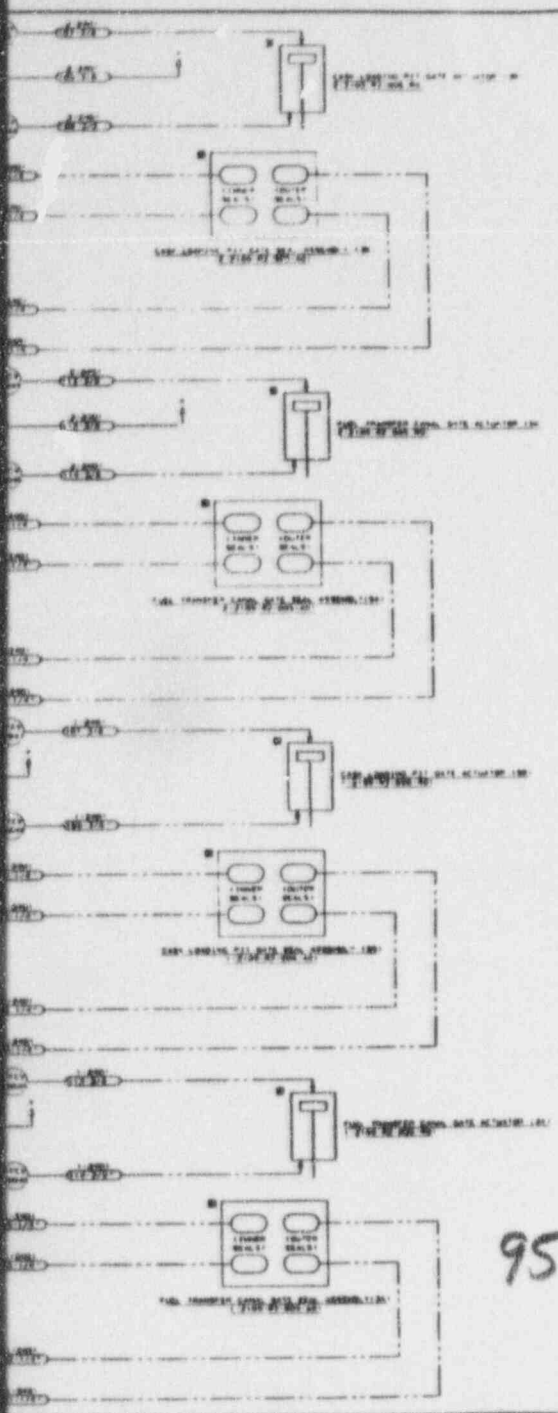
FIGURE 9.3.1-1 (SHEET 8 OF 9)





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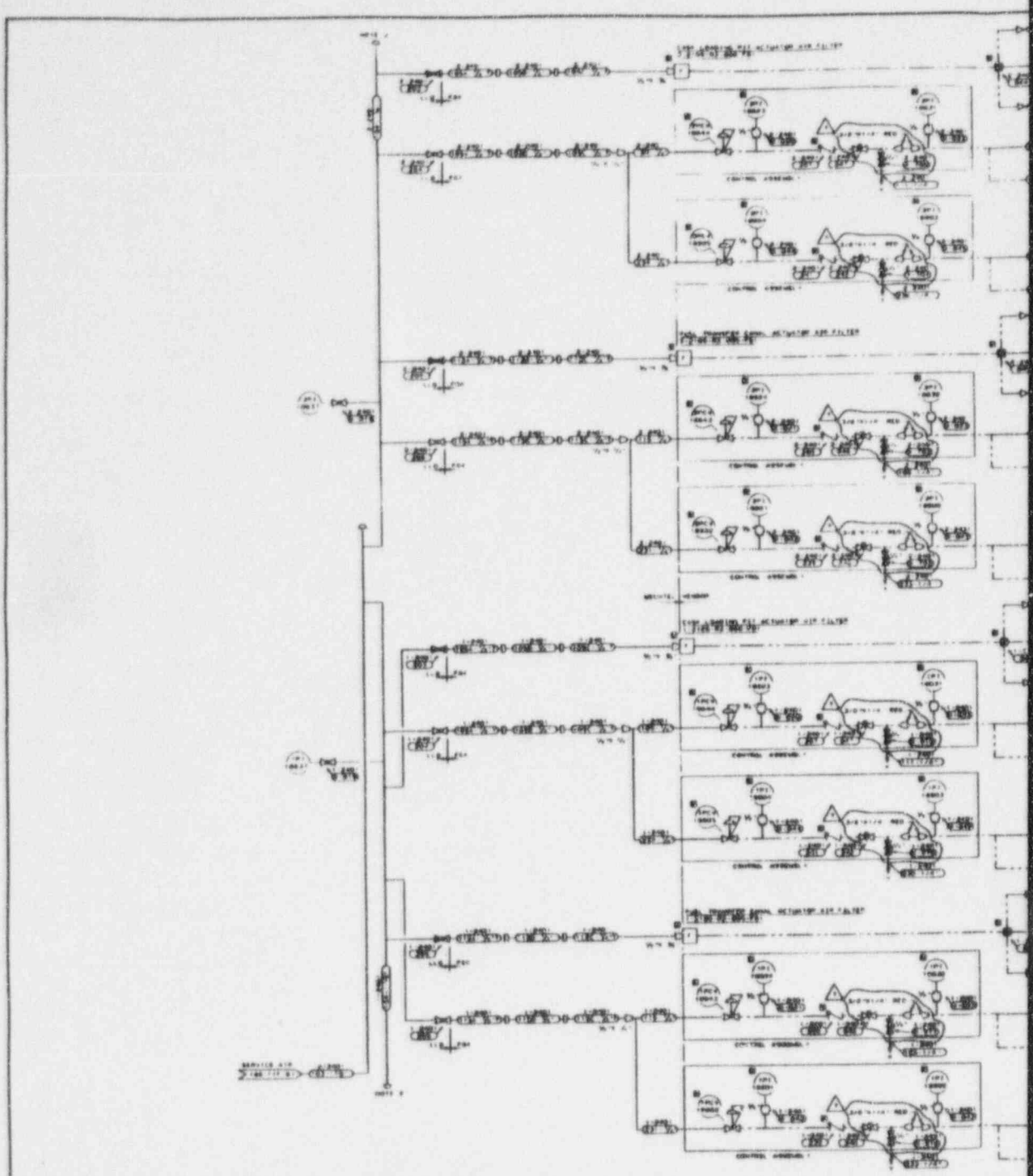
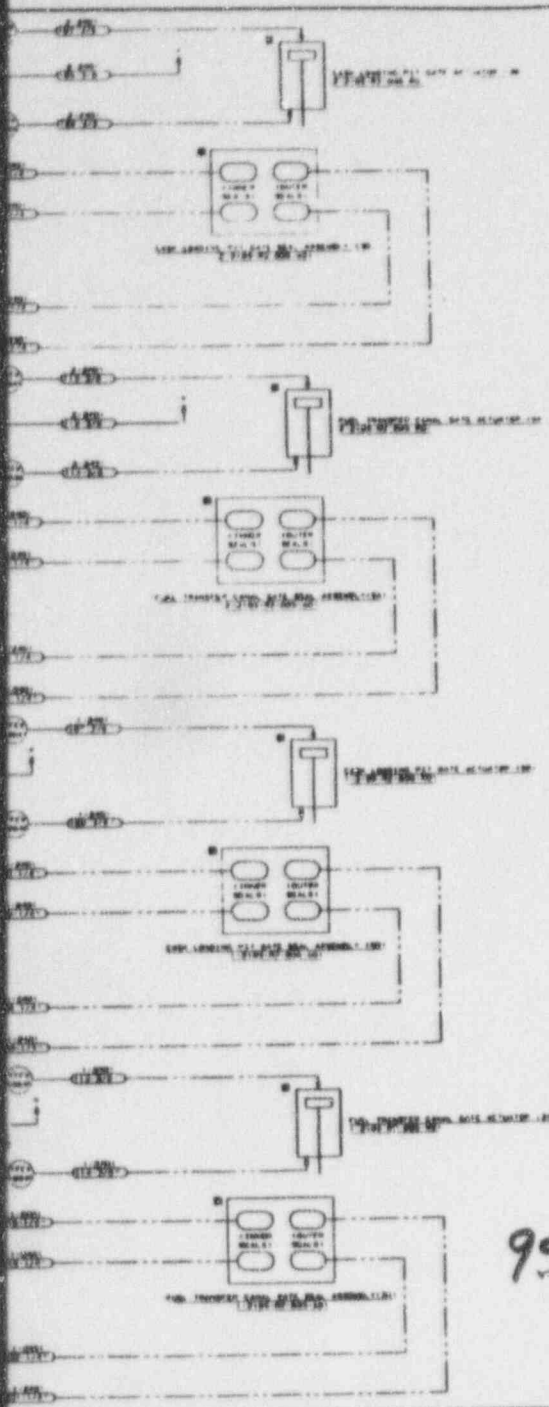
Georgia Power VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	INSTRUMENT AND SERVICE AIR SYSTEM
	FIGURE 9.3.1-1 (SHEET 8 OF 9)





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UNIT 1 AND UNIT 2

INSTRUMENT AND
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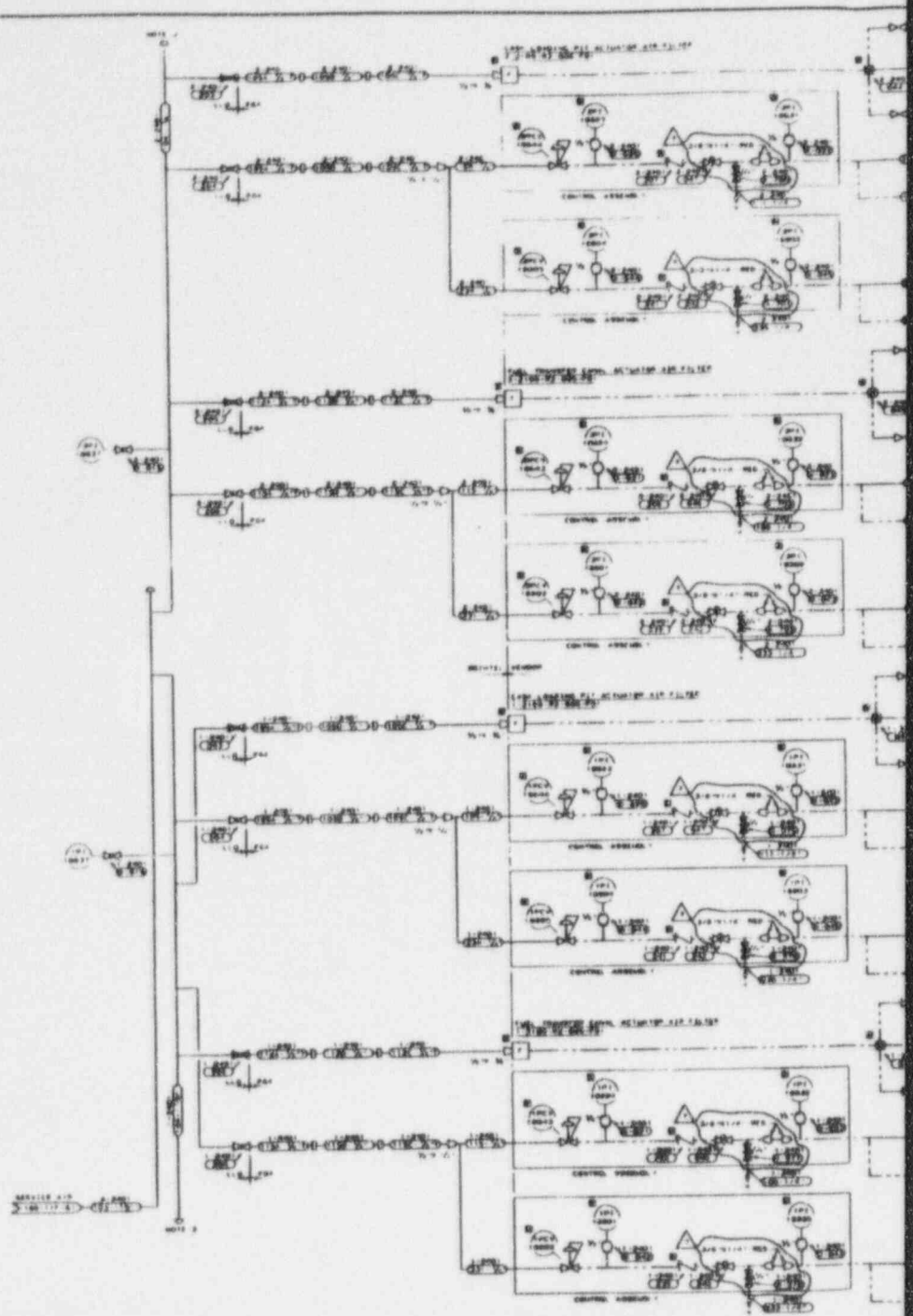
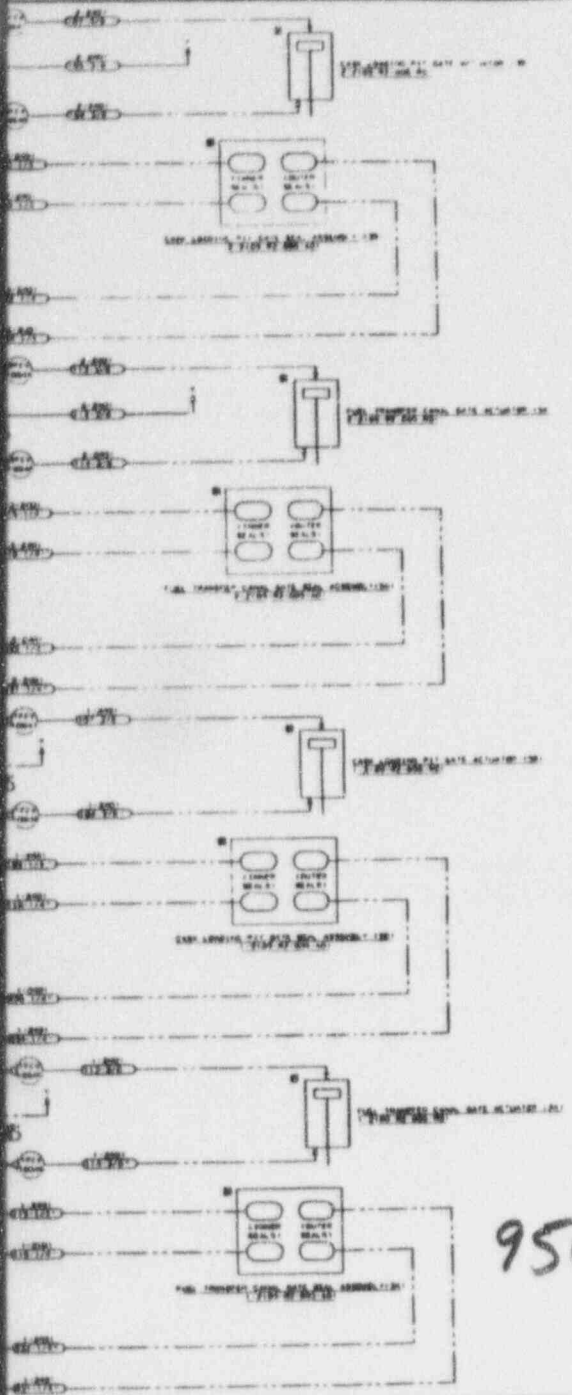
FIGURE 9.3.1-1 (SHEET 8 OF 9)





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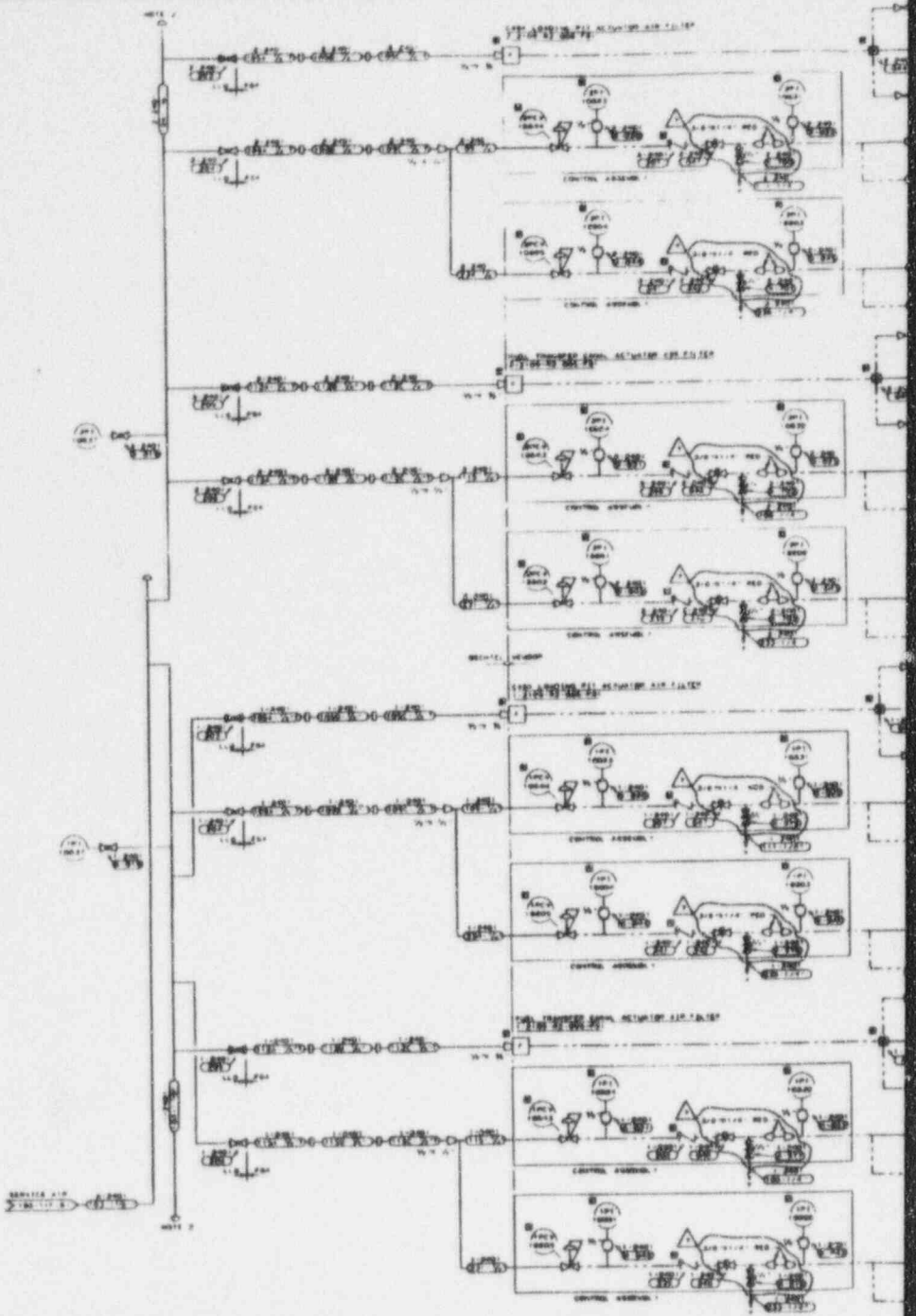
Georgia Power VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	INSTRUMENT AND SERVICE AIR SYSTEM
	FIGURE 9.3.1-1 (SHEET 8 OF 9)



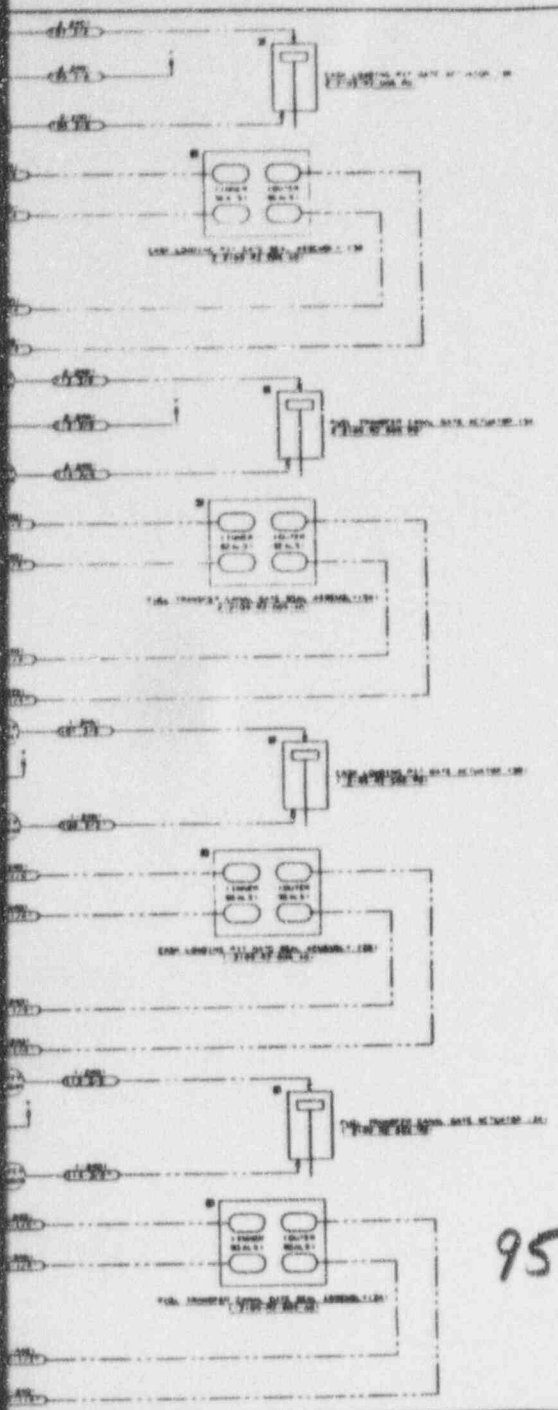


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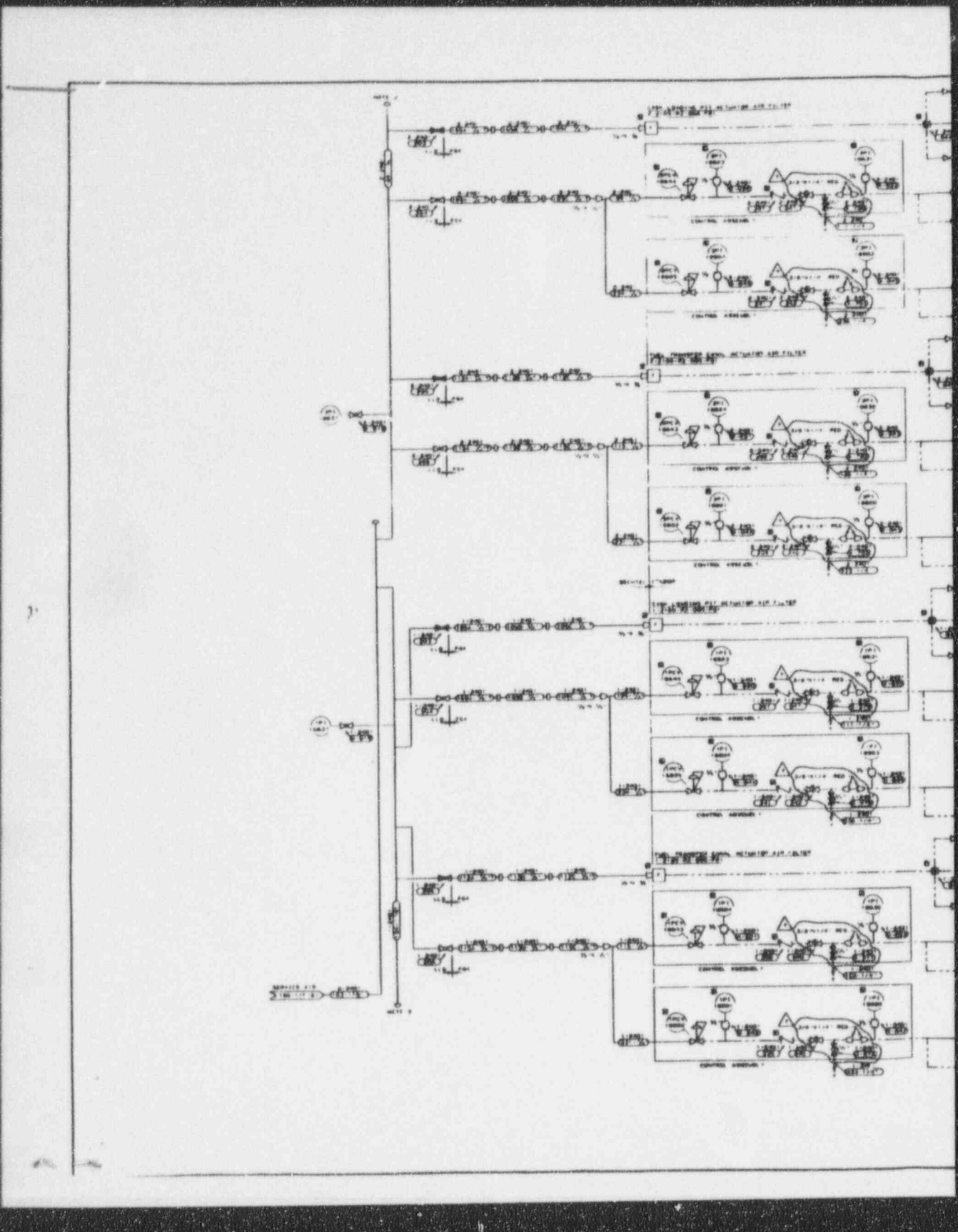
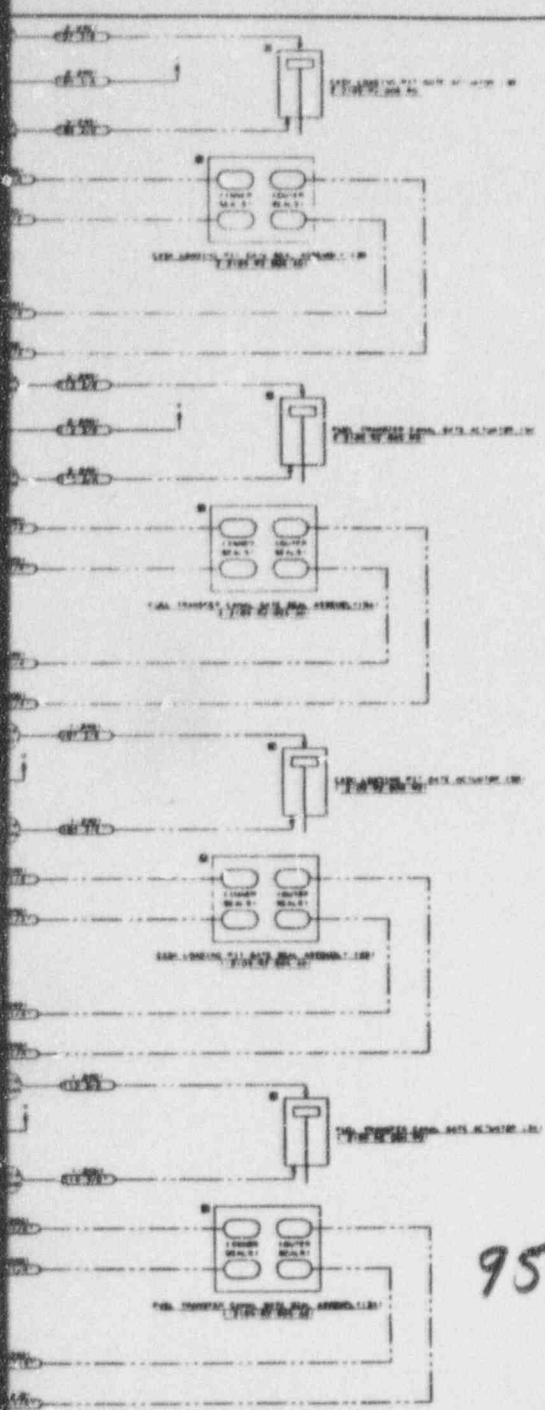
FIGURE 9.3.1-1 (SHEET 8 OF 9)





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INSTRUMENT AND
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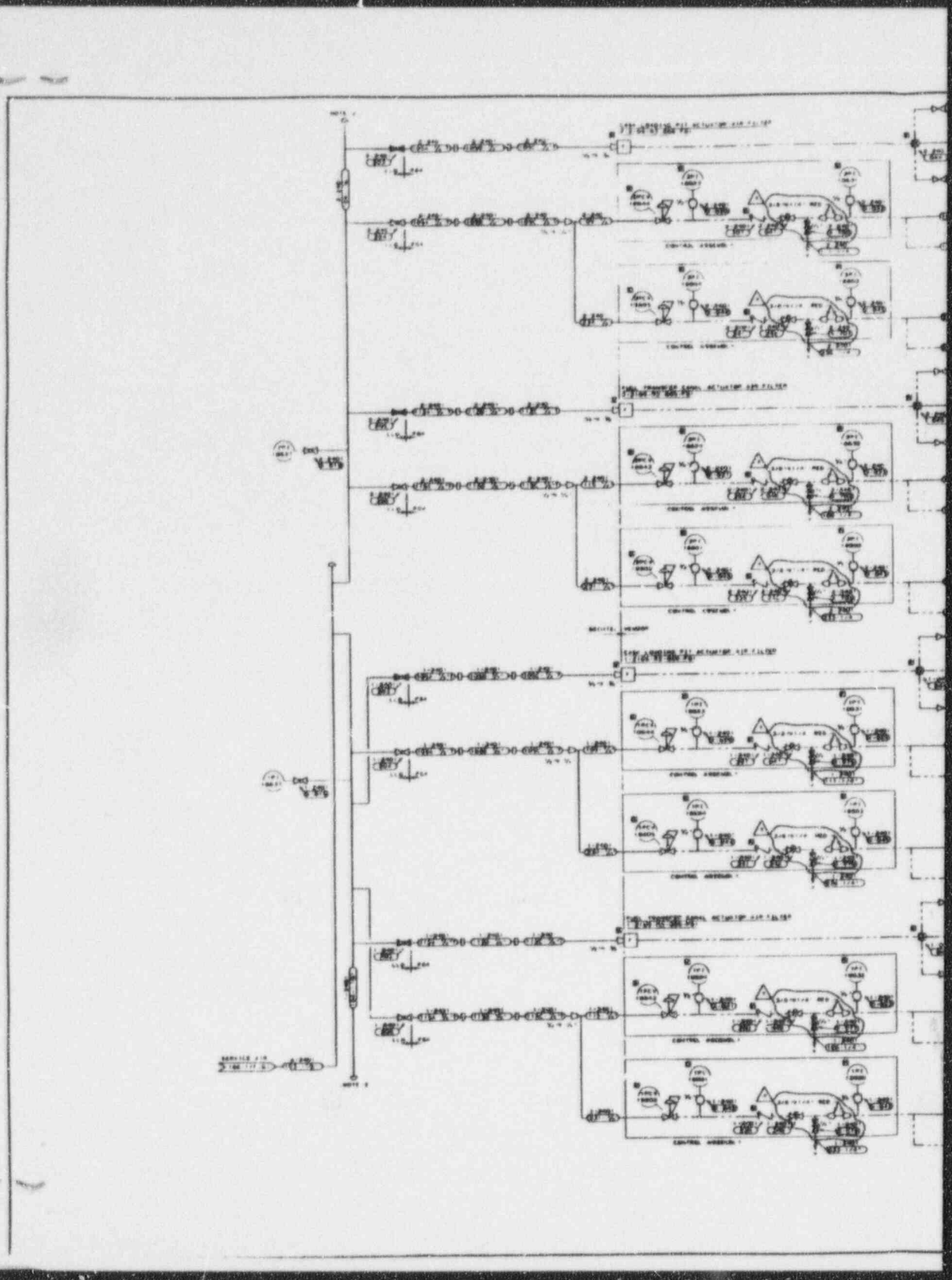
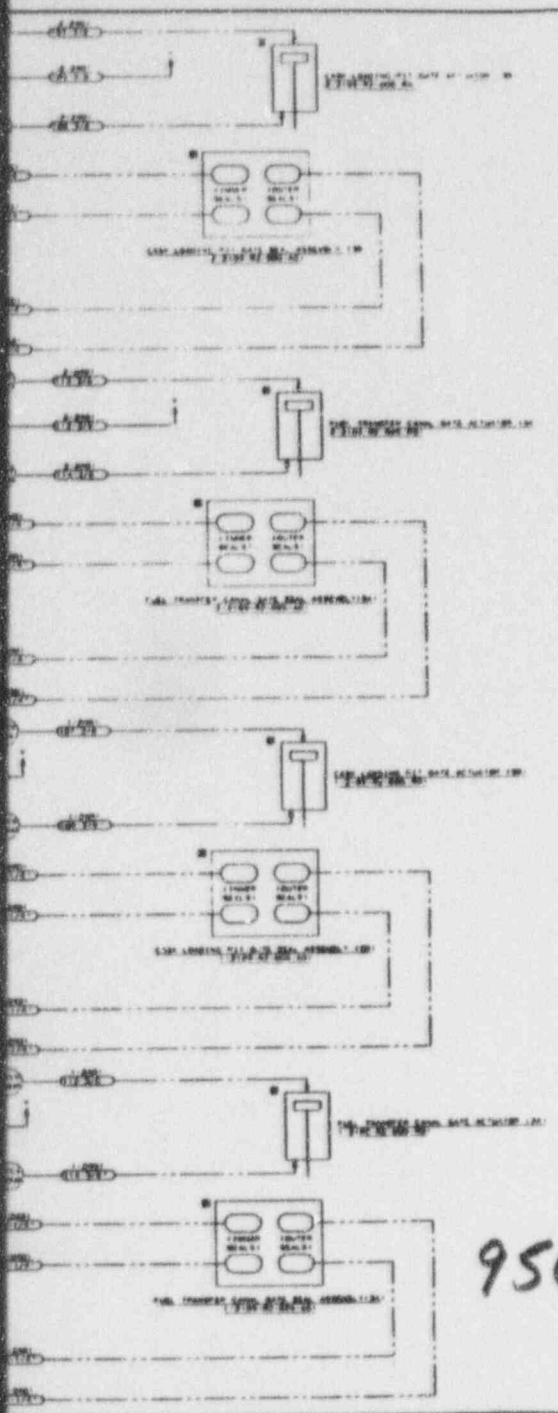
FIGURE 9.3.1-1 (SHEET 8 OF 9)





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UNIT 1 AND UNIT 2

INSTRUMENT AND
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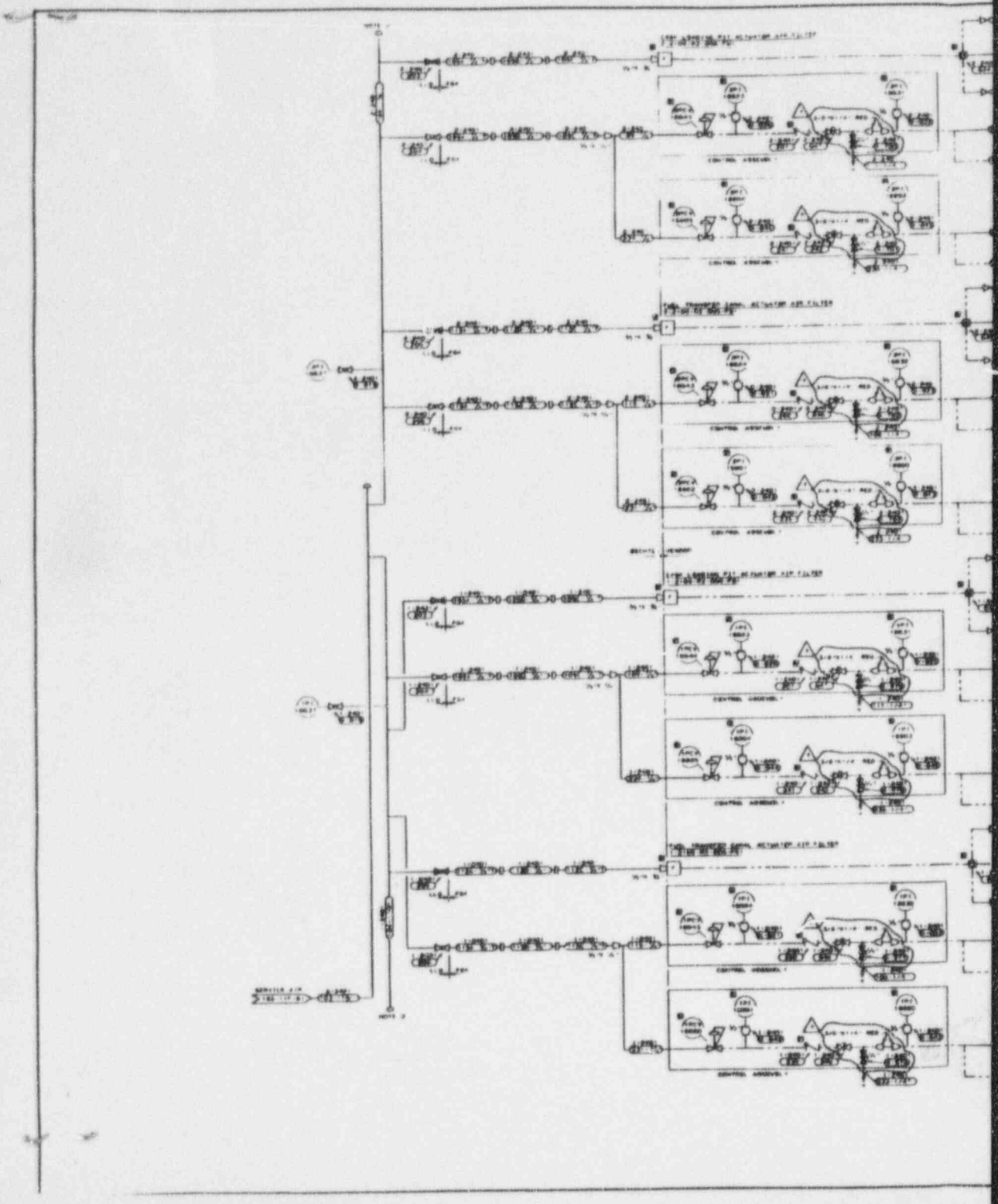
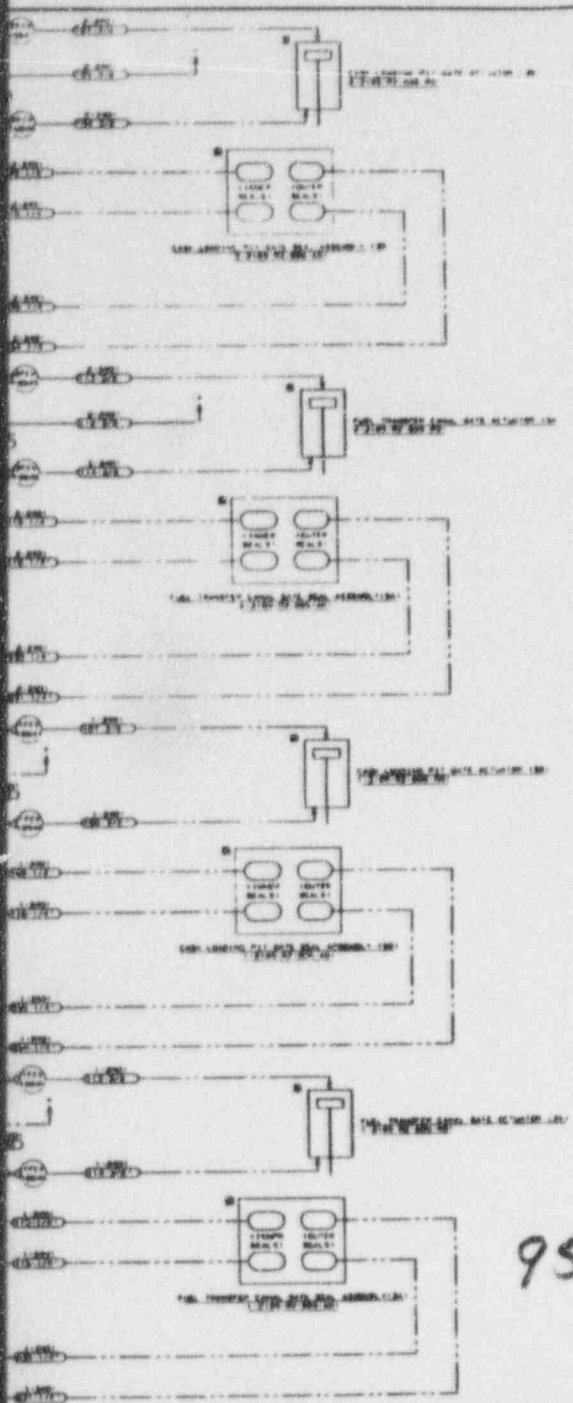
FIGURE 9.3.1-1 (SHEET 8 OF 9)





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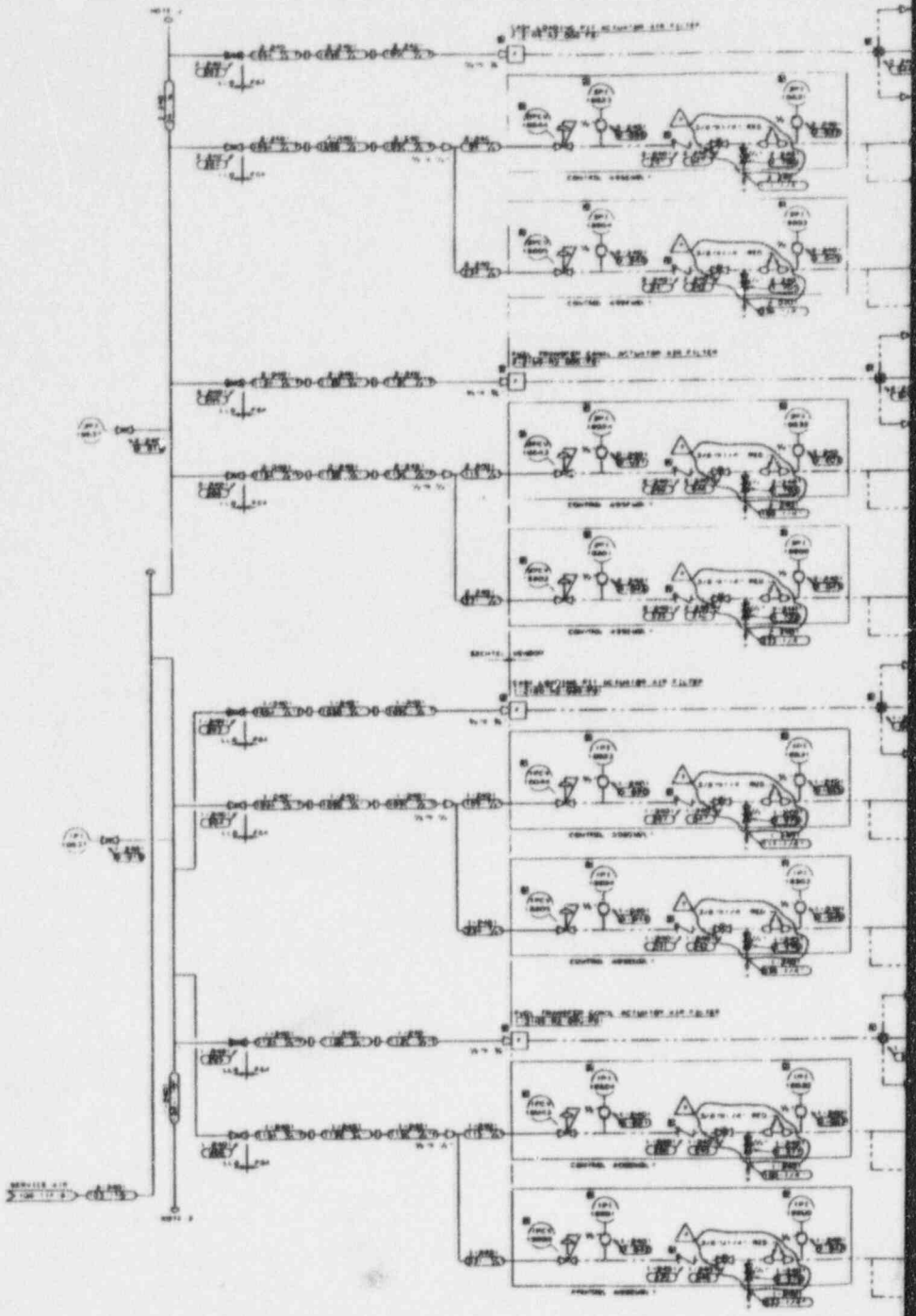
Georgia Power VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	INSTRUMENT AND SERVICE AIR SYSTEM
	FIGURE 9.3.1-1 (SHEET 8 OF 9)



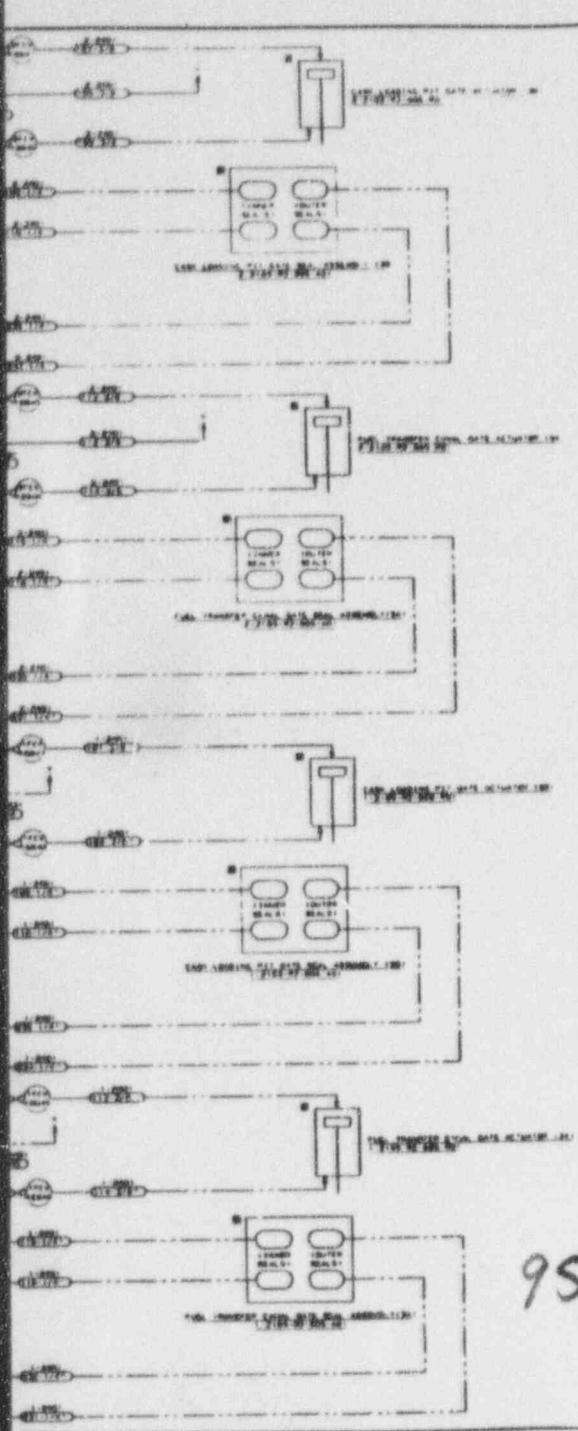


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FIGURE 9.3.1-1 (SHEET 8 OF 9)