CITY OF WINNIPEG

SOUTH END WATER POLLUTION
CONTROL CENTRE

SECONDARY CLARIFIERS OPERATING MANUAL

Prepared by:

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1.0 SECONDARY CLARIFIER SYSTEM - INTRODUCTION

1.1 PURPOSE

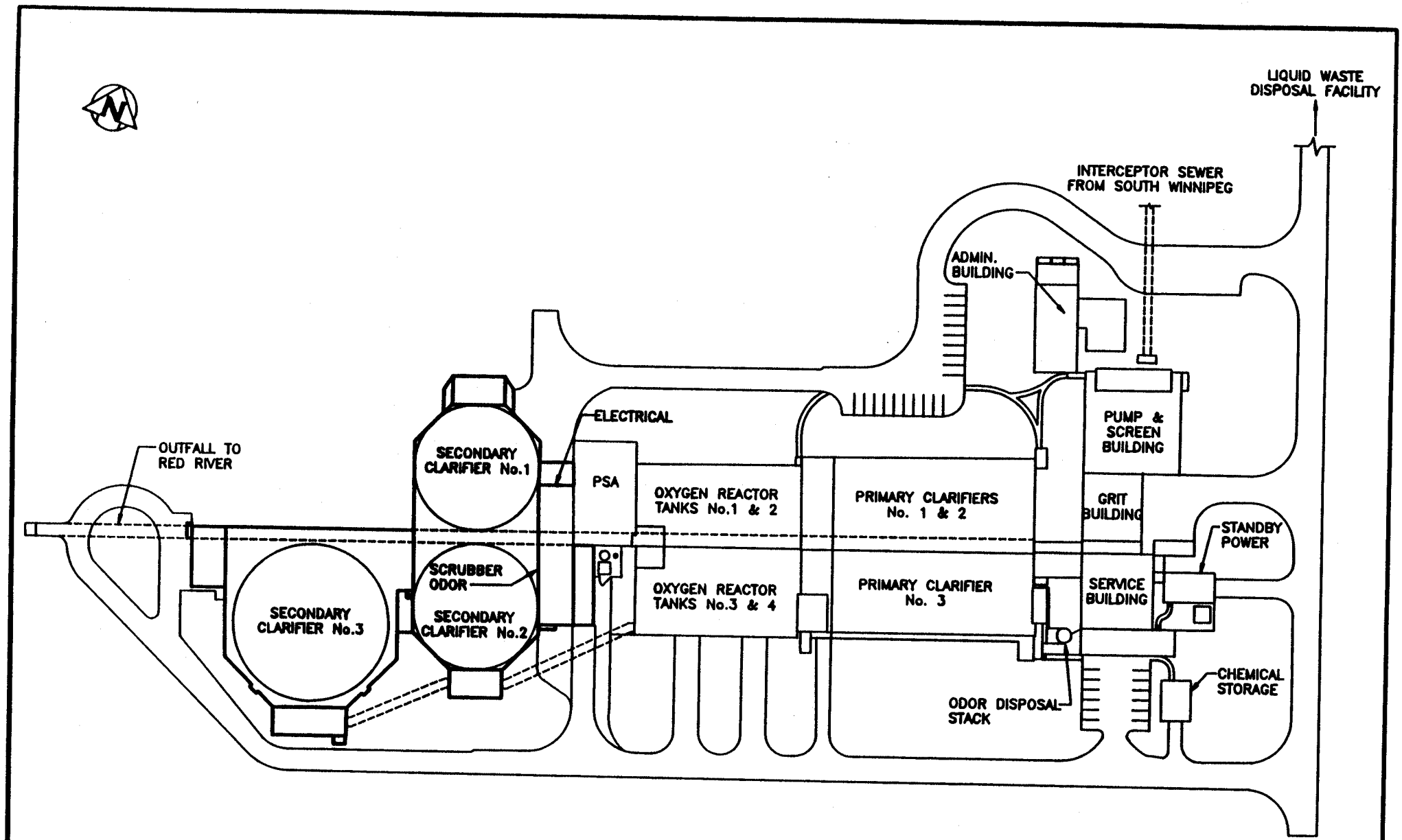
The secondary clarifier system is located downstream and adjacent to the oxygen reactor system. The function of this system is to separate the solids from the mixed liquor to produce a clarified final effluent, low in suspended solids (SS) and biochemical oxygen demand (BOD). The clarifiers provide a relatively quiescent state where the heavier suspended solids settle to produce sludge and light suspended solids float to produce scum. The system mechanically removes the sludge and scum from the clarifiers. Subsequently, most of the sludge is pumped to the oxygen reactors as return activated sludge (RAS) while excess waste activated sludge (WAS) is pumped to the primary clarifiers. The scum is pumped to the sludge storage tanks.

The secondary clarifier area is shown on the Site Plan in Figure 1-1. The ground, basement, and upper ventilation room layouts are shown on Figures 1-2 to 1-4 inclusive.

1.2 PROCESS SYSTEMS

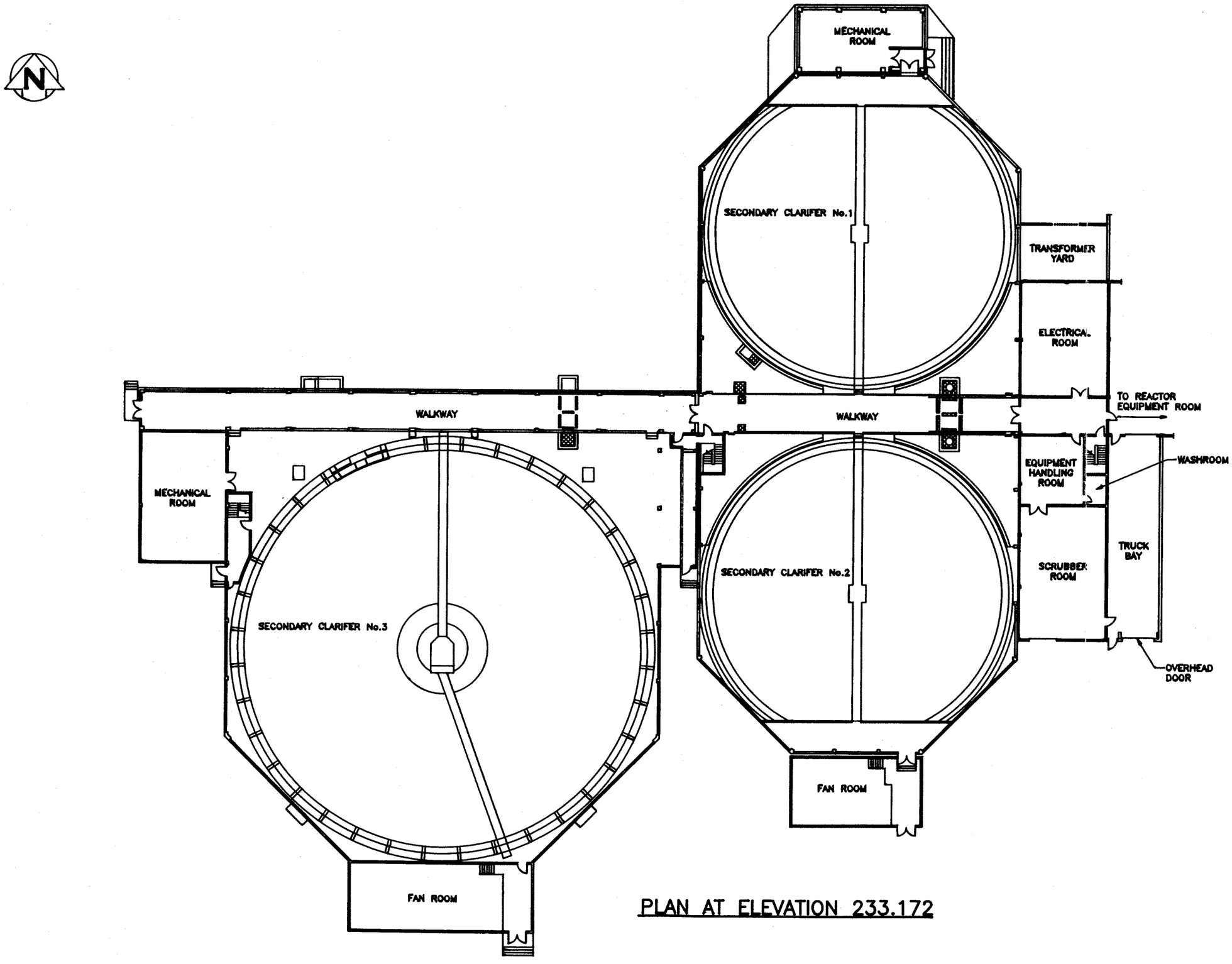
The secondary clarifier influent system consists of a mixed liquor conduit that feeds three secondary clarifiers. The mixed liquor system is separated into two channels. Within the system, flow is controlled by stop-logs, baffles, and butterfly control valves to balance flows to the individual clarifiers.

Solids separation occurs within the secondary clarifier tanks. The heavier suspended solids in the mixed liquor settle to the clarifier bottom forming sludge. This sludge, known as return activated sludge (RAS), contains the micro-organism population necessary for the oxygen reactor system. For this reason, it is pumped back to the oxygen reactors to maintain the micro-organism population.



SITE PLAN

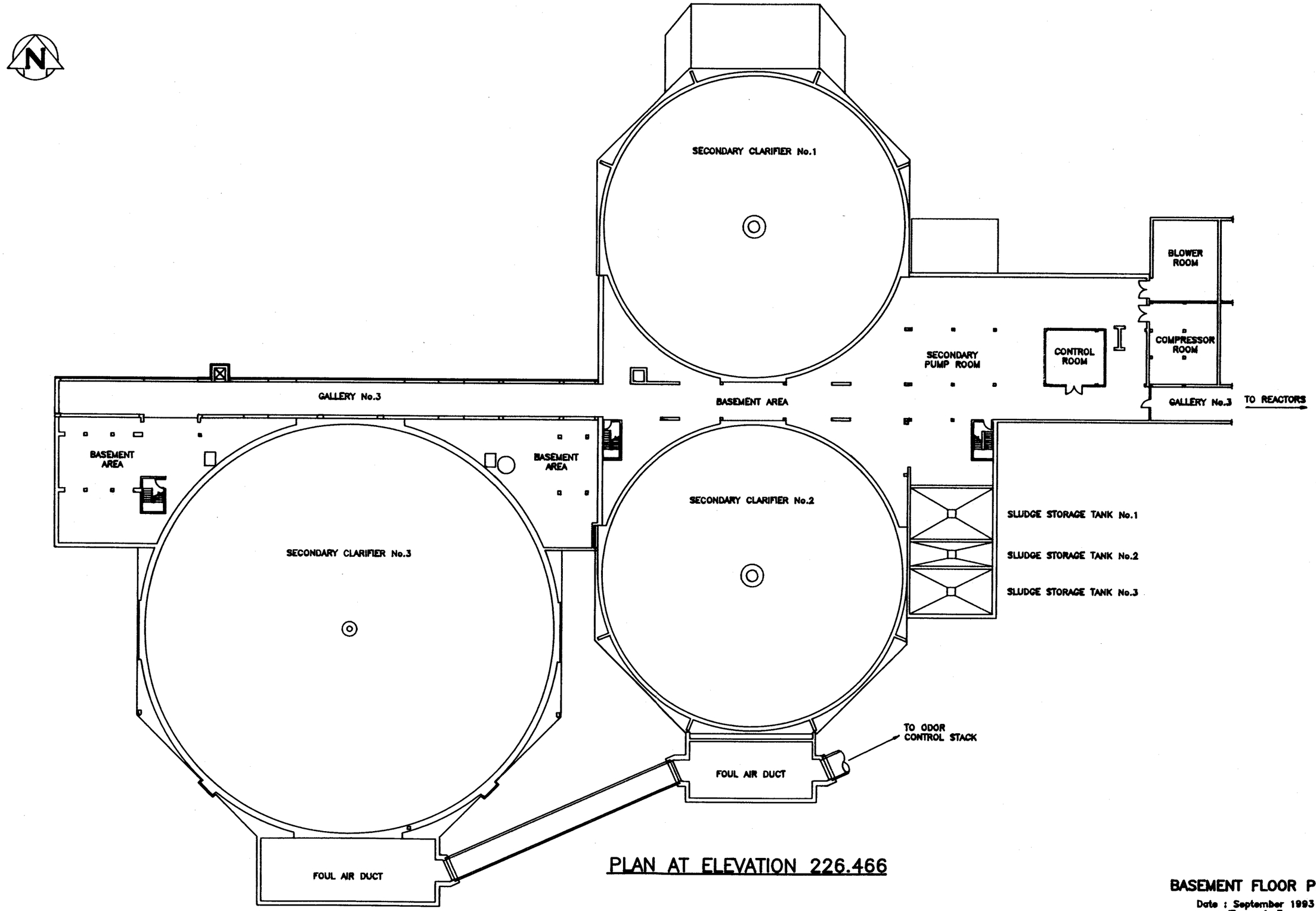
Date : September 1993
Figure 1-1



PLAN AT ELEVATION 233.172

GROUND FLOOR PLAN

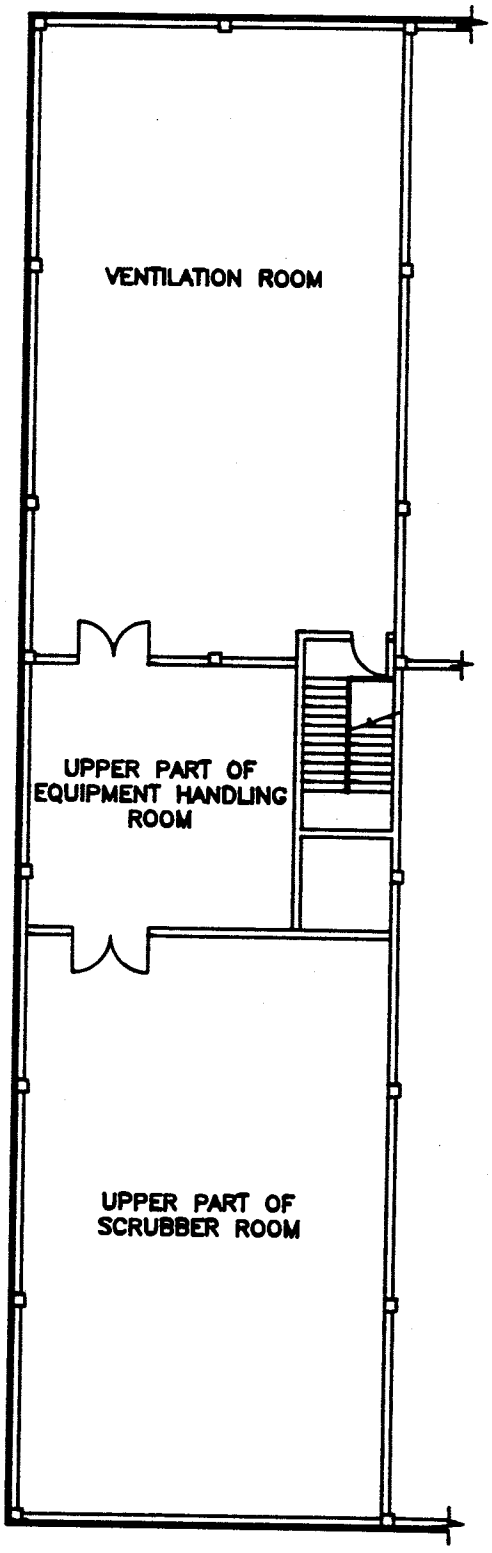
Date : September 1993
Figure 1-2



PLAN AT ELEVATION 226.466

BASEMENT FLOOR PLAN

Date : September 1993
Figure 1-3



PLAN AT ELEVATION 237.592

VENTILATION ROOM PLAN

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Figure 1-4

Excess or waste activated sludge (WAS) is pumped to the primary clarifiers for co-thickening with the primary sludge. The primary sludge pumping system pumps the co-thickened primary sludge and WAS to the sludge storage tanks. The volume of WAS pumped is controlled and its solids concentration is monitored.

Light suspended solids float to the surface and form scum. The scum system provides for mechanical skimming of the scum off the water surface. The scum is discharged into hoppers and is pumped to the sludge storage tanks.

The end product resulting from the removal of the suspended solids from the mixed liquor is a clarified final effluent which flows over the clarifier weirs into the effluent trough. From there, the clarified final effluent is discharged into the effluent conduit. The effluent conduit drains into the outfall system which discharges into the Red River. The effluent is sampled to monitor treatment performance.

Figure 1-5 provides a schematic of the secondary clarifier system.

1.3 SUB-SYSTEMS

To properly operate the secondary clarifier system, various support systems are required. These support systems are detailed in this manual and include the following:

(1) Flushing Water;
(2) Seal Water;
(3) Process Air;
(4) Instrument Air;
(5) Sump Drainage;
(6) Sampling;
(7) H_2S Detection;
(8) Security;
(9) Heating and Ventilation;
(10) Electrical.

1.4 HISTORY

A short history of the construction and expansion of the Secondary Clarifier Area is as follows:

1) The secondary clarifier area was built as part of the original plant construction in 1974. At this time it contained the following equipment and facilities:

   a) Secondary Clarifiers No. 1 & No. 2;
   b) 3 - 40 hp variable speed drive RAS Pumps;
   c) 2 - 3 hp WAS Pumps;
   d) 2 - 5 hp Scum Pumps;
   e) 2 - 25 hp Sludge/Truck Pumps;
   f) 2 - 3 hp Sludge Thickening Pumps;
   g) 1 - 50 hp WAS Thickening Pump;
   h) 2 - 1 hp Clarifier Drives;
   i) 2 - 25 hp & 2 - 10 hp Air Compressors;
   j) 2 - 75 hp Aeration Blowers;
   k) 1 - 20 hp & 2 - 125 hp Flushing Water Pumps;
   l) 1 - 1 hp Flushing Water Strainer;
   m) 2 - 1½ hp Seal Water Pumps;
   n) 1 - 3/4 hp & 4 - 2 hp Sump Pumps;
   o) An HVAC system consisting of Exhaust/Supply Fans, Cooling Tower Pumps, Hot Water Circulating Pumps, a Condensate Pump, and a Chiller;
   p) A central sampler system for all plant areas.

2) In 1992 the secondary clarifier area was expanded and upgraded as follows:

   a) Secondary Clarifier No. 3 was added, almost doubling the plant secondary clarifier capacity;
   b) 2 - 60 hp variable speed drive RAS Pumps were added to supplement the three existing ones;

c) The two existing WAS Pumps were replaced with 2 - 15 hp variable speed drive new ones;

d) 1 - 7½ hp Scum Pump was added to supplement the two existing ones;

e) The 2 - 25 hp Sludge/Truck Pumps were removed and replaced with 2 - 25 hp Sludge Transfer Pumps;

f) The 2 - 3 hp Sludge Thickening Pumps and the 1 - 50 hp WAS Thickening Pump were abandoned;

g) A 1 hp drive unit was added for Clarifier No. 3;

h) All existing Air Compressors were removed and replaced with 2 - 60 hp Compressors to provide for a plant-wide system;

i) 1 - 75 hp Flushing Water Pump was added to supplement the existing system;

j) The Seal Water Pumps were removed in favour of a plant-wide system;

k) 4 - 2 hp Sump Pumps were added to supplement the existing system;

l) The HVAC system was expanded and upgraded;

m) The Sampler system was expanded and upgraded;

n) An area door monitoring Security system was added;

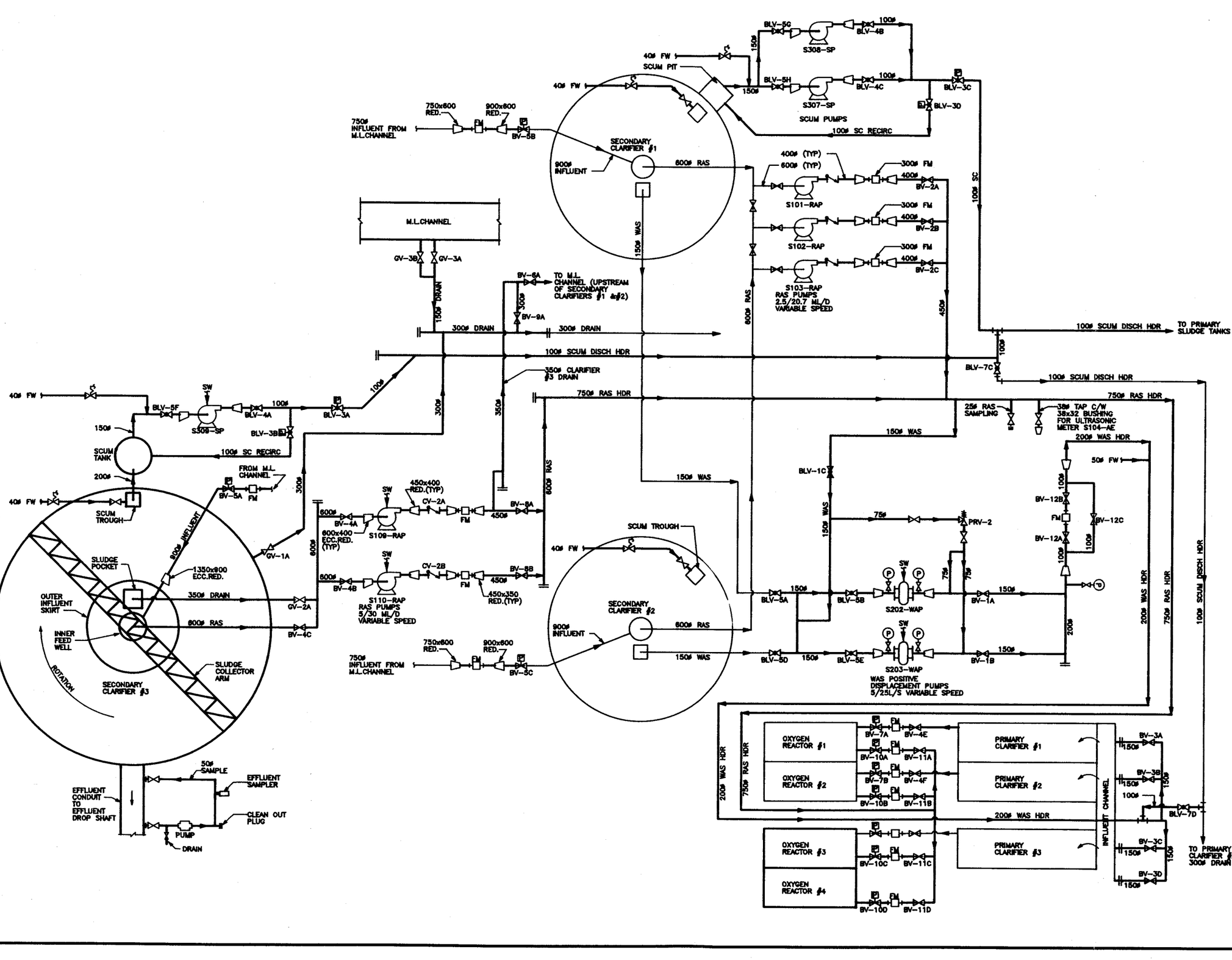
o) All area lighting and building services were upgraded;

p) FDP-S was added for centralized control;

q) All area equipment was put under the monitoring and control of a plant-wide DCS system - the INFI 90 as supplied by Bailey Controls.

1.5 NUMBERING SYSTEM

The numbering system for the secondary clarifier system has been incorporated in the computer control system. The following sample number, S101-RAP, is used to illustrate this numbering system. The first letter "S" locates the equipment in the secondary clarifier area. The subsequent three digits, the 100 series, designate the instrumentation loops for this specific type of equipment. The second and third digits in the 100 series number identify the equipment within the specific grouping. The letters RAP, short for RAS pump, describe the piece of equipment in abbreviated form. To assist in the understanding of the system in this area all the equipment abbreviations are listed in Table 1-1.



LEGEND

- BUTTERFLY VALVE (BV)
- PNEUMATIC POWERED BUTTERFLY VALVE (BV)
- CHECK VALVE (CV)
- FLEXIBLE CONNECTION
- MAGNETIC FLOW METER (FM)
- GATE VALVE (GV)
- GLOBE VALVE (GLV)
- HOSE VALVE (HV)
- NEEDLE VALVE (NV)
- ANGLE PRESSURE RELIEF VALVE (PRV)
- PRESSURE RELIEF VALVE (PRV)
- SOLENOID VALVE (SV)
- VACUUM RELIEF VALVE (VRV)
- PRESSURE GAUGE
- PRESSURE SWITCH
- REDUCER (RED.)
- ECCENTRIC REDUCER (ECC.RED.)
- CENTRIFUGAL PUMP
- POSITIVE DISPLACEMENT PUMP

BLD FLG	BLIND FLANGE
CL	CHLORINE SOLUTION
CO	CLEAN OUT
CONC.	CONCRETE
DISCH	DISCHARGE
DS	SLUDGE DISCHARGE
FD	FLOOR DRAIN
FFD	FUNNEL FLOOR DRAIN
FW	FLUSHING WATER
GALV	GALVANIZED
HDR	HEADER
HFW	HOT FLUSHING WATER
M.L.	MIXED LIQUOR
NO	NORMALLY OPEN
OPNG	OPENING
PA	PROCESS AIR
PS	PRIMARY SLUDGE
RAS	RETURN ACTIVATED SLUDGE
RD	ROOF DRAIN
SC	SCUM
SR	SLUDGE RECIRCULATION
STM	STEAM
SW	SEAL WATER
WAS	WASTE ACTIVATED SLUDGE
W/	WITH

SECONDARY CLARIFIERS SYSTEM SCHEMATIC

Date : September 1993
Figure 1-5

TABLE 1-1

LIST OF EQUIPMENT ABBREVIATIONS

EQUIPMENT	ABBREVIATIONS
Return Activated Sludge Pump	RAP
Waste Activated Sludge Pump	WAP
Sludge Recirculation Pump	STP
Scum Pump/Sampler Pump	SP
Clarifier Bridge Drive	SC
Aeration Blower	AB
Air Compressor	AC
Flushing Water Pump	FWP
Flushing Water Strainer	FWS
Sump Pump	SMP
Pipe Flushing Pump	PFP
Air Handling Unit	AHU
Exhaust Fan	EF
Supply Fan	FN
Hot Water Circulating Pump	HWP
Chilled Water Pump	CWP
Condensate Pump	CNP
Circulating Pump	CP
Chiller	CH
Glycol Pump	GP
Unit Heater	UH
Monorail	MR
Overhead Door	TD
Manual Hand Valve	HV
Automatic Flow Valve	FV
Hand Control Station	HK, HS
Lock-Off-Stop Pushbutton Station	LOS

1.6 CONTROL REVIEW

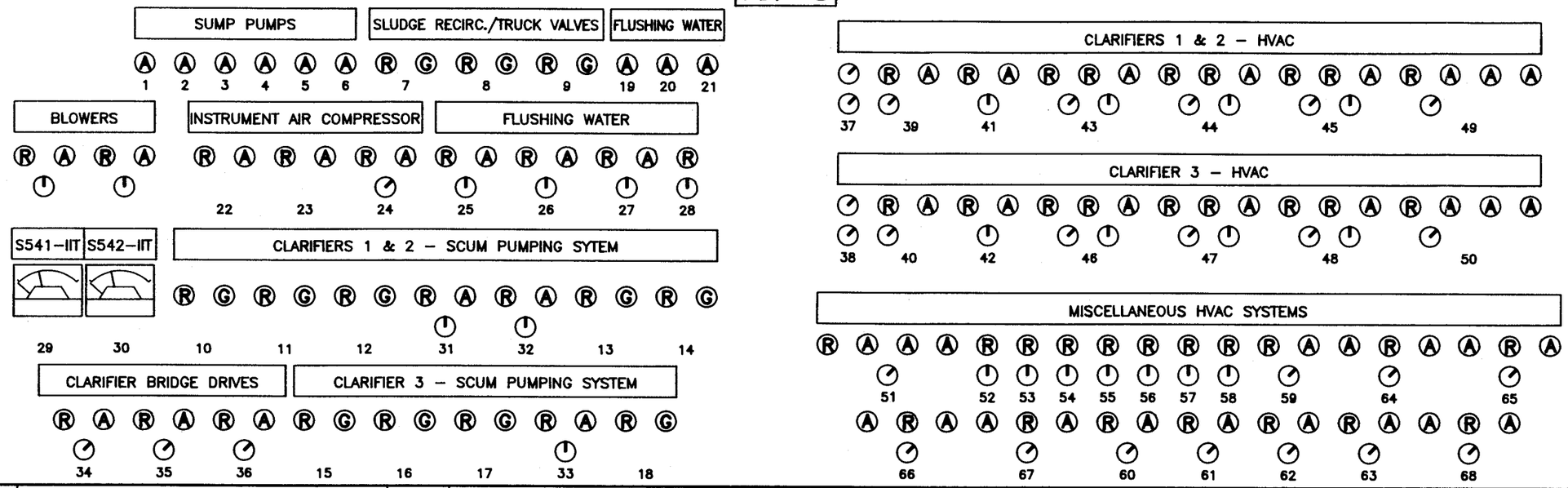
The secondary clarifier system has one main control panel designated Field Device Panel FDP-S. It is located in the Control Room as shown in Figure 1-6. The front face of FDP-S is shown in Figure 1-7.

Control and indication provided at the field device panel is in most cases available to the central Computer Control System, the Bailey INFI-90 system. Cross references between the field device panel and the corresponding provisions in the Computer Control System are made in the Bridging Table 1-2. Operation of the control devices at this panel and all local control panels are discussed in the sections of this manual specific to each system. Equipment/Instrument Summary Tables, along with any required additional Bridging Tables, are provided in each section to better summarize and describe all equipment control.

1.7 ALARMS

Alarms in the Secondary Clarifier Area are displayed at FDP-S, local control panels, and/or the INFI-90 system area control stations. The alarms displayed on the INFI-90 system include all alarms shown on FDP-S and a number of others including high tank level alarms, some HVAC alarms, security alarms, and various transmitter signal alarms. These alarms are divided into three different categories: Process Alarms, Utility Alarms, and HVAC Alarms. They have been summarized in Alarm Summary Tables 1-3, 1-4, and 1-5, listing the alarm types, display locations, origins and potential causes, and the operator's appropriate responses.

FDP-S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	Ⓡ Ⓖ A – OPEN, B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	Ⓡ Ⓐ A – RUN, B – PUMP FAIL, C① – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A Ⓡ A – RUN, B① – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	Ⓡ Ⓐ A – RUN, C① – B – FAIL, C – COMP/OFF/HAND, D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – LOSS OF SEAL WATER, C① – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	Ⓡ Ⓐ A – RUN, B – HIGH TORQUE FAIL, C⊘ – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A⊘ A – COMP/HAND, B⊘ B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C① – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW, D⊘ E① D – SLOW/FAST, E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	Ⓡ Ⓐ Ⓐ Ⓐ A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E⊘ E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	AⓇ B① A – RUN, B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	Ⓐ Ⓡ Ⓐ D⊘ A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

SECONDARY CLARIFIERS
FIELD DEVICE PANEL FDP–S

Date : September 1993
Figure 1–7

TABLE 1-2

FDP-S/INFI 90 BRIDGING TABLE

ITEM NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
1	5-U					5-U
2	5-U					5-U
3	5-U					5-U
4	5-U					5-U
5	5-U					5-U
6	5-U					5-U
7	5-K	1S			5-K	5-K
8	5-K	5S			5-K	5-K
9	5-K	4S			5-K	5-K
10	5-I	1Y		5-I	5-I	5-I
11	5-I	3V			5-I	5-I
12	5-I	5S		5-I	5-I	5-I
13	5-I	1C		5-I	5-I	5-I
14	5-I	1O		5-I	5-I	5-I
15	5-J	5S		5-J	5-J	5-J
16	5-J	8S			5-J	5-J
17	5-J	6S		5-J	5-J	5-J
18	5-J	1S		5-J	5-J	5-J
19	5-S					5-S
20	5-S					5-S
21	5-S					5-S
22	5-T					5-T
23	5-T					5-T
24	5-T					5-T
25	5-S	4P			5-S	5-S
26	5-S	1P, 5P			5-S	5-S
27	5-S	3P, 5P			5-S	5-S
28	5-S	2P			5-S	5-S
29	5-T	9S, 7S			5-T	5-T
30	5-T	6S, 7S			5-T	5-T
31	5-I	2S		5-I	5-I	5-I
32	5-I	3S		5-I	5-I	5-I
33	5-J	7S			5-J	5-J
34	5-E					5-E

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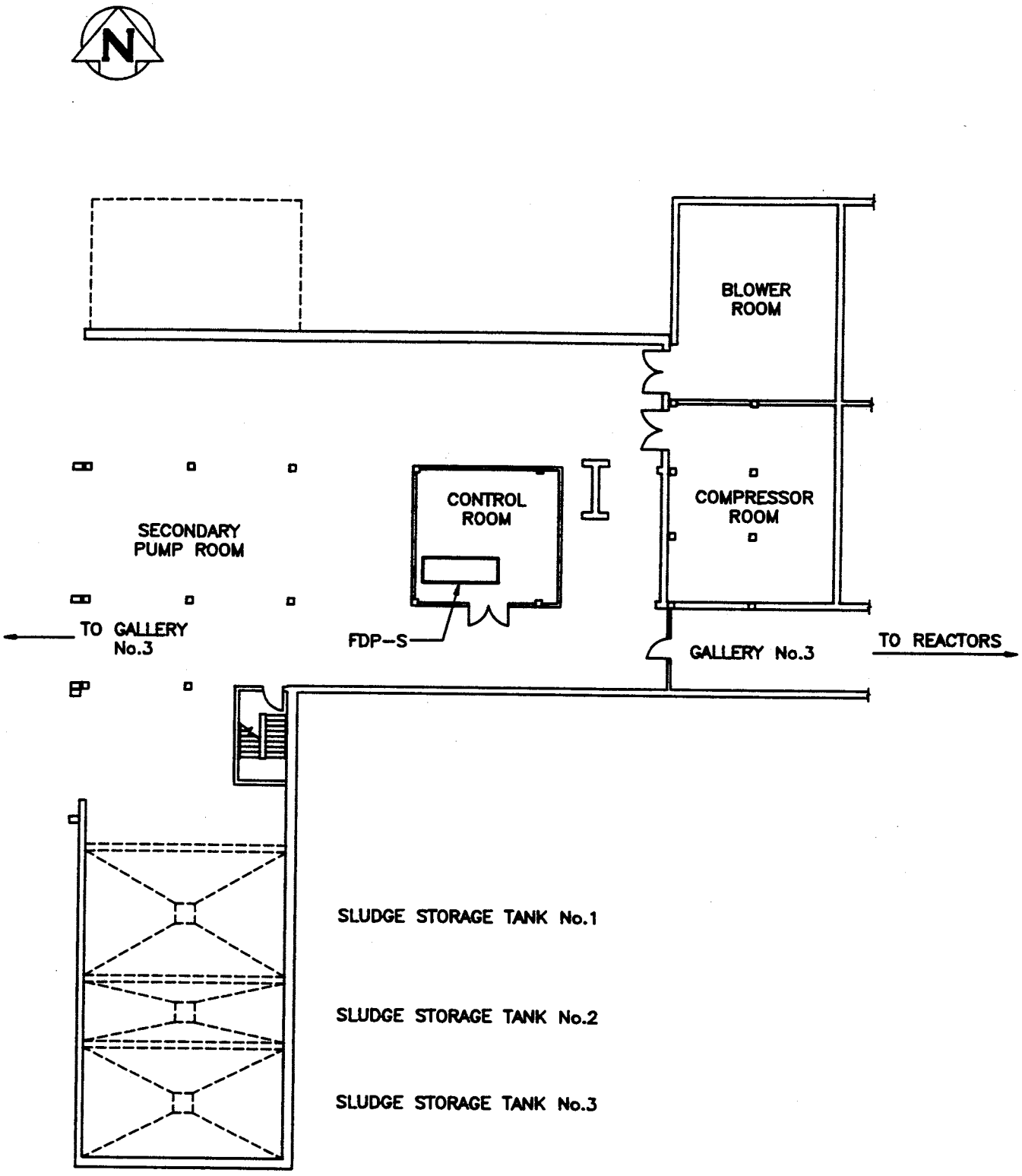


BASEMENT FLOOR PLAN

FIELD DEVICE PANEL FDP-S LOCATION

Date : September 1993
Figure 1-6

TABLE 1-2 (continued)

FDP-S/INFI 90 BRIDGING TABLE

ITEM NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
35	5-E					5-E
36	5-F					5-F
37	5-M	1F			5-M	5-M
38	5-N	1F			5-N	5-N
39	5-M					5-M
40	5-N					5-N
41	5-M, OVERVIEW	6F			5-M	5-M
42	5-N, OVERVIEW	6F			5-N	5-N
43	5-M, OVERVIEW	3F			5-M	5-M
44	5-M, OVERVIEW	4F			5-M	5-M
45	5-M, OVERVIEW	5F			5-M	5-M
46	5-N, OVERVIEW	3F			5-N	5-N
47	5-N, OVERVIEW	4F			5-N	5-N
48	5-N, OVERVIEW	5F			5-N	5-N
49	5-R					5-R
50	5-R					5-R
51	5-R					5-R
52	5-Q	5P			5-Q	5-Q
53	5-Q	2P	5-Q		5-Q	5-Q
54	5-Q	3P	5-Q		5-Q	5-Q
55	5-Q	7P	5-Q		5-Q	5-Q
56	5-Q	8P	5-Q		5-Q	5-Q
57	5-R	1P	5-R		5-R	5-R
58	5-R	2P	5-R		5-R	5-R
59	5-P					5-P
60	5-O					5-O
61	5-O					5-O
62	5-O					5-O
63	4-Q	1D				4-Q
64	5-O	1T		5-O		5-O
65	5-M			5-M		5-M
66	5-O	2T		5-O		5-O
67	5-O	3T		5-O		5-O
68	4-Q	1T		4-Q		4-Q

TABLE 1-3

PROCESS ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S809-LA	Mixed liquor overflow channel	Level switch	High mixed liquor level in overflow channel	Check for closed channel discharge valves to clarifiers. Check same for proper operation. Check stop logs in channels for proper positioning.
S765-OF S766-OF S767-OF	Drive shaft of following motors: S765-SC S766-SC S767-SC	Torque limit switch on bridge drive shaft	Bridge drive collector mechanism jammed with debris - probably thick heavy sludge	Inspect drive mechanism for accumulated debris and clear away. Attempt to restart drive.
S101-PAL S102-PAL S103-PAL S108-PAL S109-PAL	Seal water line to RAS pumps	Low pressure switch	Low seal water pressure	Check for closed seal water valve. Check seal water solenoid for proper operation. Check City potable water system for flow. Press "RESET" at VFD panel and attempt to restart pump.
S101-QF S102-QF S103-QF S108-QF S109-QF	VFD panel	VFD panel sensing devices	General alarm triggered by a drive failure	Check VFD panel diagnostics for cause of failure. Take corrective action as determined by cause. Press "RESET" at VFD panel and attempt to restart pump.
S202-PAL S203-PAL	Seal water line to WAS pumps	Low pressure switch	Low seal water pressure	Check for closed seal water valve. Check seal water solenoid for proper operation. Check City potable water system for flow. Press "RESET" at VFD panel and attempt to restart pump.

(continued)

TABLE 1-3 (continued)

PROCESS ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S202-XF S203-XF	Intake line to WAS pumps	Dry pump monitor	No sludge in WAS pump intake line	Check for closed pump intake valves. Check RAS header flow meters for RAS flow to WAS pumps. Press "RESET" at VFD panel and attempt to restart pump.
S202-QF S203-QF	VFD panel	VFD panel sensing devices	General alarm triggered by a drive failure	Check VFD panel diagnostics for cause of failure. Take corrective action as determined by cause. Press "RESET" at VFD panel and attempt to restart pump.
S307-QF S308-QF S309-QF	Seal water line to scum pumps	Low pressure switch	Low seal water pressure	Check for closed seal water valve. Check seal water solenoid for proper operation. Check City potable water system for flow. Attempt to restart pump.
S413-LA S414-LA S415-LA	Sludge storage tanks No. 1, 2, and 3	High level switch	High sludge level in tanks	Check for closed sludge tank discharge valve. Check sludge tank level sensors for proper operation. Check sludge transfer pumps for proper operation.

TABLE 1-4

UTILITY ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S551-PAL S552-PAL S553-PAL	Seal water line to flushing water pumps	Low pressure switch	Low seal water pressure	Check for closed seal water valve. Check seal water solenoid for proper operation. Check City potable water system for flow. Attempt to restart pump.
S550-QF S551-QF S552-QF	IQ-1000 at MCC	Current sensing transformers	Pump failure due to overcurrent, ground fault, or low seal water pressure	Check pump electrical cabling for short circuiting. Check pump for clogged discharge line. Check for loss of seal water. Attempt to restart pump.
S554-PAH	Strainer filter	Differential pressure switch	Strainer filter clogged with debris	Shutdown strainer and clean filter. Attempt to restart strainer.
S554-QF	Strainer control panel	Strainer sensing devices	Strainer failure	Check strainer panel diagnostics for cause and take corrective action. Check power supply to strainer. Attempt to restart strainer.
S541-QF S542-QF	Blower unit and IQ-1000 at MCC	Current sensing transformers High temperature switch	Blower current overload/surge, ground fault, or high discharge air temperature	Check blower electrical cabling for short circuit. Check for closed discharge valves. Check for dirty air intake. Attempt to restart blower.
S535-QF S536-QF	Compressor control panel	Compressor sensing devices	Compressor failure	Check compressor panel diagnostics for cause and take corrective action. Check power supply to compressor. Attempt to restart compressor.

(Continued)

TABLE 1-4 (Continued)

UTILITY ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S537-QF	Fan unit	Differential pressure switch	No air flow across fan unit	Check following items on fan: - Belts, pulleys, filters, motor starter, supply air damper, and switch. Attempt to restart fan.
S546-PAL	Instrument air line	Low pressure switch	Low instrument air pressure	Check compressors for proper operation. Check for closed discharge valves. Check for dirty intake filter.
S537-TAH	Instrument air line	High temperature switch	High discharge air temperature	Check compressors for proper operation.
S537-PAH	Fan air intake filter	Differential pressure switch	Clogged air intake filter	Clean out air filter.
S569-LA S575-LA S576-LA S578-LA S580-LA S582-LA	Sump pit	High level switch	High water level in sump pit	Check sump pumps for proper operation. Check level controllers for proper operation.
S529-AF S530-AF S531-AF S532-AF	Effluent samplers	Control relay	Unit power failure	Check internal fuses at sampler. Check power supply to sampler.

(Continued)

TABLE 1-4 (Continued)

UTILITY ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S535-AH AH	Hydrogen sulfide detectors	H_2S sensor	Excess of 10 ppm H_2S level in Truck Bay or Scrubber Room	Clear personnel from all affected areas until levels return to safe limit. Check ventilation system.
S535-AF AF	H_2S detectors	Control relay	Unit power failure	Check internal fuses at detector. Check power supply to detector.
S503-XA S504-XA S505-XA S506-XA S507-XA S508-XA S509-XA S510-XA S516-XA S517-XA	Secondary Clarifier Building exterior doors	Limit switch	Door open	If situation warrants, check for unauthorized entry into Secondary Clarifier Building.
S515-XA S520-XA S521-XA S522-XA S523-XA	Secondary Clarifier Building Basement and Gallery Areas	Motion detector	Object motion	If situation warrants, check for unauthorized entry into Secondary Clarifier Building.

TABLE 1-5

HVAC ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S601-QF S614-QF	Air handling units S601-AHU and S614-AHU	Ultraviolet sensor	Burner flame failure	Ensure gas flow to unit is shut off.
S689-FF S683-FF S684-FF S685-FF	Air handling units S689-AHU, S683-AHU, S684-AHH, or S685-AHU	Differential pressure switch	No air flow across air handling unit	Check following items: - Belts, pulleys, filters, motor starter, air supply dampers, and switch. Attempt to restart unit.
S689-TAL S683-TAL S684-TAL S685-TAL	Air supply ducts to same units	Low temperature switch	Low air supply temperature	Check following items: - Supply air dampers and heating coils. Attempt to restart unit.
S689-QF S683-QF S684-QF S685-QF	See above	See above	General alarm triggered by either of the above faults	See above
S604-QF S605-QF S606-QF S607-QF S608-QF S617-QF S618-QF S619-QF S620-QF S621-QF S686-QF S687-QF S690-QF S691-QF	Fan units	Differential pressure switch	No air flow across fan unit	Check following items: - Belts, pulleys, filters, motor starter, air supply dampers, and switch. Attempt to restart unit.

(continued)

TABLE 1-5 (continued)

HVAC ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S501-AE S513-AE	Electrical and Control Rooms	Smoke alarm	Fire/smoke	Check rooms for fire and/or smoke. Evacuate the area.
S502-TA S514-TA	Electrical and Control Rooms	High temperature switch	High ambient temperature in area	Check supply fans for proper operation. Check rooftop condensors and cooling coils for proper operation.
S671-FA	Hot water supply line	Low flow switch	Low hot water flow to heating coils	Ensure standby pump has come on. If alarm persists, check the following: - Both pumps for proper operation - Closed pump discharge valves - Supply from plant boilers
S667-FA	Chilled water supply line	Low flow switch	Low chilled water flow to cooling coils	Ensure standby pump has come on. If alarm persists, check the following: - Both pumps for proper operation - Closed pump discharge valves - Supply from chiller.
S647-QF S648-QF	Chiller compressors	Compressor sensing devices	Compressor unit failure	Check panel diagnostics for cause of failure and take corrective action. Attempt to restart compressor.
S649-TAH S649-TAL	Cooling tower supply and discharge lines	High and low temperature switches	Supply water high temperature or discharge water low temperature	Check cool water supply from chiller unit. Check cooling tower fan for proper operation.
S679-FA	Chiller water supply line	Low flow switch	Low chilled water flow to chiller from cooling tower	Ensure standby pump has come on. If alarm persists, check the following: - Both pumps for proper operation - Closed pump discharge valves - Supply from cooling towers.

(continued)

TABLE 1-5 (continued)

HVAC ALARM SUMMARY TABLE

Alarm	Location	Origin	Cause	Action
S609-TAL S622-TAL S662-TAL	Flushing water return line	Low temperature switch	Low flushing water return temperature	Check heat exchanger for proper operation. Check glycol pump for proper operation. Attempt to restart pump.
S609-FAL1 S622-FAL1 S662-FAL1	Flushing water return line	Low flow switch	Low flushing water return flow	Check for closed valve. Check solenoid valve for proper operation. Check heat exchanger for proper operation. Attempt to restart pump.
S609-FAL2 S622-FAL2 S662-FAL2	Glycol supply line	Low flow switch	Low glycol supply flow to pre-heat coils	Check for closed valve. Check glycol pump for proper operation. Check heat exchanger for proper operation. Attempt to restart pump.
S609-QF S622-QF S662-QF	See above	See above	General alarm triggered by any of the above faults	See above

2.0 MIXED LIQUOR INFLUENT SYSTEM

2.1 PURPOSE

The purpose of this system is to convey a balanced flow of mixed liquor, the product of the oxygen reactors, to each of the three secondary clarifiers.

2.2 SYSTEM DESCRIPTION

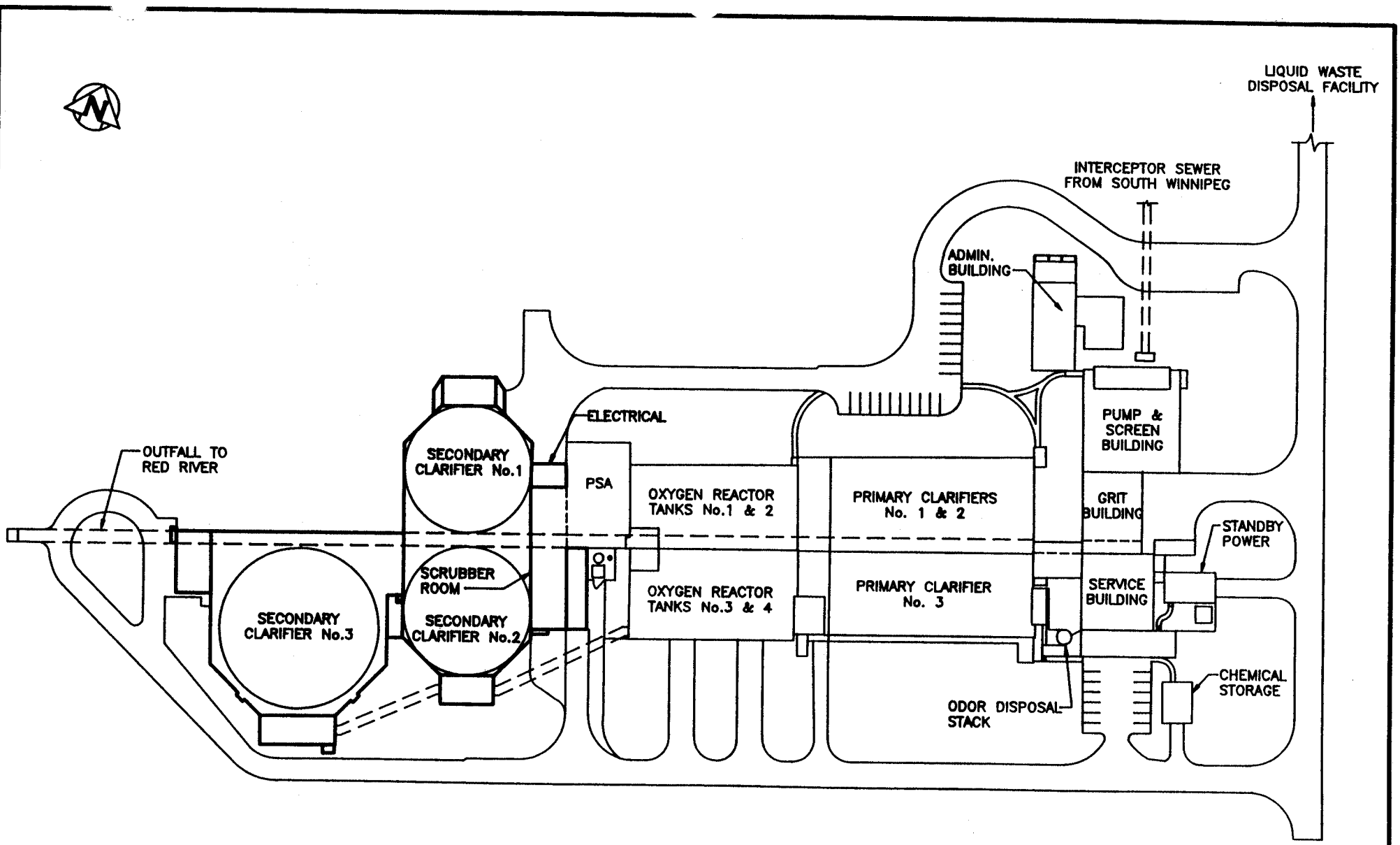
Mixed liquor flows from the reactors into two parallel channels running through the Secondary Clarifier Area. Flow through these channels is controlled by stop logs. Mixed liquor flows from a channel into a clarifier inlet pipe. An inlet pipe contains a magnetic flow meter and an automatic butterfly positioning valve which allows for very accurate control of mixed liquor flow to each clarifier. The mixed liquor flows through an influent pipe to a feed well in the centre of the clarifier.

A high wastewater level and the suspended solids level in the mixed liquor channels are continuously monitored.

A summary of the equipment described in this section is as follows:

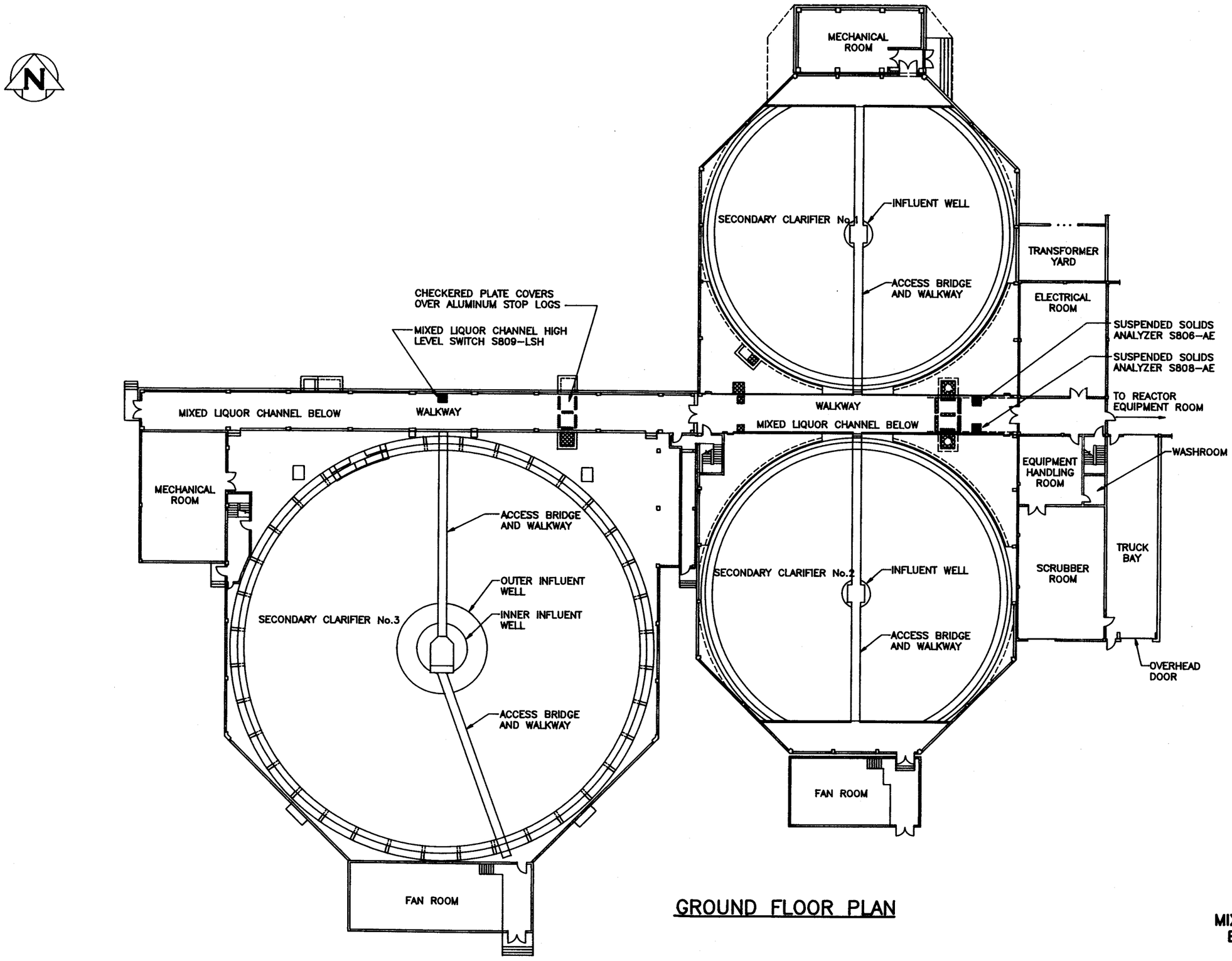
1. Three automatic butterfly positioning valves: S803-FV, S804-FV & S807-FV;
2. Three magnetic flow meters: S801-FE, S802-FE & S805-FE;
3. Two suspended solids analyzers: S806-AE & S808-AE;
4. One high level switch: S809-LSH.

The site plan provided in Figure 2-1 shows the location of the clarifiers with respect to the reactors. Equipment locations are found in the ground floor and basement floor plans shown in Figures 2-2 and 2-3. Sectional details of the clarifier inlet pipes are provided in Figure 2-4.



SECONDARY CLARIFIER SITE LOCATION

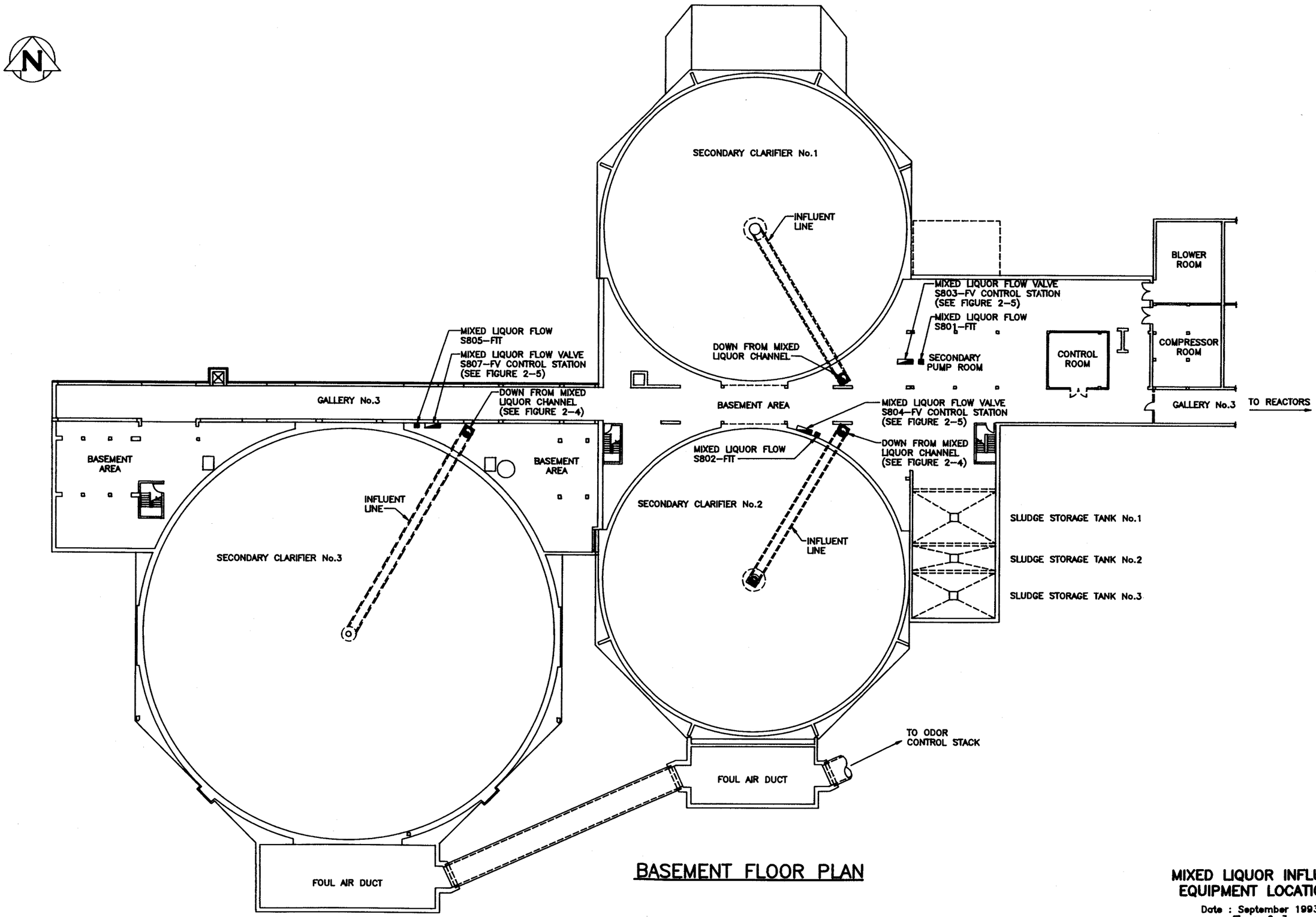
Date : September 1993
Figure 2-1



GROUND FLOOR PLAN

MIXED LIQUOR INFLUENT EQUIPMENT LOCATIONS

Date : September 1993
Figure 2-2



BASEMENT FLOOR PLAN

MIXED LIQUOR INFLUENT EQUIPMENT LOCATIONS

Date : September 1993
Figure 2–3

2.3 MONITORING AND CONTROL

2.3.1 Process Equipment

Each of the three positioning valves, S803-FV, S804-FV, and S807-FV, is controlled from a "REMOTE/LOCAL" switch at a local control station. In the "LOCAL" position an operator can set the valve position utilizing the "OPEN" and "CLOSE" pushbuttons at the station. In the "REMOTE" position valve control is surrendered to the INFI 90.

The locations of the three valve control stations are shown in Figure 2-3. A typical control station layout is provided in Figure 2-5.

The INFI 90 monitors the position of the "REMOTE/LOCAL" control switch and also the valve position.

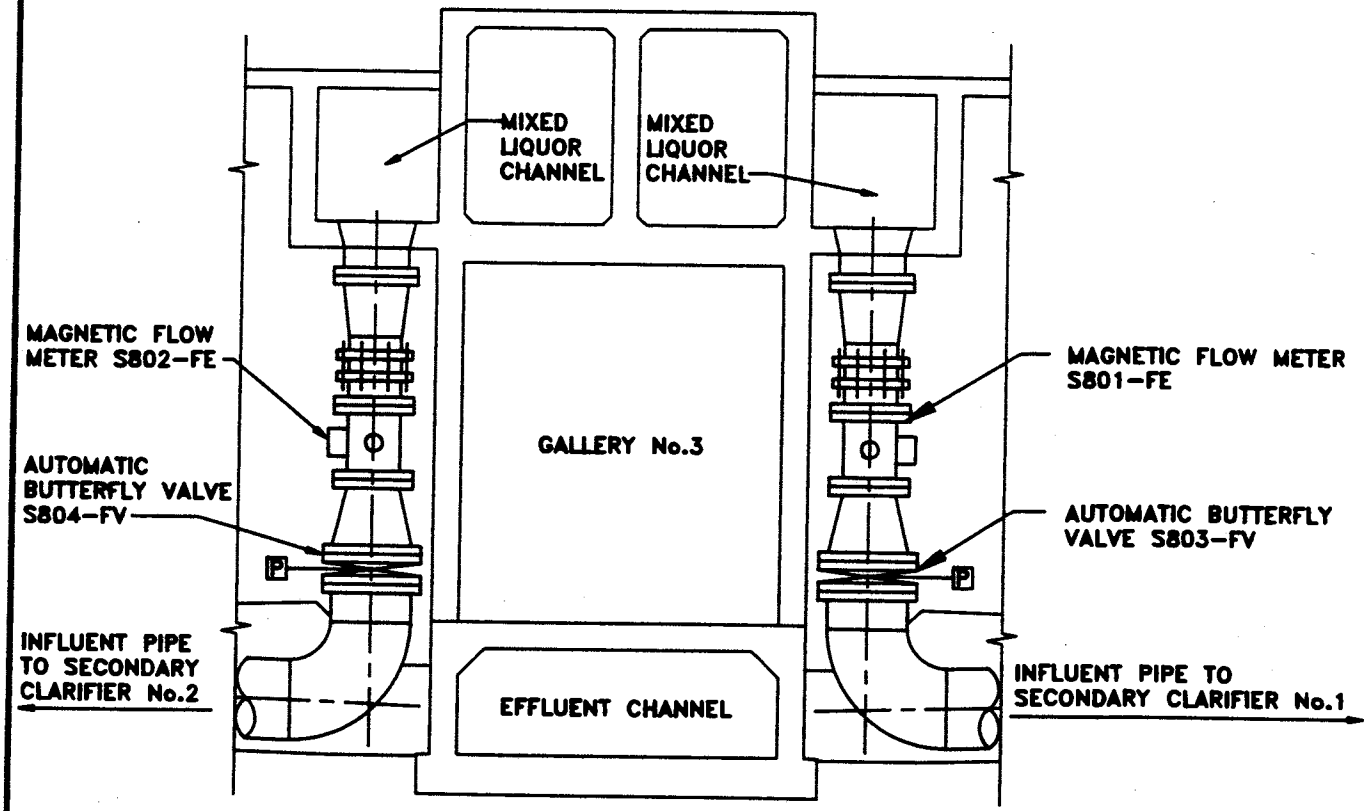
Flow through the inlet pipes is monitored continuously by three magnetic flowmeters designated S801-FE, S802-FE and S805-FE. The flow rate is displayed at a local indicating transmitter and reported to the INFI 90. The locations of the three transmitters are shown in Figure 2-3.

The suspended solids level in the channels are monitored by two suspended solids analyzers designated S806-AE and S808-AE. The level is displayed at a local indicating transmitter and reported to the INFI 90.

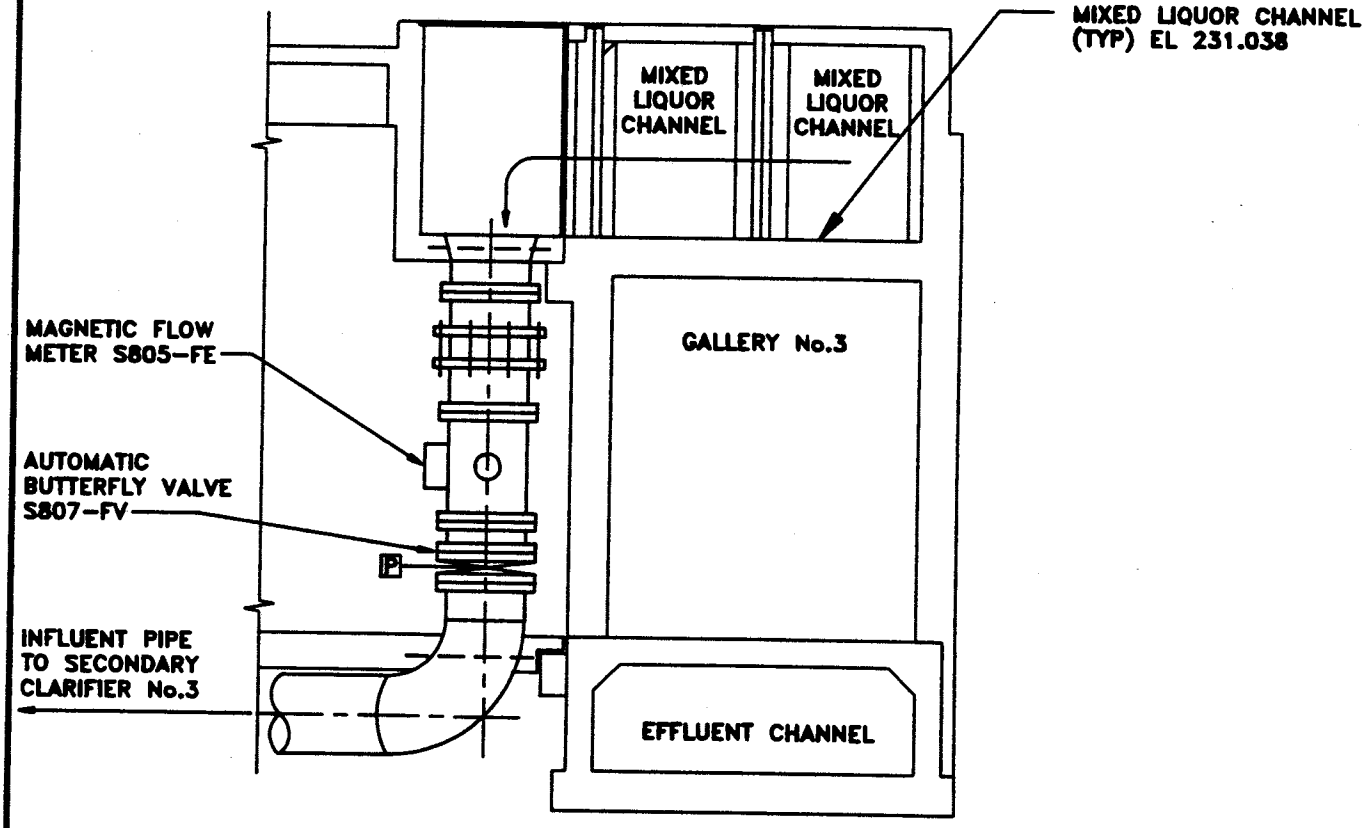
A level switch alarms the INFI 90 upon high level status in the overflow channel.

The locations of the two analyzers and the level switch are shown in Figure 2-3.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 2-1. Equipment/Instrument Summary Table 2-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Process Alarms Summary Table 1-3. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 2-6.



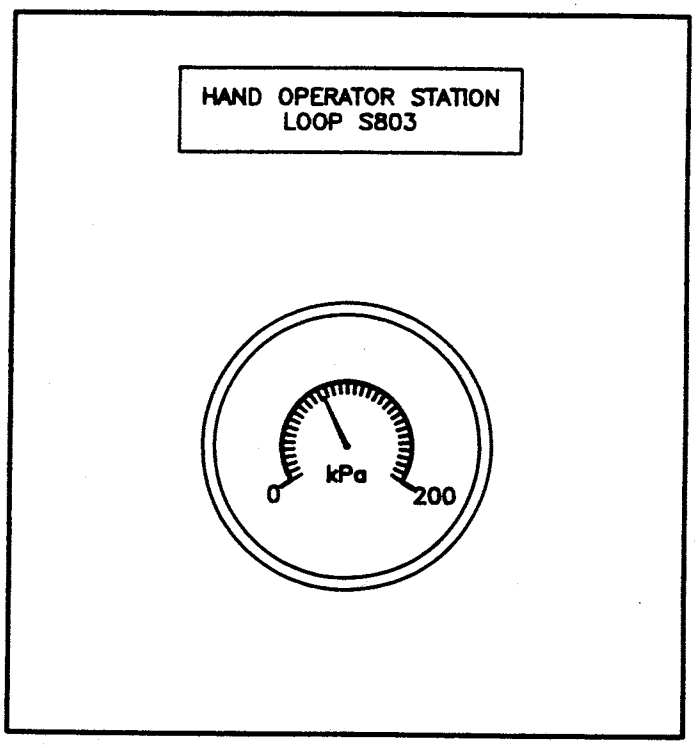
SECONDARY CLARIFIER NO. 1 & 2



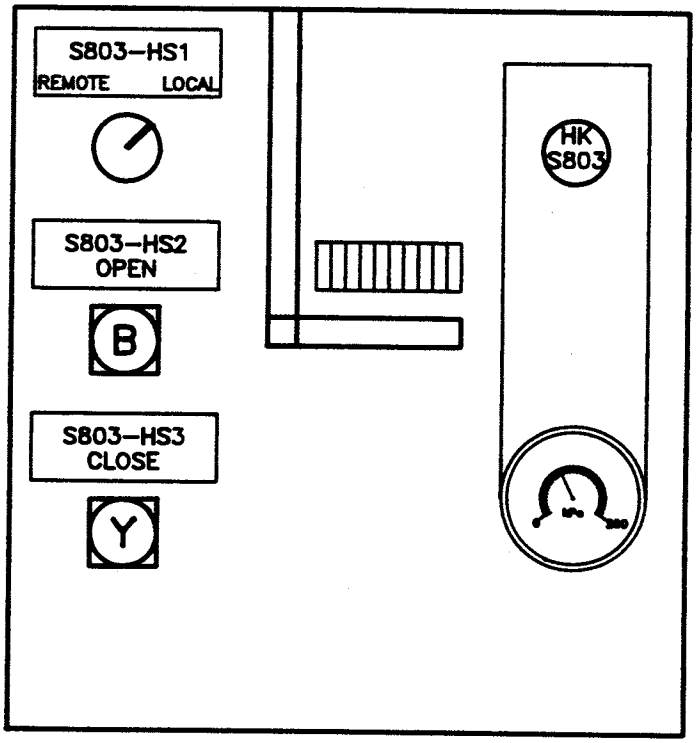
SECONDARY CLARIFIER NO. 3

INFLUENT PIPES SECTIONAL VIEW

Date : September 1993
Figure 2-4



FRONT PANEL



INTERIOR PANEL

NOTE

TYPICAL FOR VALVES
S804–FV & S807–FV

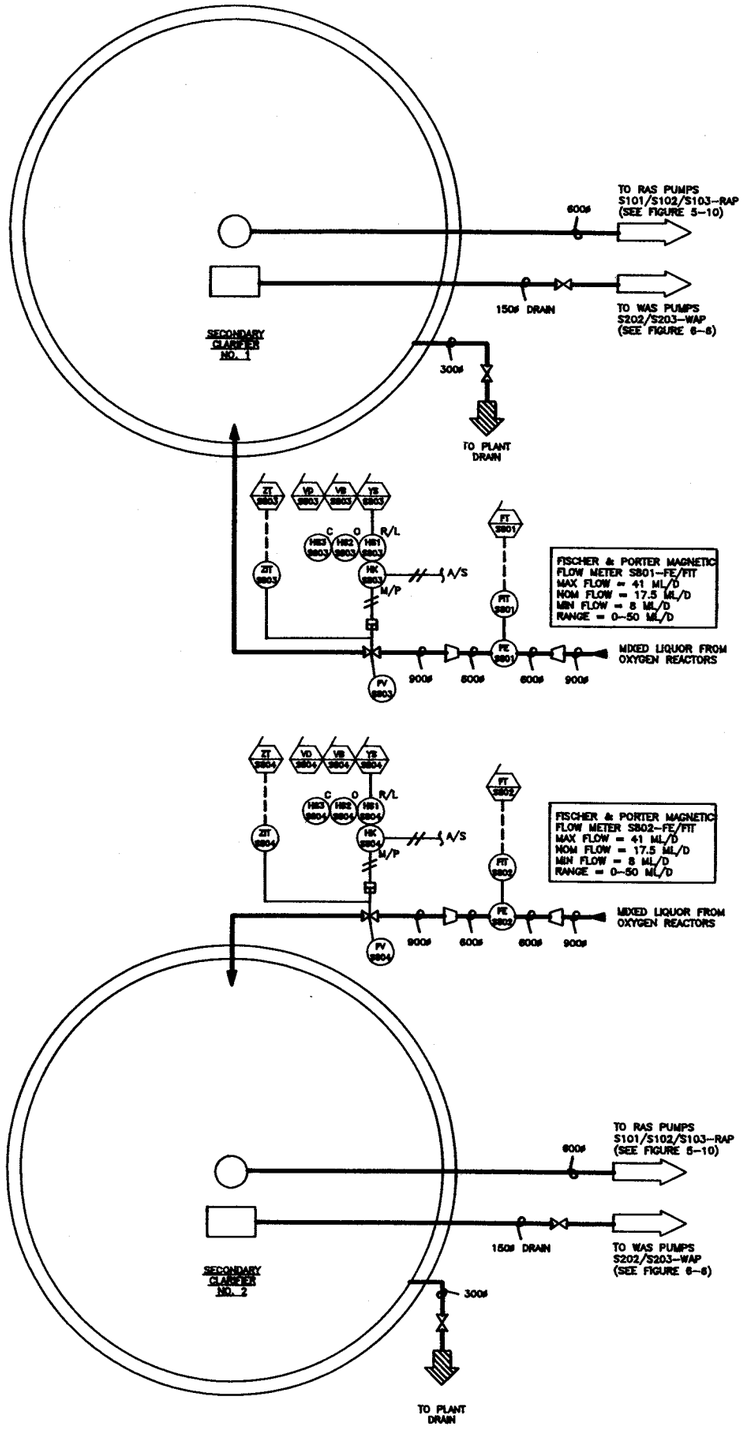
MIXED LIQUOR FLOW VALVE
CONTROL STATION LAYOUT

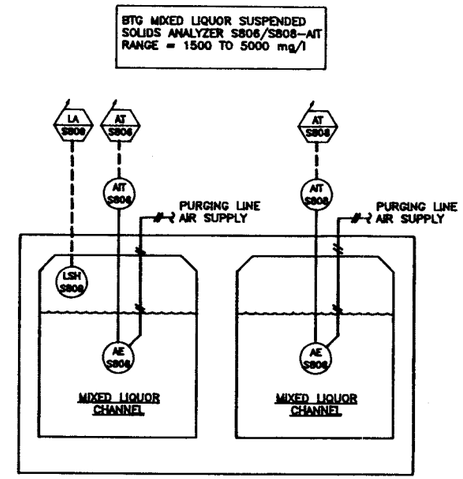
Date : September 1993
Figure 2–5

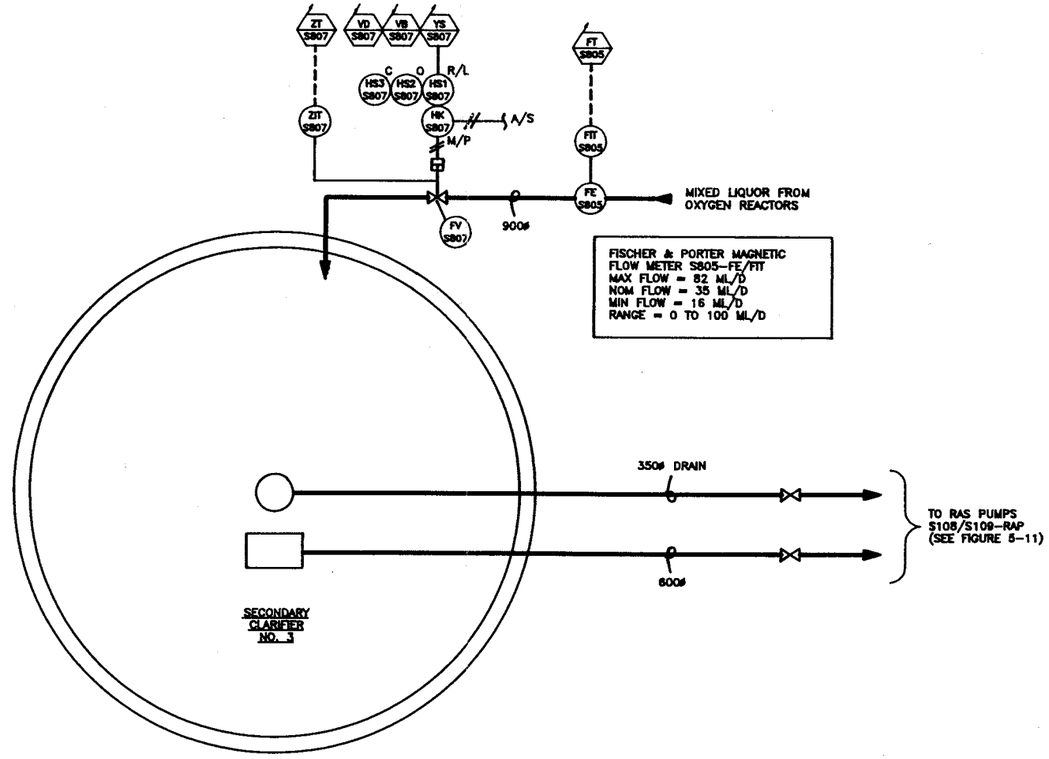
TABLE 2-1

MIXED LIQUOR INFLUENT SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S801-FI	5-A,E,OVERVIEW		5-E			5-A,E,F
S803-FV	5-E	1V	5-E	5-E		5-E
S802-FI	5-A,E,OVERVIEW		5-E			5-A,E
S804-FV	5-E	2V	5-E	5-E		5-E
S805-FI	5-A,F,OVERVIEW		5-F			5-A,E,F
S807-FV	5-F	1V	5-F	5-F		5-F
S806-AI	5-E,F,L		5-E,H,L			5-E,H,L
S808-AI	5-E,F,L		5-E,H,L			5-E,H,L
S809-LA	5-L					5-L







MIXED LIQUOR INFLUENT SYSTEM PROCESS & INSTR. DIAGRAM

Date : September 1993
Figure 2-6

TABLE 2-2

MIXED LIQUOR INFLUENT SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S801-FI	CLAR. #1 M.L. FLOW	I			I	0 - 50 ML/D
S802-FI	CLAR. #2 M.L. FLOW	I			I	0 - 50 ML/d
S805-FI	CLAR. #3 M.L. FLOW	I			I	0 - 100 ML/d
S803-HS1	CLAR. #1 VALVE CONTROL (REM/LOC)		C		I	
S803-HS2	CLAR. #1 VALVE CONTROL (OPEN)		C		C	
S803-HS3	CLAR. #1 VALVE CONTROL (CLOSE)		C		C	
S803-ZI	CLAR. #1 VALVE STATUS - POSITION	I			I	0 - 100%
S804-HS1	CLAR. #2 VALVE CONTROL (REM/LOC)		C		I	
S804-HS2	CLAR. #2 VALVE CONTROL (OPEN)		C		C	
S804-HS3	CLAR. #2 VALVE CONTROL (CLOSE)		C		C	
S804-ZI	CLAR. #2 VALVE STATUS - POSITION	I			I	0 - 100%
S807-HS1	CLAR. #3 VALVE CONTROL (REM/LOC)		C		I	
S807-HS2	CLAR. #3 VALVE CONTROL (OPEN)		C		C	
S807-HS3	CLAR. #3 VALVE CONTROL (CLOSE)		C		C	
S807-ZI	CLAR. #3 VALVE STATUS - POSITION	I			I	0 - 100%
S806-AI	M.L. CHANNEL S.S. LEVEL	I			I	1500 - 5000 mg/L
S808-AI	M.L. CHANNEL S.S LEVEL	I			I	
S809-LA	M.L. CHANNEL HIGH LEVEL ALARM				A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 2-6.

2.3.2 Automatic Control

Automatic control is based on Operator-selected control modes: Most-Open-Valve (MOV) or Total Flow.

MOV mode: 100% of the ML flow is distributed to all "in service" clarifiers. Clarifier #3, in general, receives 50% of the total flow. This mode utilizes a MOV type of strategy to adjust the position of the ML flow control valves.

MOV strategy uses an Operator-selected valve to act as the "most-open-valve". This valve will typically be the control valve in the system with the highest inherent headloss. The MOV strategy opens the selected valve to 95% and then measures the actual flow through the valve. This measured flow value is biased by an Operator-entered factor, and then used as a flow rate setpoint for the remaining control valves in the system. The MOV strategy then modulates the remaining valves in the system individually, to maintain the flow setpoint.

The Mixed Liquor strategy only allows valve S804-FV or valve S807-FV to be selected. The computer will track whichever valve is selected as MOV.

Total Flow mode: All ML control valves feeding "in service" secondary clarifiers are automatically moved to the 95% open position. A clarifier is considered "in service" if the ML control valve "COMPUTER/HAND" selector switch is in the "COMPUTER" position. All "in service" ML control valves remain in the 95% open position unless the flow through an individual valve exceeds the maximum instantaneous flow setpoint.

In automatic control mode (Total Flow only), if the flow through any valve exceeds the maximum instantaneous flow setpoint, that valve is modulated to maintain the maximum setpoint. Automatic MOV selection of the other ML control valves occurs when the flow through the ML control valve selected to be used as the "most open valve" exceeds the capacity of the valve. If the flow through the newly selected valve is exceeded an alarm is generated and the strategy changes to TOV, where the maximum instantaneous flow will modulate the valves.

If the flow in the ML conduit exceeds the capacity of the valves, the over flow passes into the bypass channel.

2.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific screen graphic displays noted here and summarized in Bridging Table 2-1.

Using the displays and control keyboard, the Operator is able to manually open/close/ position each ML control valve (S803-S804/S807), and adjust the following automatic parameters:

1) Select automatic control mode (MOV or Total Flow);

2) Select the ML control valve to be used as the "most-open-valve". If the valve selected is not available for computer control ("COMPUTER/HAND" selector switch in "HAND" position), the automatic strategy will be de-activated and an alarm will be initiated;

3) Set bias factors for each clarifier;

4) Select automatic or manual control of ML control valve;

5) Set flow setpoints for ML flow controllers in automatic;

6) Select Operator entered flow setpoint or calculated setpoint;

7) Computer programmer to adjust the "maximum instantaneous flow" setpoint;

8) Select ML suspended solids valve.

Clarifier #1 and #2 - Graphic 5E - Clarifier #3 - Graphic 5F operating procedures:

1) Verify that ML valve S807 is in "COMPUTER" - Graphic 5F;

2) Verify that ML valve S803 and S804 are in "COMPUTER" - Graphic 5E;

3) From either Graphic 5E or 5F, press "V" and select the control mode. "TOV" = Total Flow Mode or "MOV" = Most Open Valve Mode;

4) From either Graphic 5E or 5F, press "M" and select the ML valve to be the "Most Open Valve". S804 = Clarifier #2 or S807 = Clarifier #3 (if you selected MOV mode);

5) From Graphic 5E, press "1B" and enter the Flow Bias for Clarifier #1 or, press "2B" and enter the Flow Bias for Clarifier #2. Or, from Graphic 5F, press "1B" and enter the Flow Bias for Clarifier #3.

NOTE: The ML valve which was selected as MOV will open 95% and the actual flow through the valve is measured. This measured flow value is biased by the "Bias Factor" which the Operator has entered. This factor is used as a flow rate setpoint for the other ML valves;

6) From Graphic 5E, press "1V" and verify that the ML valve S803 is in "auto". Then, press "2V" and verify that the ML valve S804 is in "auto". From Graphic 5F, press 1V" and verify that the ML valve S807 is in "auto";

7) From either Graphic 5E or 5F, press "4C" and select the method of the suspended solids calculation, (Calc by Operator entry or metered);

8) From either Graphic 5E or 5F, press "4A" (ML Suspended Solids Operator Entered Value) and enter a value;

9) From either Graphic 5E or 5F, press "4B" (RAS Suspended Solids Operator Entered Value) and enter a value.

NOTE: This system interfaces with the "RAS Pumping System", "WAS Pumping System" and the "PE Splits Systems".

2.4 ROUTINE CHECKS

1. **Automatic Positioning Valves:** S803-FV, S804-FV & S807-FV
   Check that the valves are not leaking and that the pneumatic actuators are operating correctly.

2.5 EQUIPMENT DATA

1. **Automatic Positioning Valves:** S803-FV, S804-FV & S807-FV

Locations:	Clarifier Basement Areas	
Purpose:	To control flow of mixed liquor from oxygen reactors to secondary clarifiers.	
Manufacturer:	Valve:	Keystone
	Actuator:	GH Bettis Model #1312-M

2. **Magnetic Flow Meters:** S801-FE/FIT, S802-FE/FIT & S805-FE/FIT

Locations:	Clarifier Basement Areas	
Purpose:	To measure flow of mixed liquor from oxygen reactors to secondary clarifiers.	
Manufacturer:	Fischer Porter, Model 50SD1	
	Range:	0 - 50 ML/d (S801-FE & S802-FE)
		0 - 100 ML/d (S805-FE)
	Input:	120 VAC, 60 Hz; Output: 4-20 mADC

3. **Suspended Solids Analyzers:** S806-AE/AIT & S808-AE/AIT

Location:	Walkway	
Purpose:	To measure level of suspended solids in mixed liquor channels	
Manufacturer:	BTG Suspended Solids Meter Type MEX-3	
	Range:	1500 - 5000 mg/L
	Input:	120 VAC, 60 Hz; Output: 4-20 mADC

3.0 SECONDARY CLARIFIER TANKS

3.1 PURPOSE

The purpose of the secondary clarifier tanks is to provide for clarification by settling of the mixed liquor from the oxygen reactors. This process consists of separating and removing the heavier and lighter suspended particles from the mixed liquor to produce a clarified effluent.

3.2 SYSTEM DESCRIPTION

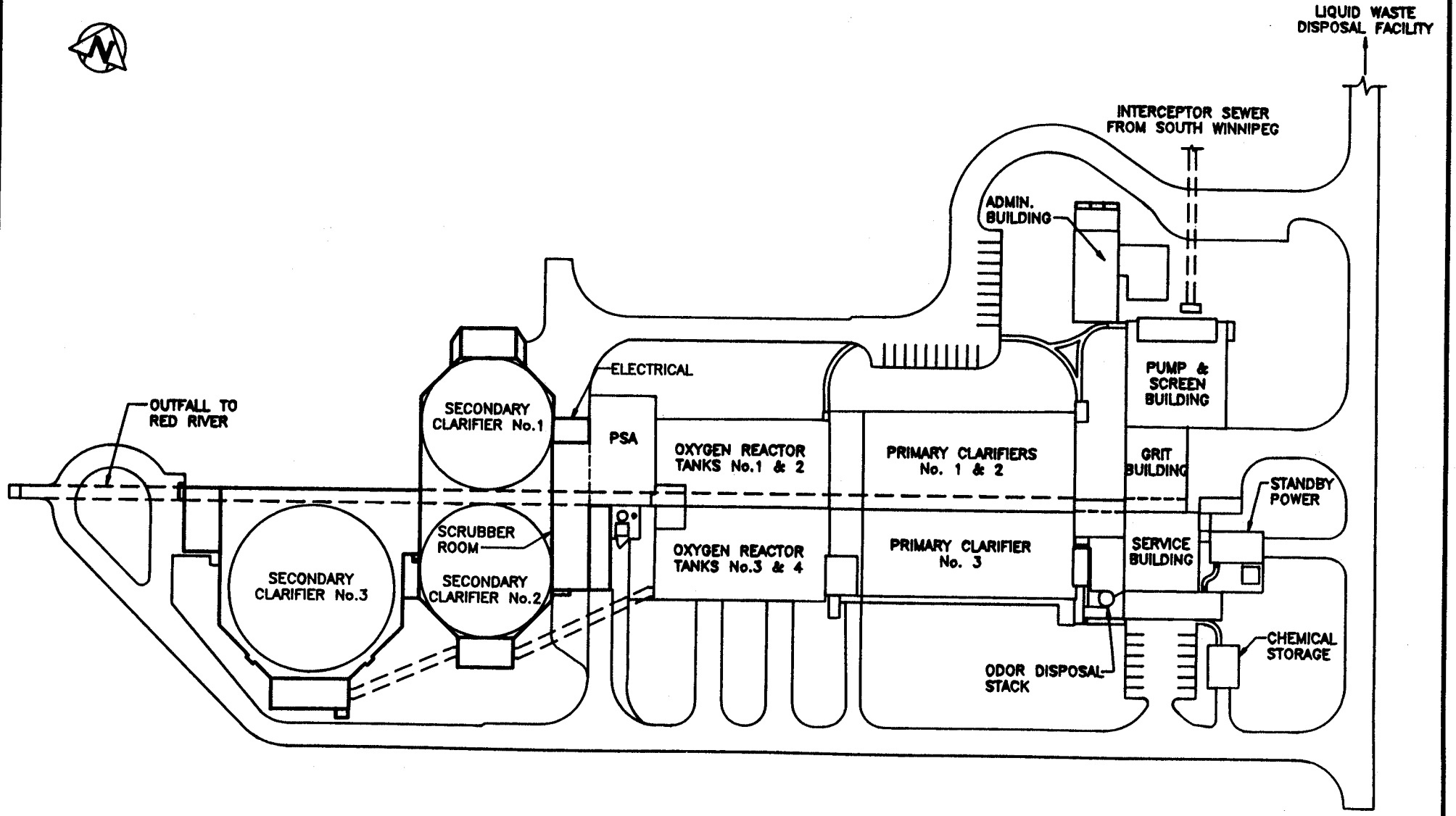
The secondary clarifier system has a total of three circular tanks located on the west side of the plant as shown on the site plan in Figure 3-1.

Clarification of the mixed liquor begins once it is discharged from the influent well located at the centre of the clarifier. The tanks retain the mixed liquor for a period ranging from 200 to 400 minutes in a relatively quiescent state. During this period of time, the suspended solids are separated from the mixed liquor. The heavier particles settle to produce sludge while the lighter particles float to produce scum.

Each clarifier has a 300 ϕ drain line and valve feeding into the plant drain line to allow for draining of a tank. Clarifier filling and draining requires the use of the RAS and WAS pumps.

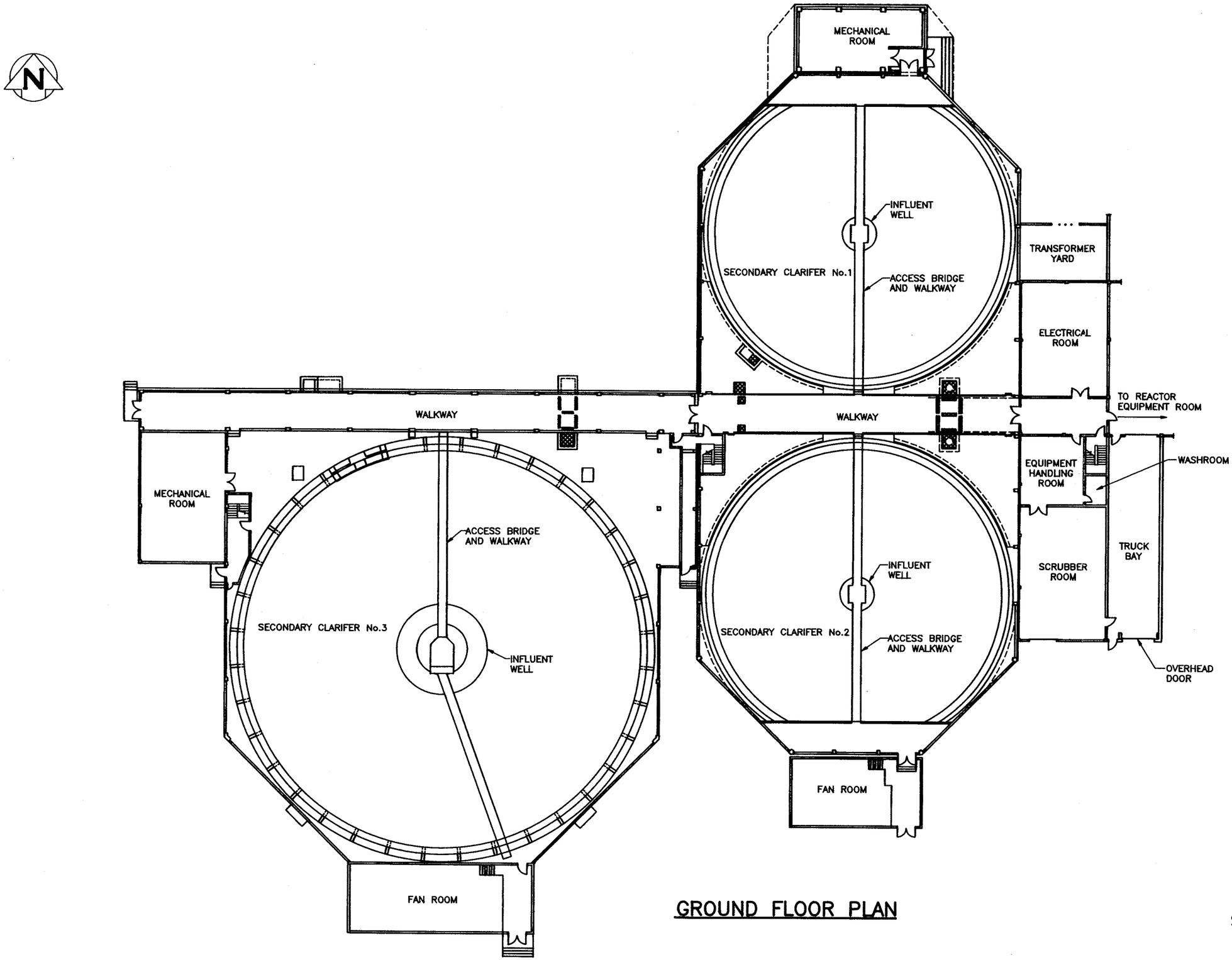
Equipment locations are found on the ground floor and basement floor plans shown in Figures 3-2 and 3-3.

Physical dimensions and hydraulic characteristics of the tanks are detailed in Table 3-1.



SECONDARY CLARIFIER TANKS
SITE LOCATION

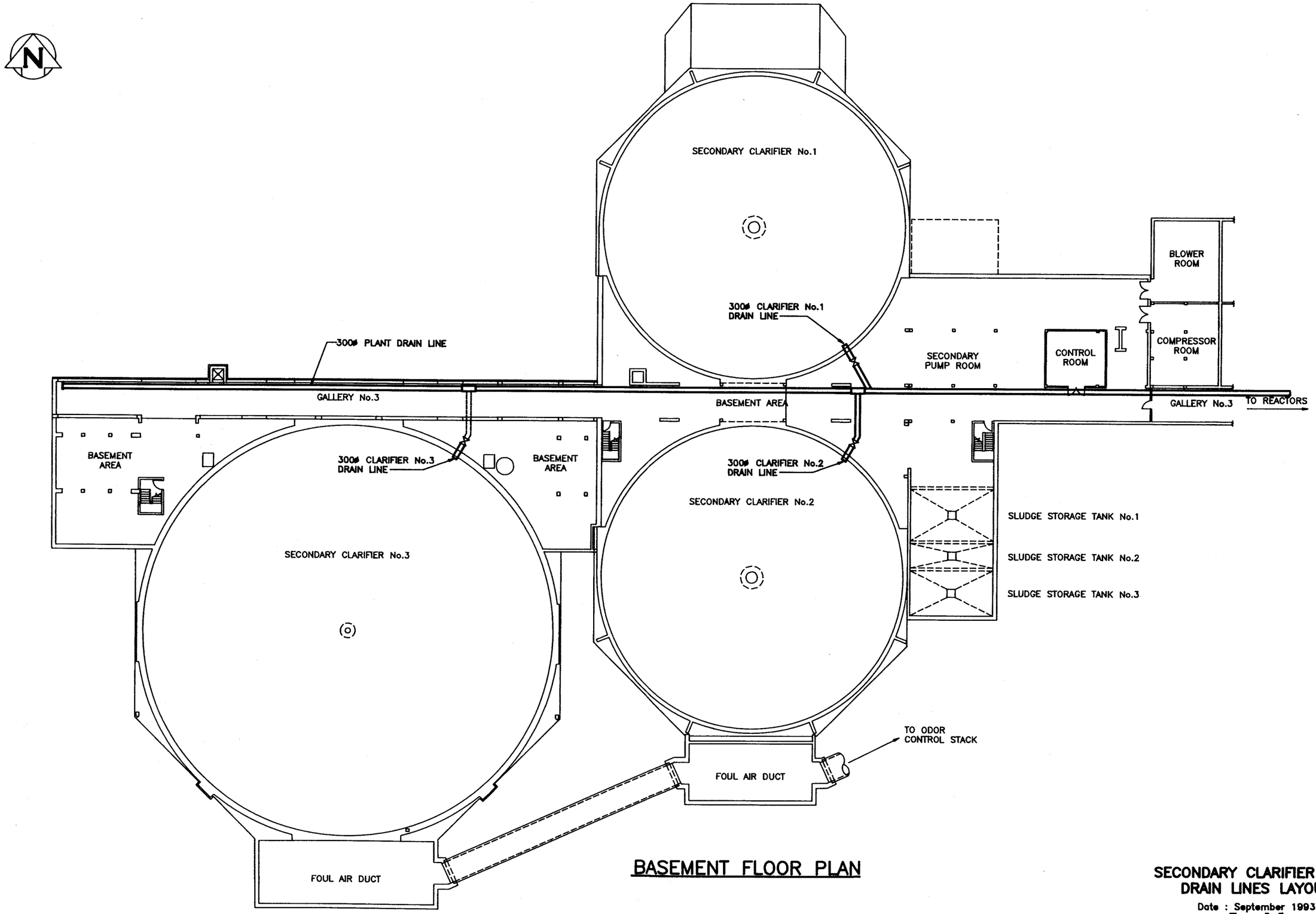
Date : September 1993
Figure 3-1



GROUND FLOOR PLAN

SECONDARY CLARIFIER TANKS LAYOUT

Date : September 1993
Figure 3-2



BASEMENT FLOOR PLAN

SECONDARY CLARIFIER TANK DRAIN LINES LAYOUT

Date : September 1993
Figure 3-3

TABLE 3-1

SECONDARY CLARIFIER PHYSICAL & HYDRAULIC DATA

	Clarifier No. 1 & No. 2	Clarifier No. 3
Diameter (m)	33.5	45.7
Side Wall Depth (m)	4.6	4.6
Volume (m^3) each	4048.0	7544
Surface areas (m^2) each	880.0	1640
Weir Length (m) each	105	144
Flow Distribution (ML/d)		
ADWF (58 ML/d each)	14.5	29
PDWF (100 ML/d)	25	50
% (each)	25	50
Detention Time (HR)		
ADWF (58 ML/d)	6.70	6.24
PDWF (100 ML/d)	3.89	3.62
Surface Overflow Rate ($m^3/m^2/d$)		
ADWF (58 ML/d)	3.66	3.84
PDWF (100 ML/d)	6.18	6.63
Weir Loading		
ADWF (58 ML/d)	201	201
PWWF (100 ML/d)	347	347

3.3 CLARIFIER FILLING

Pre-filling Checks

1. Ensure that the 300 mm diameter drain valve is closed;
2. Examine the entire tank to ensure that no tools or debris remain within the tank;
3. Operate the bridge drive mechanism at least one full turn to ensure that it operates freely. See Section 4.0 for details of mechanism operation.

Filling Procedure

1. SLOWLY open the automatic butterfly valve feeding mixed liquor into the tank. This ensures that the tank fills with minimal adverse effect on the mixed liquor flow balance. All stem measurements are recorded in the "SECONDARY LOG BOOK". See Section 2.0 for details of valve operations;
2. Allow the clarifier to fill and overflow the weirs;
3. Start the bridge drive mechanism as detailed in Section 4.0;
4. Start the RAS pumps as detailed in Section 5.0.

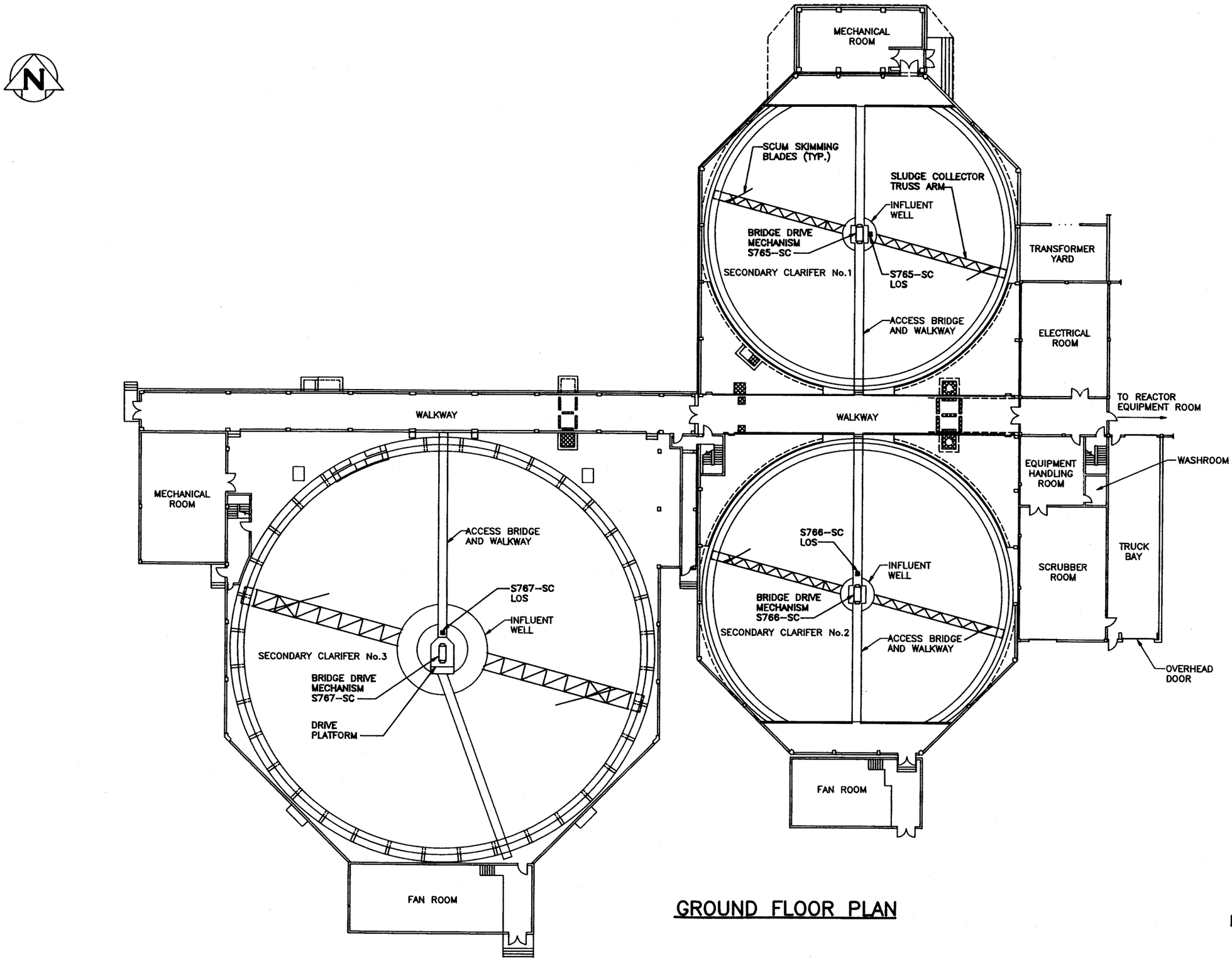
3.4 CLARIFIER DRAINING

1. Close the automatic butterfly control valves;
2. Draw the sludge blanket level down with RAS pumps and then stop the associated RAS pump;
3. Close the RAS valve to the associated pump;
4. OPEN the 300 mm diameter drain valve to the 300 mm plant drain;
5. STOP the sludge collector mechanism;
6. Hose down the clarifier floor and redrain the clarifier.

Clarifier No. 3: Drain clarifier down using RAS pumps.

Clarifiers No. 1 & 2: After draining down with the 300 mm plant drain to floor level close the 300 mm drain valve.

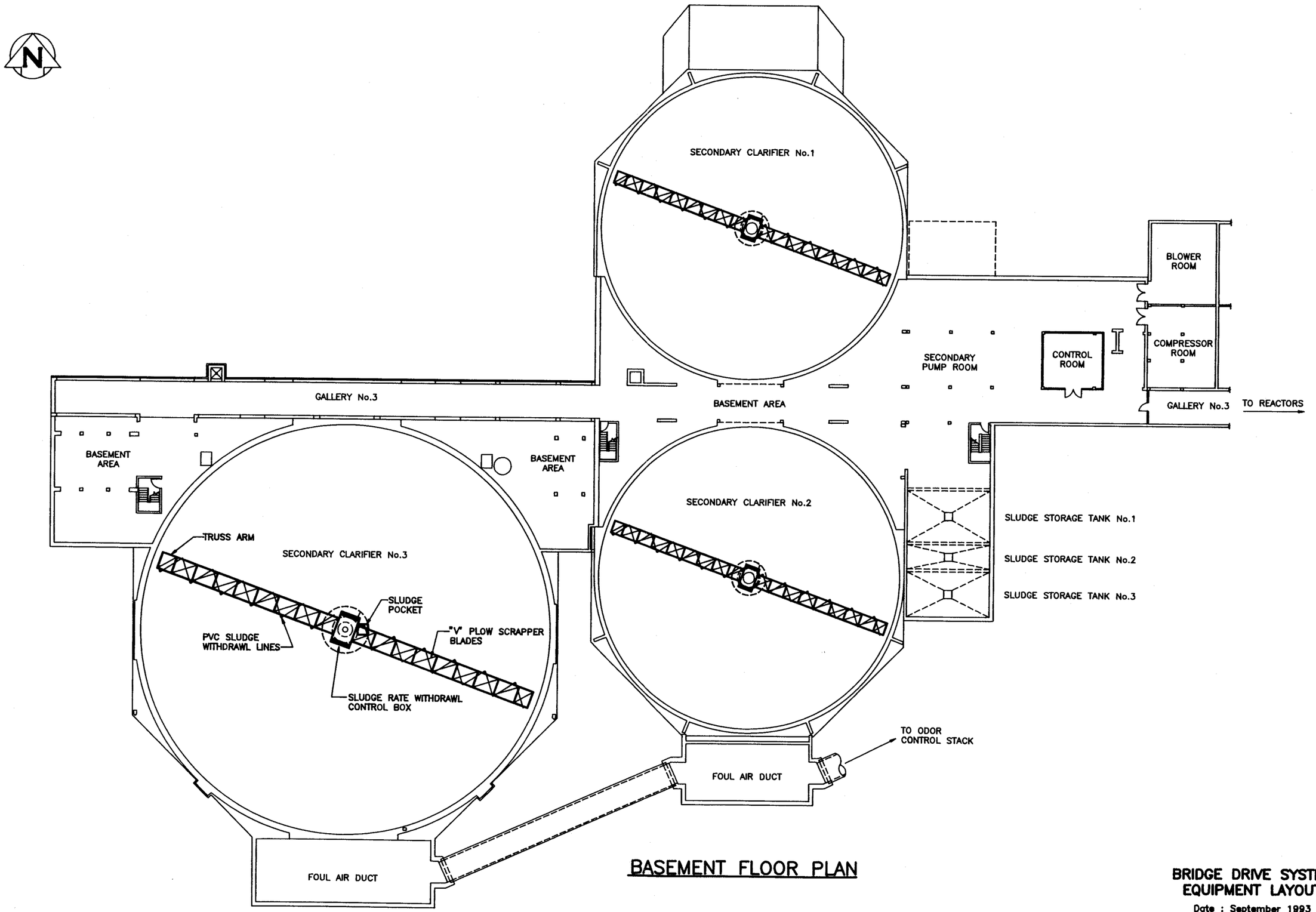
The remaining sludge must be pumped out using the WAS pumps and the 150 mm drain on the WAS line.



GROUND FLOOR PLAN

BRIDGE DRIVE SYSTEM EQUIPMENT LAYOUT

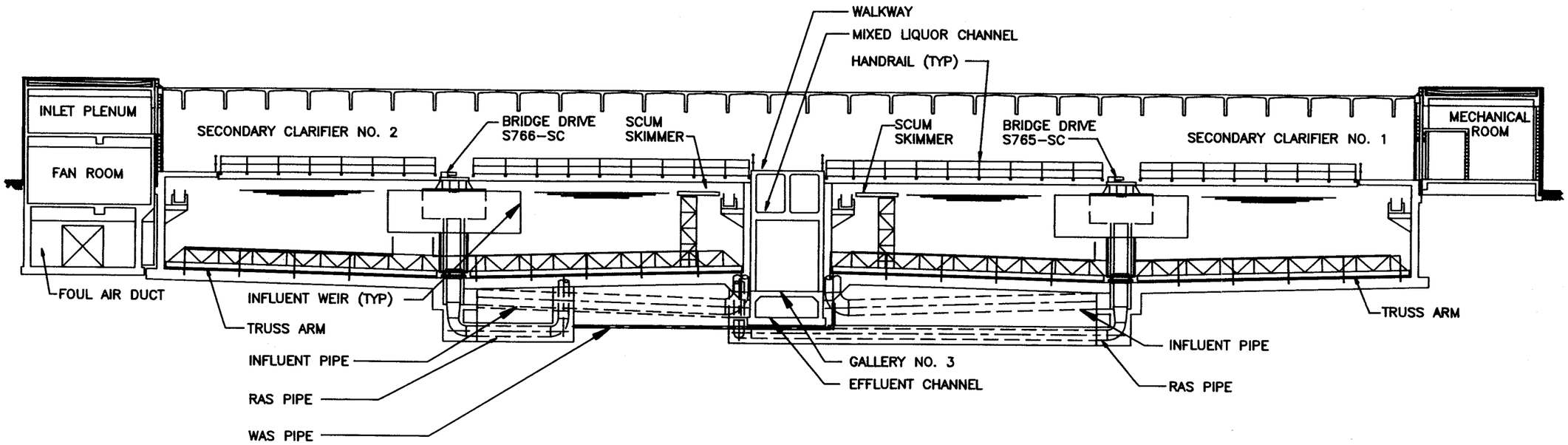
Date : September 1993
Figure 4–1



BASEMENT FLOOR PLAN

BRIDGE DRIVE SYSTEM EQUIPMENT LAYOUT

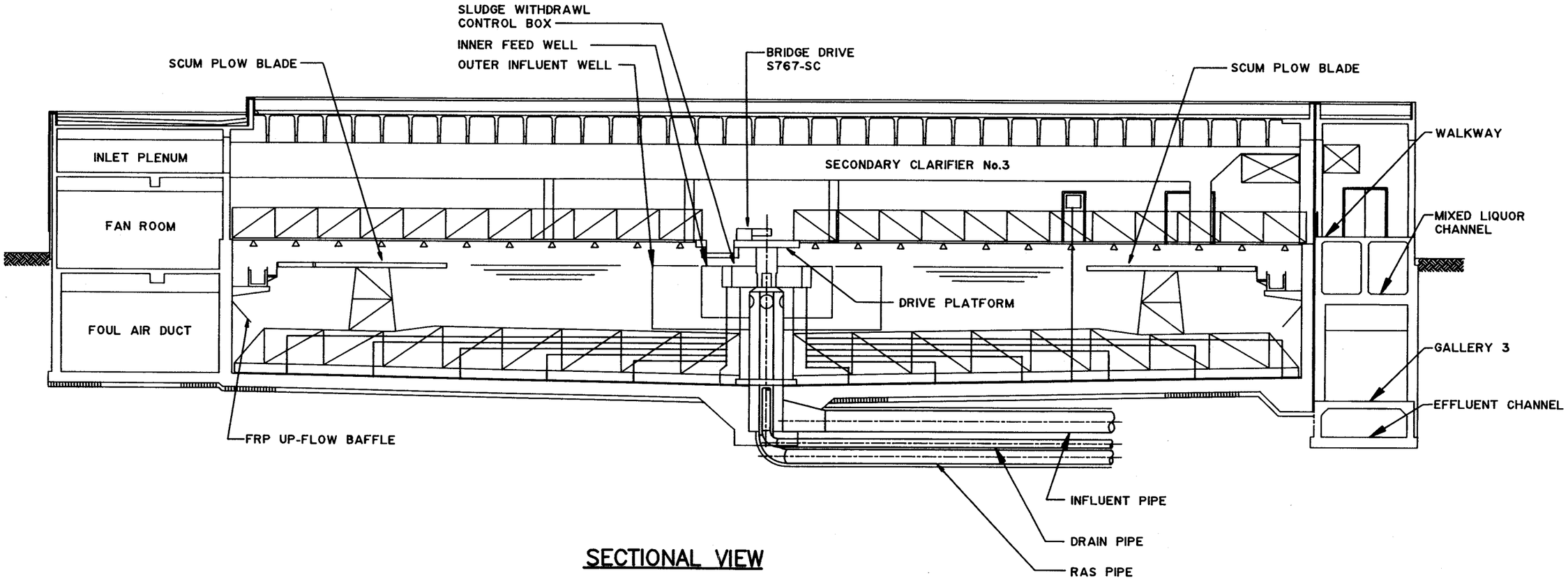
Date : September 1993
Figure 4–2



SECTIONAL VIEW

CLARIFIERS No.1 & 2
BRIDGE DRIVE SYSTEM

Date : September 1993
Figure 4-3



SECTIONAL VIEW

NOTE:

FOR DETAIL OF DRIVE PLATFORM
REFER TO FIGURE 4-5

CLARIFIER No.3
BRIDGE DRIVE SYSTEM

Date : September 1993
Figure 4-4

4.0 BRIDGE DRIVE SYSTEM

4.1 PURPOSE

Each clarifier is equipped with a bridge drive mechanism which collects the sludge at the bottom of the clarifier as well as the scum floating on the surface.

4.2 SYSTEM DESCRIPTION

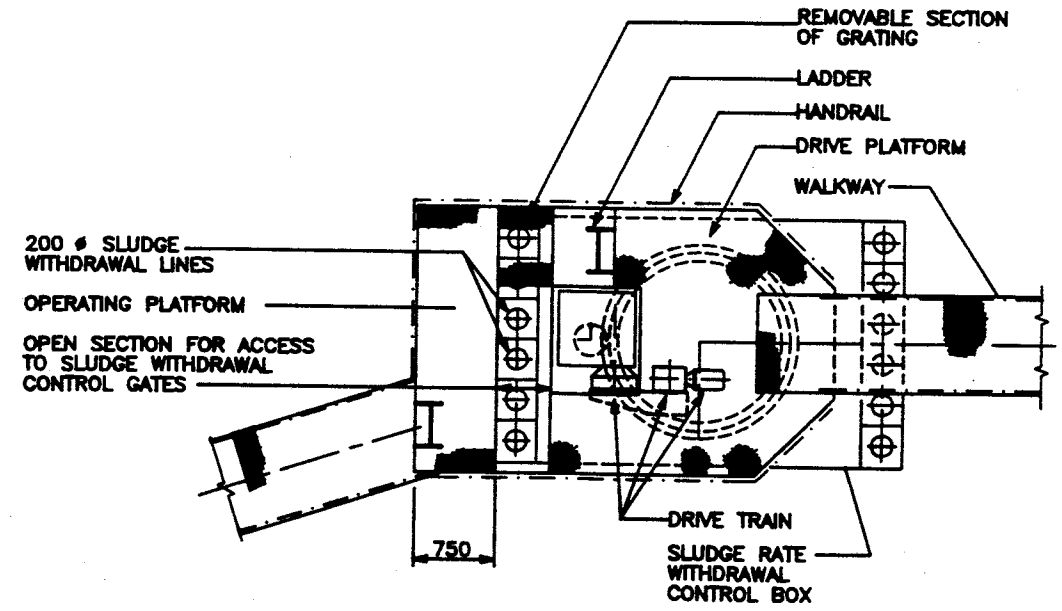
The clarifiers are of the centre column siphon feed and peripheral overflow type with a central bridge driving mechanism which supports and rotates a centre cage with two sludge rake arms and two scum blades. Sludge is syphoned off by draft tubes to a central hopper. Scum is collected over the water surface, dewatered over a beach plate, and dumped into a hopper which drains to a scum tank.

Complete descriptions of the sludge and scum systems are provided in Sections 5.0, 6.0, and 7.0.

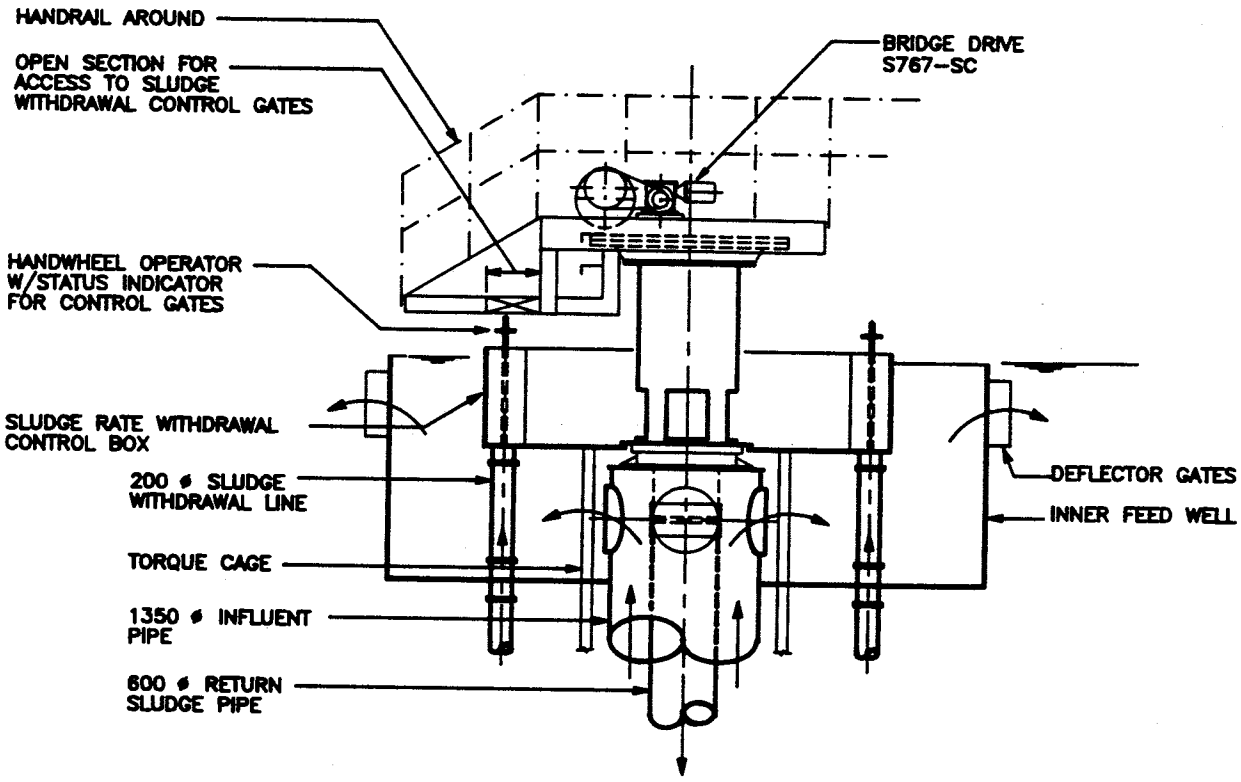
A summary of the equipment described in this section is as follows:

1. Secondary Clarifier No. 1 Bridge Drive Mechanism: S765-SC;
2. Secondary Clarifier No. 2 Bridge Drive Mechanism: S766-SC;
3. Secondary Clarifier No. 3 Bridge Drive Mechanism: S767-SC.

Equipment layouts are found on the ground floor and basement floor plans shown in Figures 4-1 and 4-2. Sectional views of the clarifiers are provided in Figures 4-3 and 4-4. Figure 4-5 shows a detailed layout of the bridge drive platform.



PLAN

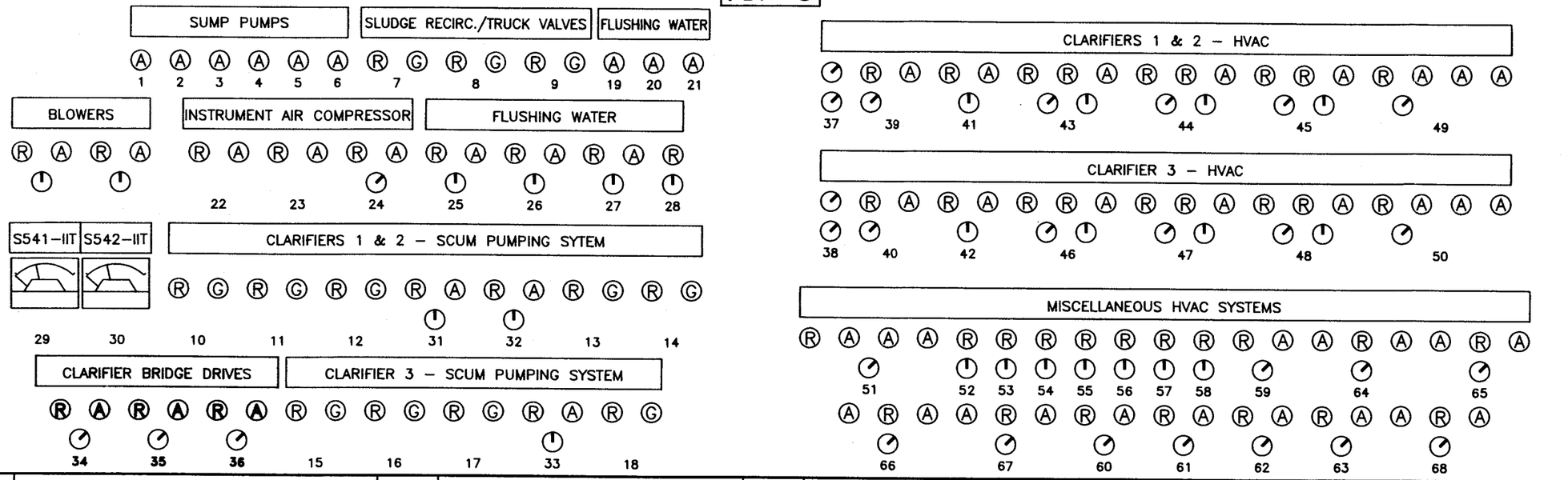


SECTION

CLARIFIER No.3
DRIVE PLATFORM DETAIL

Date : September 1993
Figure 4-5

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	Ⓡ Ⓖ A – OPEN, B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	Ⓡ Ⓐ, C⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	Ⓡ Ⓐ, C① A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A Ⓡ, B① A – RUN, B – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	Ⓡ Ⓐ, C①, D A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

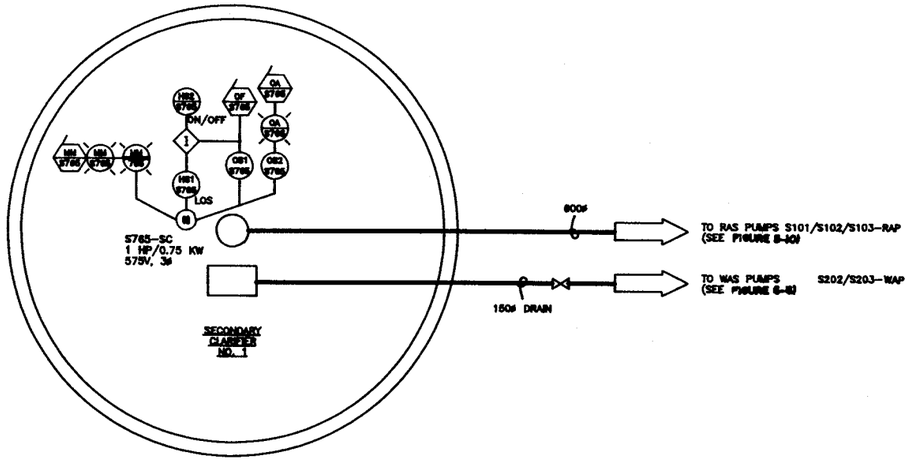
No.	DESCRIPTION
	Ⓡ Ⓐ, C① A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	Ⓡ Ⓐ, C⊘ **A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON**
No. 34–36	
34	**CLARIFIER No.1 BRIDGE – S765–SC**
35	**CLARIFIER No.2 BRIDGE – S766–SC**
36	**CLARIFIER No.3 BRIDGE – S767–SC**
	A⊘, B⊘ A – COMP/HAND, B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	Ⓡ Ⓐ, C⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	Ⓡ Ⓐ, C① A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

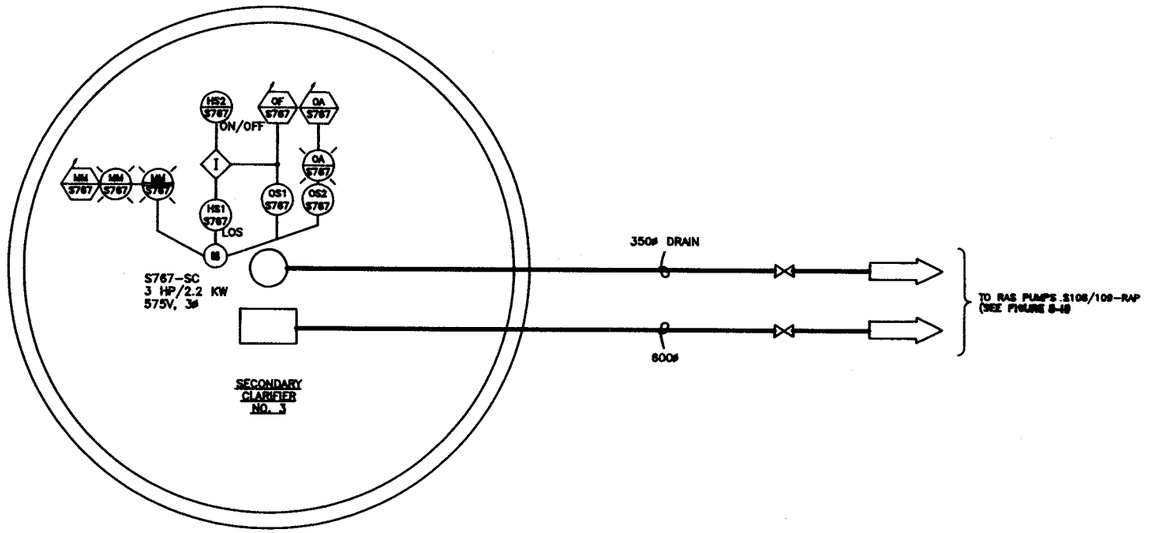
No.	DESCRIPTION
	Ⓡ Ⓡ Ⓐ, D⊘, E① A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	Ⓡ Ⓐ Ⓐ Ⓐ, E⊘ A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A Ⓡ, B① A – RUN, B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	Ⓡ Ⓐ, C⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

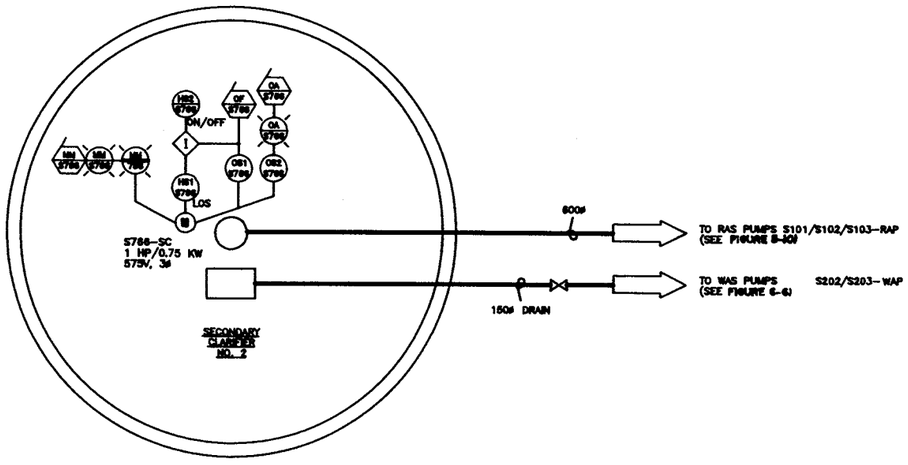
No.	DESCRIPTION
	Ⓐ Ⓡ Ⓐ, D⊘ A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

BRIDGE DRIVE SYSTEM
FIELD DEVICE PANEL FDP–S

Date : September 1993
Figure 4–6







BRIDGE DRIVE SYSTEM PROCESS & INSTR. DIAGRAM

Date : September 1993

Figure 4-7

4.3 MONITORING AND CONTROL

4.3.1 Process Equipment

Each of the bridge drive mechanisms, S765-SC, S766-SC & S767-SC, is controlled from an "ON/OFF" switch at FDP-S. Drive "RUN" status indication is available at FDP-S and at the MCC. In addition, a "HIGH TORQUE FAIL" alarm is monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of the drives is shown in Figure 4-6.

The INFI 90 monitors the following drive parameters:

1. Drive "RUN" status;
2. Drive "HIGH TORQUE" warning;
3. Drive "HIGH TORQUE FAILURE" alarm.

The "HIGH TORQUE FAILURE" alarm condition will immediately stop the drive. The drive can be manually shut down and locked-out using the "LOCK-OFF-STOP" (LOS) pushbutton field located near each unit. The buttons may be found on the floor plan in Figure 4-1.

Cross reference between this equipment and the INFI 90 may be found in Bridging Table 4-1. Equipment/Instrument Summary Table 4-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in the Process Alarms Summary Table 1-3. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 4-7.

4.3.2 Automatic Control

The INFI 90 does not control the rotating bridge drives. The drives should be turned "on" from FDP-S whenever a clarifier is "in service".

TABLE 4-1

BRIDGE DRIVE SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S765-SC	5-E					5-E
S766-SC	5-E					5-E
S767-SC	5-F					5-F

TABLE 4-2

BRIDGE DRIVE SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S765-HS1	BRIDGE DRIVE CONTROL (LOS)	S				
S765-HS2	BRIDGE DRIVE CONTROL (ON/OFF)			C		
S765-MM	BRIDGE DRIVE STATUS - RUN		I	I	I	
S765-OA	HIGH TORQUE			A	A	100%
S765-OF	HIGH TORQUE FAILURE				A	125%
S766-HS1	BRIDGE DRIVE CONTROL (LOS)	S				
S766-HS2	BRIDGE DRIVE CONTROL (ON/OFF)			C		
S766-MM	BRIDGE DRIVE STATUS - RUN		I	I	I	
S766-OA	HIGH TORQUE			A	A	100%
S766-OF	HIGH TORQUE FAILURE				A	125%
S767-HS1	BRIDGE DRIVE CONTROL (LOS)	S				
S767-HS2	BRIDGE DRIVE CONTROL (ON/OFF)			C		
S767-MM	BRIDGE DRIVE STATUS - RUN		I	I	I	
S767-OA	HIGH TORQUE			A	A	40%
S767-OF	HIGH TORQUE FAILURE				A	80%

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 4-7.

4.4 ROUTINE CHECKS

1. Check oil levels in the gear box regularly;
2. Regularly inspect drive mechanism for wear and damage.
3. Regularly inspect and calibrate bridge drive torque switches.

4.5 EQUIPMENT DATA

1. **Bridge Drive Motors:** S765-SC and S766-SC

   Location: Clarifiers No. 1 & No. 2 drive platform

   Purpose: Provide driving mechanism for bridge

   Manufacturer: Sterling Power Systems Inc., Type FBNF-2

   0.56 kw (0.75 hp), 575V, 3 ph, 60 Hz, 1800 rpm, 1.0 FLA

   Gear Reduction Ratio: 105.9

2. **Bridge Drive Motor:** S767-SC

   Location: Clarifier No. 3 drive platform

   Purpose: Provide driving mechanism for bridge

   Manufacturer: SEW - Eurodrive, Type R76DT80N4

   0.75 kw (1.0 hp), 330/575V, 3 ph, 60 Hz, 1656/22 rpm, 2.61/1.5 FLA

5.0 RETURN ACTIVATED SLUDGE SYSTEM

5.1 PURPOSE

The purpose of this system is to provide for the removal of the sludge collected from the bottom of the clarifiers by the draft tubes on the drive mechanism. Known as Return Activated Sludge (RAS), it is an integral part of the secondary treatment process because it contains the microorganisms that consume the organic matter contained in the wastewater.

5.2 SYSTEM DESCRIPTION

Each secondary clarifier is equipped with a rotating sludge collector mechanism which withdraws settled sludge through multiple collection pipes. The collector mechanism rotates continuously while a clarifier is in service. Each clarifier has a series of 200 mm diameter suction pipes which are connected to the 600 mm diameter RAS suction header pipe.

Sludge collected in the secondary clarifiers is continuously removed from each "in service" clarifier by variable speed RAS pumps. Clarifiers 1 and 2 are equipped with three variable speed RAS pumps designated S101-RAP, S102-RAP & S103-RAP. Each clarifier has a duty pump while the third pump is a standby for both clarifiers. Clarifier 3 is equipped with two variable speed RAS pumps, S108-RAP & S109-RAP. Similarly, one is duty and the other standby. Each pump is equipped with a magnetic flow meter to monitor RAS flow.

All five RAS pumps are connected to a common RAS header which conveys the RAS to each of the oxygen reactors via one of four train lines. Each line contains a magnetic flow meter and an automatic butterfly positioning valve for accurate control of RAS flow to each reactor.

The sludge blanket level in each clarifier, in addition to the suspended solids level in the RAS header, are continuously monitored.

A summary of the equipment described in this section is as follows:

1. Five variable speed RAS pumps: S101-RAP, S102-RAP, S103-RAP, S108-RAP, and S109-RAP;
2. Five RAS pump magnetic flow meters: S105-FE, S106-FE, S107-FE, S110-FE, and S111-FE;
3. Four automatic butterfly positioning valves: S121-FV, S122-FV, S123-FV, and S124-FV;
4. Four magnetic flow meters: S125-FE, S126-FE, S127-FE, and S128-FE;
5. Three sludge blanket level detectors: S701-LE, S702-LE, and S703-LE;
6. One suspended solids analyzer: S104-AE.

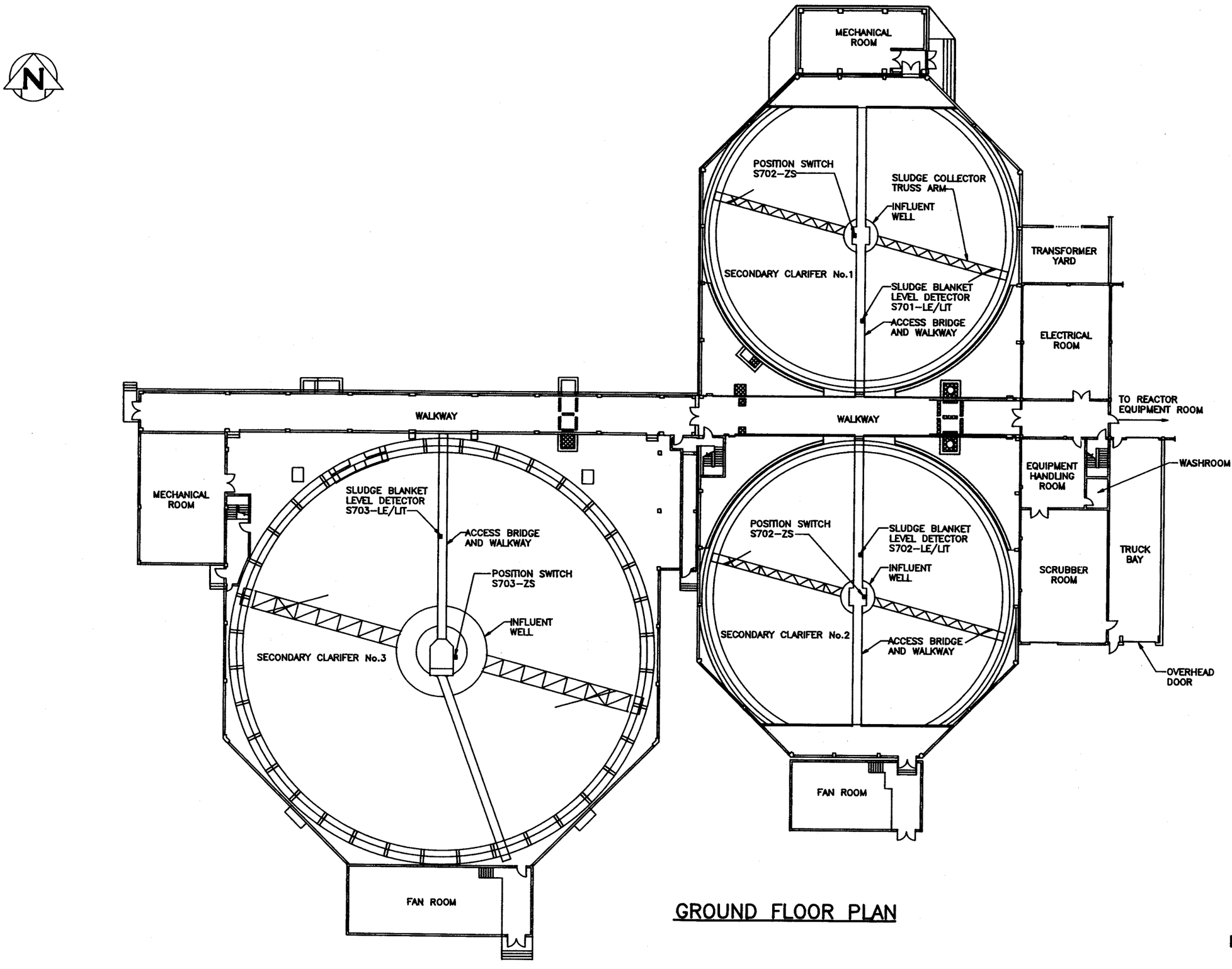
RAS equipment locations are found on the ground floor and basement floor plans shown in Figures 5-1 and 5-2. A sectional view of clarifier No. 3 is provided in Figure 5-3. Figure 5-4 shows a detailed layout of the RAS pumps and piping for all three clarifiers and similarly, Figure 5-5 shows a detailed layout of the RAS piping to the reactors.

5.3 MONITORING AND CONTROL

5.3.1 Process Equipment

The five RAS pumps are monitored and controlled from individual Variable Frequency Drive (VFD) panels located in the Electrical Room on the ground floor as shown in Figure 5-6. A typical layout for the RAS pumps S101-RAP, S102-RAP, and S103-RAP panel is provided in Figure 5-7. Similarly, a typical layout for the pumps S108-RAP and S109-RAP panel is provided in Figure 5-8.

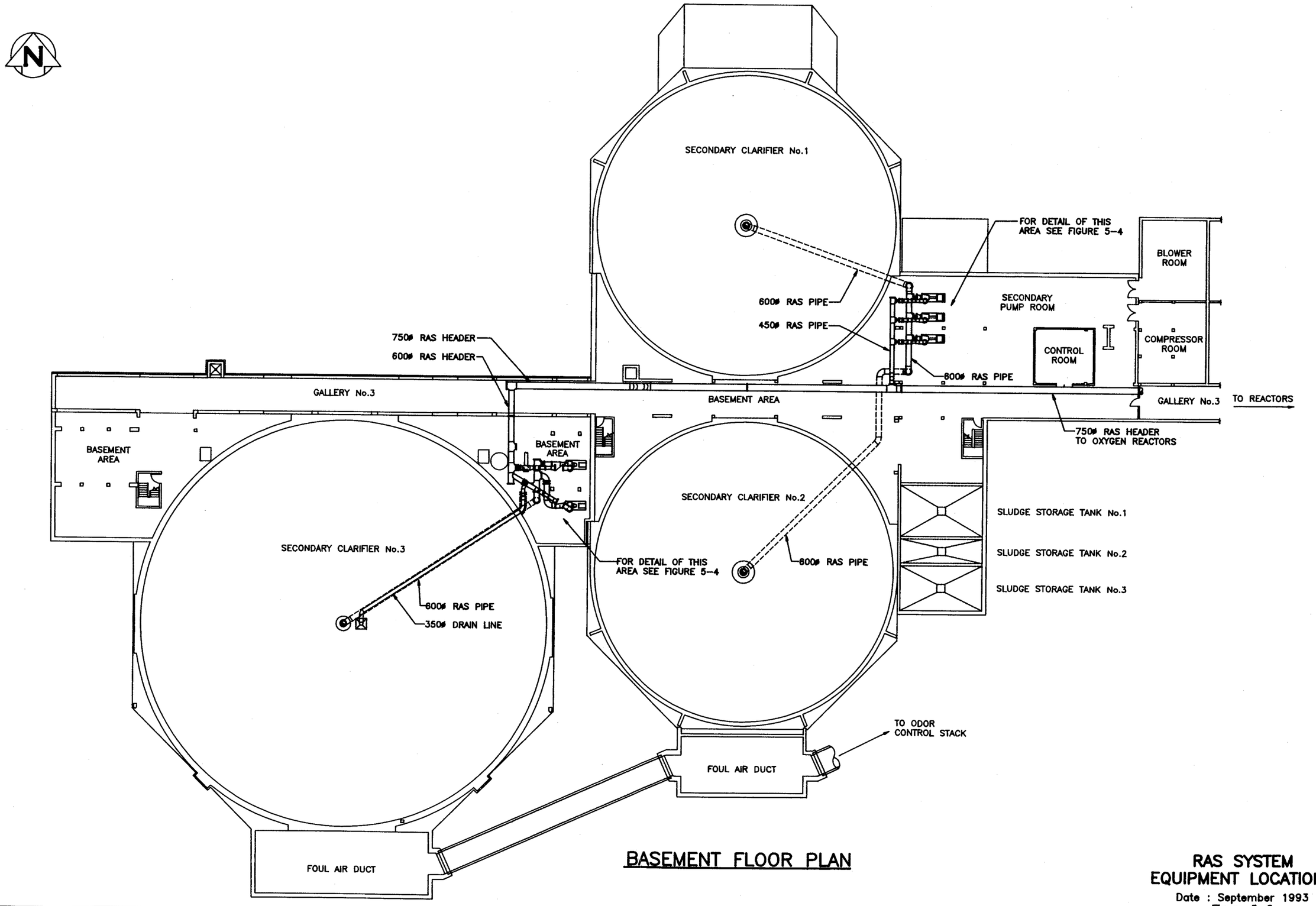
Each of the three RAS pumps, S101-RAP, S102-RAP, and S103-RAP, is controlled from a "COMP/OFF/HAND" switch at its respective VFD panel. The "HAND" and "OFF"



GROUND FLOOR PLAN

RAS SYSTEM
EQUIPMENT LOCATIONS

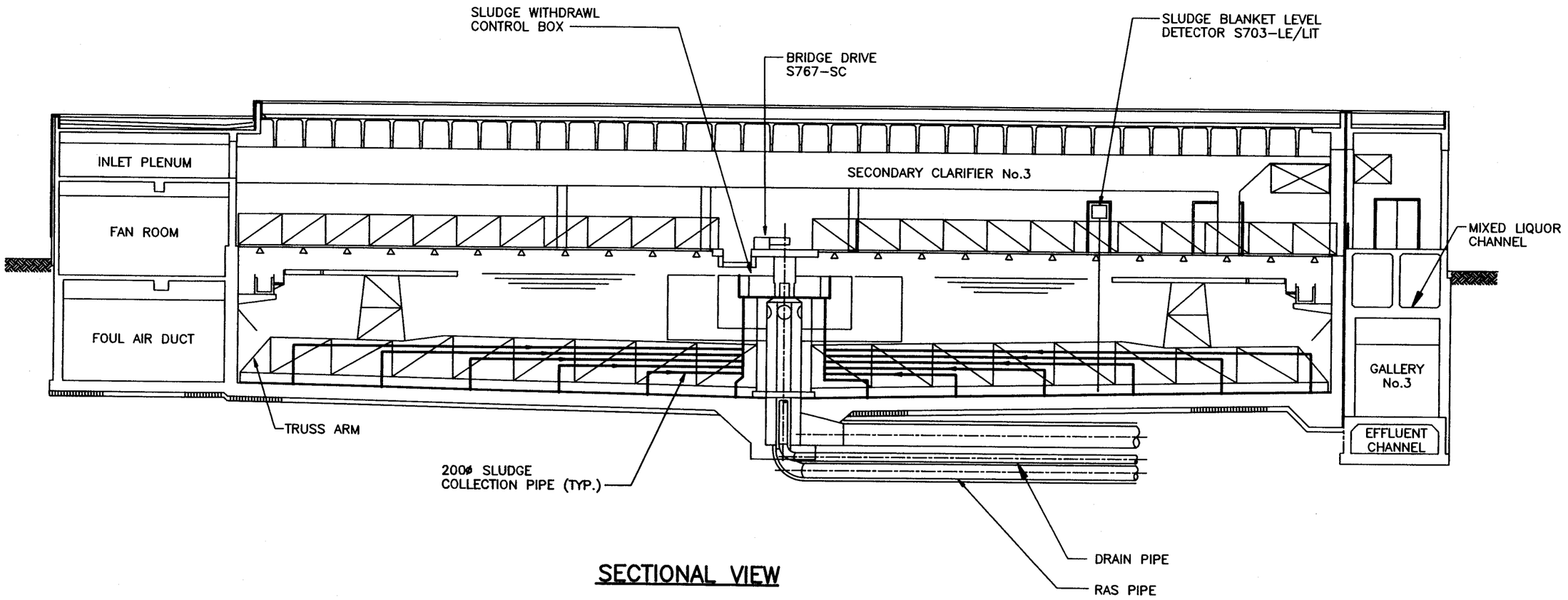
Date : September 1993
Figure 5-1



BASEMENT FLOOR PLAN

RAS SYSTEM EQUIPMENT LOCATIONS

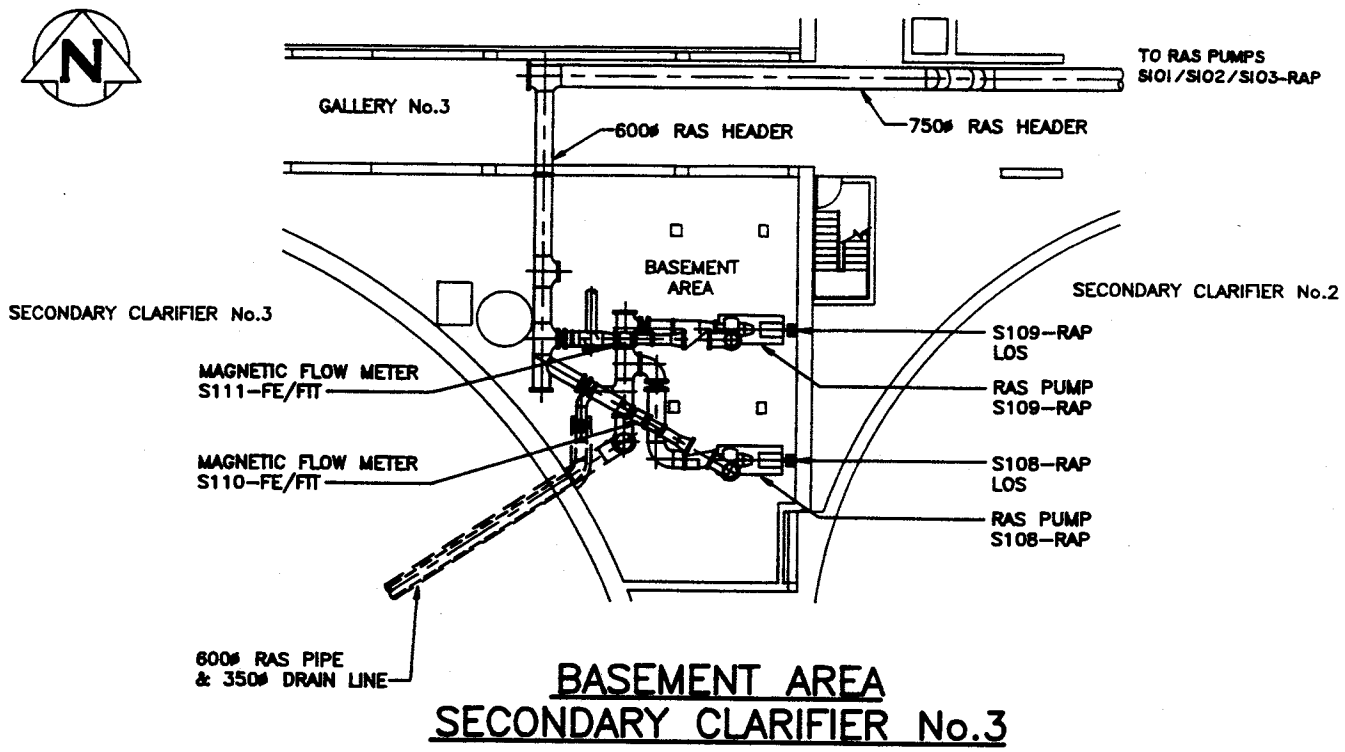
Date : September 1993
Figure 5-2



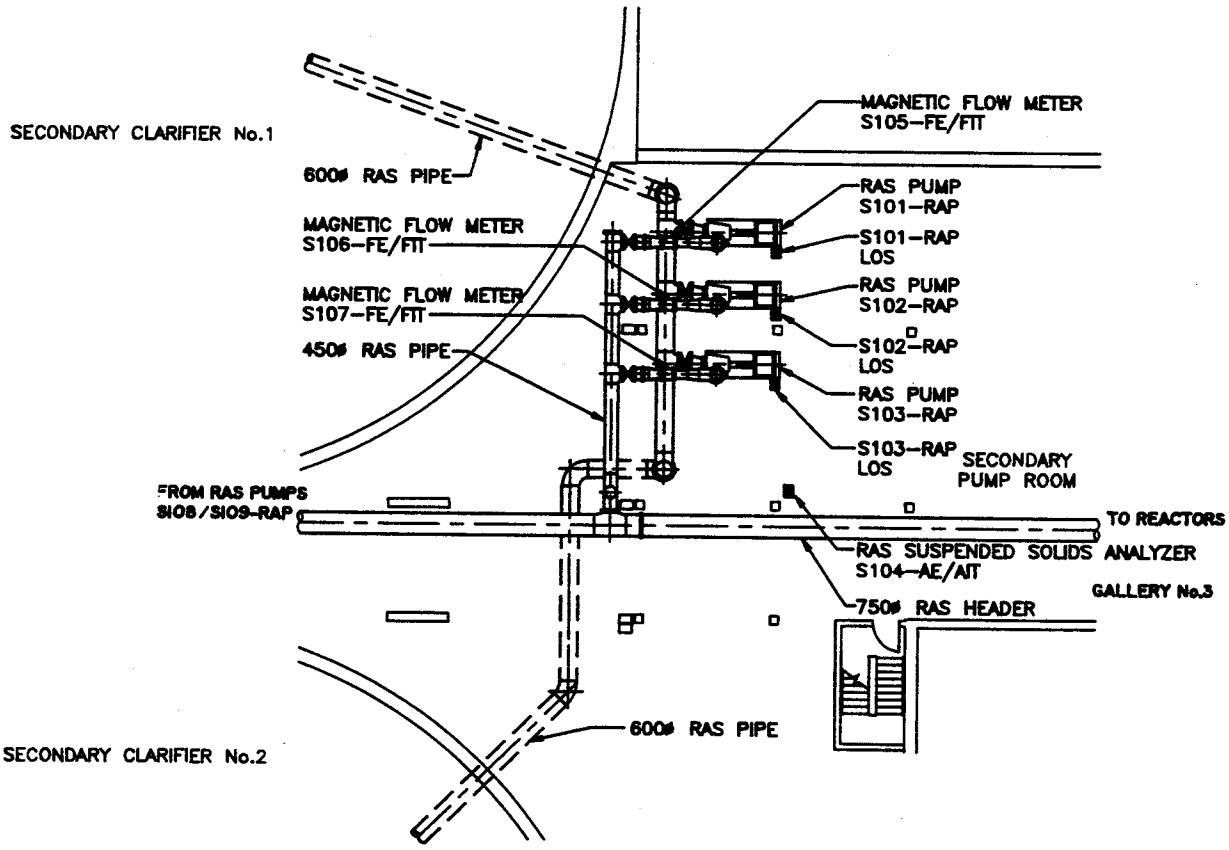
SECTIONAL VIEW

SECONDARY CLARIFIER No.3
SECTIONAL VIEW

Date : September 1993
Figure 5–3



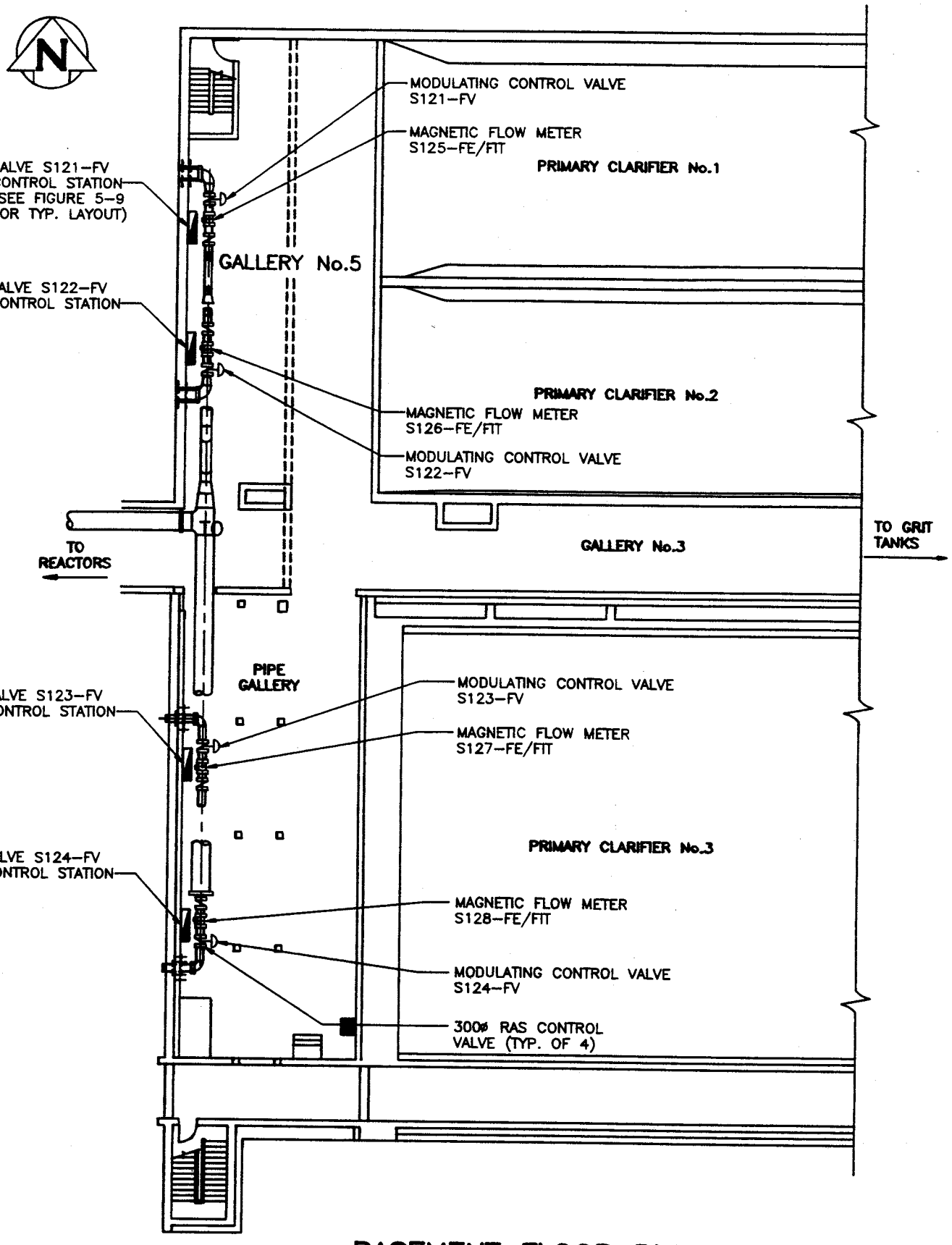
BASEMENT AREA
SECONDARY CLARIFIER No.3



BASEMENT AREA
CLARIFIERS No.1 & 2

RAS SYSTEM
EQUIPMENT LOCATIONS

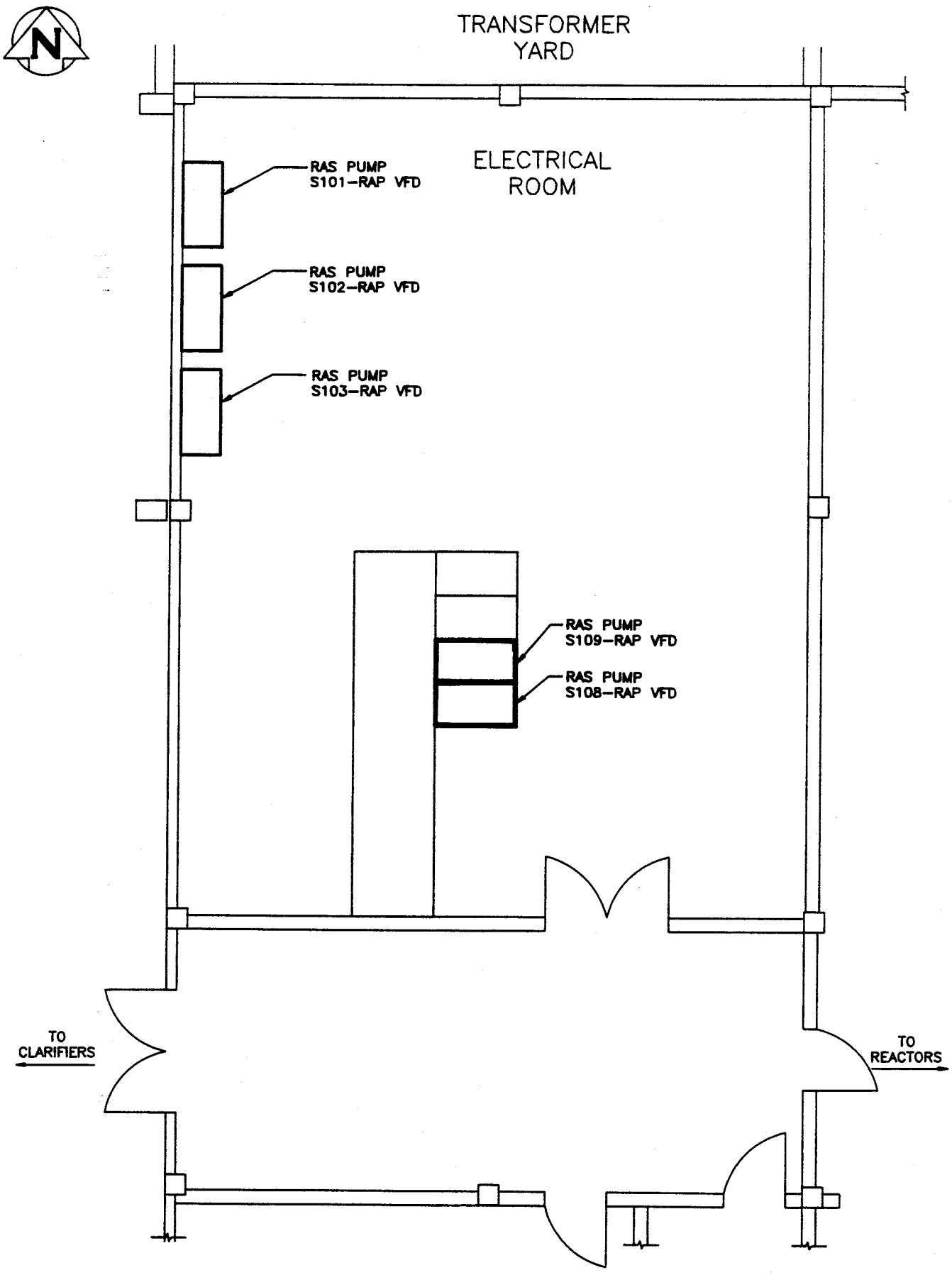
Date : September 1993
Figure 5-4



BASEMENT FLOOR PLAN

RAS SYSTEM EQUIPMENT LOCATIONS

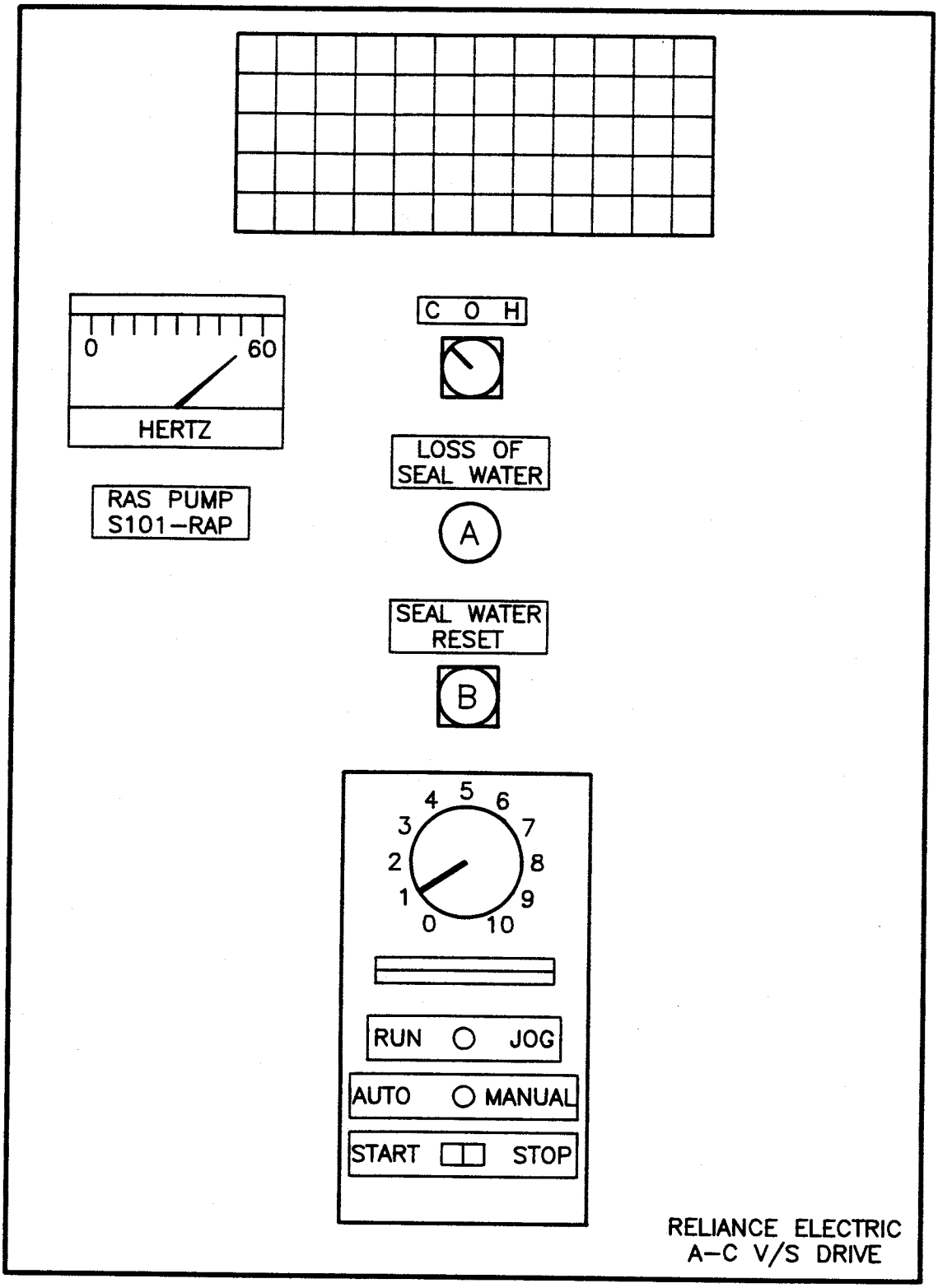
Date : September 1993
Figure 5-5



GROUND FLOOR PLAN

RAS PUMP VFD LOCATIONS

Date : September 1993
Figure 5–6

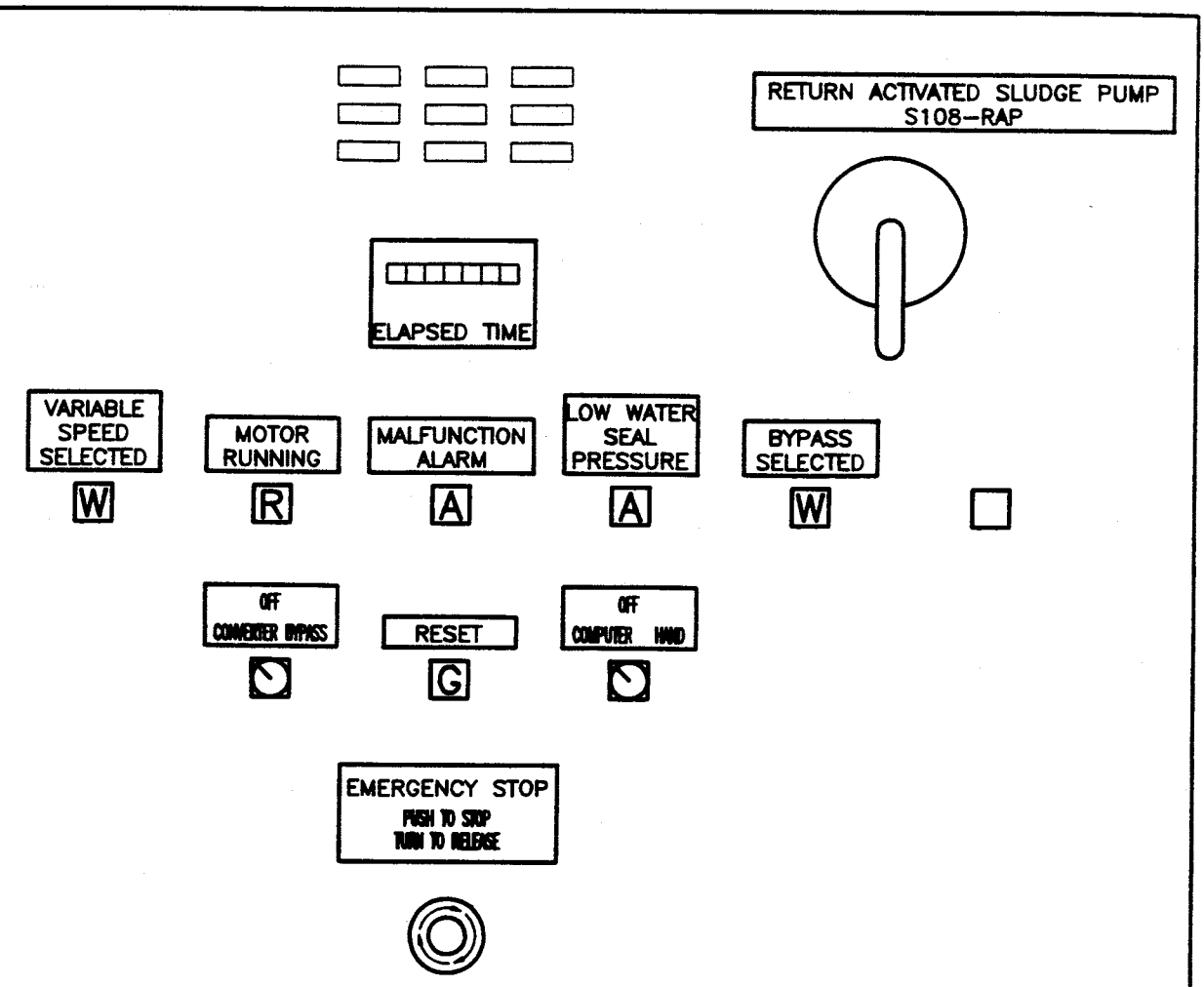


RAS PUMP S101–RAP VARIABLE FREQUENCY DRIVE

(SIMILAR FOR PUMPS S102–RAP & S103–RAP)

SECONDARY CLARIFIERS No.1 & 2
RAS PUMPS VFD LAYOUT

Date : September 1993
Figure 5–7



PROGRAMMING CONSOLE

TELEDRIVE SYSTEMS INC.

RAS PUMP S108-RAP VARIABLE FREQUENCY DRIVE

(SIMILAR FOR RAS PUMP S109-RAP)

SECONDARY CLARIFIER No.3
RAS PUMPS VFD LAYOUT

Date : September 1993
Figure 5-8

positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. When in the "HAND" position an operator can control pump operation from a "STOP/START" switch and set pump speed from a rotary dial. Pump "RUN/READY" status indication is available at the MCC. Pump "RUN/JOG" and "AUTO/MANUAL" statuses, in addition to the VFD frequency, are monitored at the VFD panel. A "LOSS OF SEAL WATER" alarm condition is also monitored and is cleared using the "RESET" pushbutton.

The INFI 90 monitors the following pump parameters:

1. Pump "COMP/OFF/HAND" control switch status;
2. Motor "RUN" status;
3. Motor speed;
4. "DRIVE MALFUNCTION" alarm conditions

Each pump may be shut down and locked-out using the "LOS" switch field located near each unit. These switches are shown in Figure 5-4.

Each of the two remaining RAS pumps, S108-RAP and S109-RAP, is controlled from a "COMP/OFF/HAND" switch at its respective VFD panel. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. While in the "HAND" position an operator can control pump operation from a "CONVERTER/OFF/BYPASS" switch. In the "CONVERTER" position the pump is controlled from the programming console keypad at the panel. In the "BYPASS" position the pump runs at full speed. The pump will not operate in the "OFF" position. An operator can monitor "VARIABLE SPEED SELECTED", "BYPASS SELECTED", and "MOTOR RUNNING" statuses at the panel. "LOW WATER SEAL PRESSURE" and "DRIVE MALFUNCTION" alarm conditions are also monitored and are cleared using the "RESET" pushbutton.

The INFI 90 monitors the following pump parameters:

1. Pump "COMP/OFF/HAND" control switch status;
2. Motor "RUN" status;
3. Motor speed;
4. "DRIVE MALFUNCTION" common alarm.

Each pump may be shutdown and locked-out using the "EMERGENCY STOP" pushbutton at the panel or the "LOS" switch field located near each unit. The latter are shown in Figure 5-4.

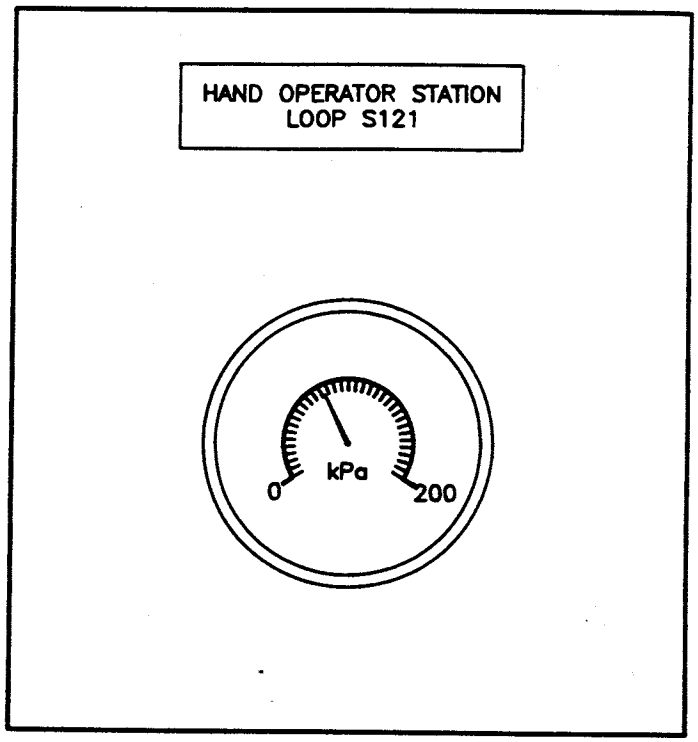
Flow from each RAS pump is monitored by five magnetic flowmeters designated S105-FE, S106-FE, S107-FE, S110-FE, and S111-FE. The flow rate is displayed at a local indicating transmitter and reported to the INFI 90. The locations of these flowmeters are shown in Figure 5-4.

Each of the four reactor train positioning valves, S121-FV, S122-FV, S123-FV, and S124-FV, is controlled from a "REMOTE/LOCAL" switch at a local control station. In the "LOCAL" position an operator can set the valve position utilizing the "OPEN" and "CLOSE" pushbuttons at the station. In the "REMOTE" position valve control is surrendered to the INFI 90.

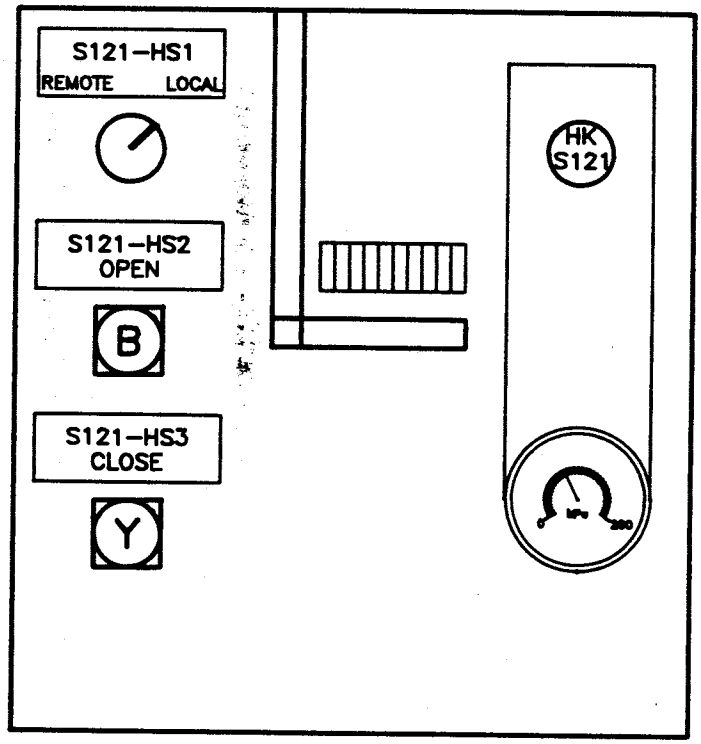
The locations of the four valve control stations are shown in Figure 5-5. A typical control station layout is provided in Figure 5-9.

The INFI 90 monitors the position of the "REMOTE/LOCAL" control switch status and also the valve position.

RAS flow through the train lines to the reactors is monitored by four magnetic flowmeters designated S125-FE, S126-FE, S127-FE, and S128-FE. The flow rate is displayed at a local indicating transmitter and reported to the INFI 90. The locations of these transmitters are shown in Figure 5-5.



FRONT PANEL



INTERIOR PANEL

NOTE

TYPICAL FOR VALVES S122–FV,
S123–FV & S124–FV

RAS FLOW VALVE
CONTROL STATION LAYOUT

Date : September 1993
Figure 5–9

TABLE 5-1

RAS SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S101-RAP	5-E	1P	5-E	5-E	5-E	5-E
S105-FI	5-E		5-E			
S102-RAP	5-E	2P	5-E	5-E	5-E	5-E
S106-FI	5-E		5-E			
S103-RAP	5-E	3P	5-E	5-E	5-E	5-E
S107-FI	5-E		5-E			
S108-RAP	5-F	1S	5-F	5-F	5-F	5-F
S110-FI	5-F		5-F			
S109-RAP	5-F	1T	5-F	5-F	5-F	5-F
S111-FI	5-F		5-F			
S121-FV	5-G		5-G			
S125-FI	4-M,5-A,G,OVERVIEW		5-G			4-M,5-A
S122-FV	5-G		5-G			
S126-FI	4-N,5-A,G,OVERVIEW		5-G			4-N,5-A
S123-FV	5-G		5-G			
S127-FI	4-0,5-A,G,OVERVIEW		5-G			4-O,5-A
S124-FV	5-G		5-G			
S128-FI	4-P,5-A,OVERVIEW		5-G			4-P,5-A
S701-LI	5-A,E,OVERVIEW		5-E			5-A,E
S702-LI	5-A,E,OVERVIEW		5-E			5-A,E
S703-LI	5-A,F,OVERVIEW		5-F			5-A,F
S104-AI	5-E,F		5-E			5-E,H

TABLE 5-2

CLARIFIERS NO. 1 AND 2 RAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S101-HS1	PUMP CONTROL (LOS)	S				
S101-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S101-HS4	PUMP CONTROL (START/STOP)			C	C	
S101-MN	PUMP CONTROL (RUN)				C	
S101-SC	PUMP CONTROL (SPEED)			C	C	
S101-MM	PUMP STATUS - MOTOR RUN		I		I	
S101-ST	PUMP STATUS - SPEED				I	0 - 1200 rpm
S101-PAL	LOSS OF SEAL WATER			A		
S101-QF	DRIVE FAILURE			Q	Q	
S101-HS3	FAILURE RESET			R		
S105-FI	RAS FLOW	I			I	0 - 20 ML/d
S102-HS1	PUMP CONTROL (LOS)	S				
S102-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S102-HS4	PUMP CONTROL (START/STOP)			C	C	
S102-MN	PUMP CONTROL (RUN)				C	
S102-SC	PUMP CONTROL (SPEED)			C	C	
S102-MM	PUMP STATUS - MOTOR RUN		I		I	
S102-ST	PUMP STATUS - SPEED				I	0 - 1200 rpm
S102-PAL	LOSS OF SEAL WATER			A		
S102-QF	DRIVE FAILURE			Q	Q	
S102-HS3	FAILURE RESET			R		
S106-FI	RAS FLOW	I			I	0 - 20 ML/d

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 5-10.

(continued)

TABLE 5-2 (continued)

CLARIFIERS NO. 1 AND 2 RAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S103-HS1	PUMP CONTROL (LOS)	S				
S103-HS2	PUMP CONTROL (C/O/H)			C	I	
S103-HS4	PUMP CONTROL (START/STOP)			C	C	
S103-MN	PUMP CONTROL (RUN)				C	
S103-SC	PUMP CONTROL (SPEED)			C	C	
S103-MM	PUMP STATUS - MOTOR RUN		I		I	
S103-ST	PUMP STATUS - SPEED				I	0 - 1200 rpm
S103-PAL	LOSS OF SEAL WATER			A		
S103-QF	DRIVE FAILURE			Q	Q	
S103-HS3	FAILURE RESET			R		
S107-FI	RAS FLOW	I			I	0 - 20 ML/d
S701-LI	CLAR. #1 SLUDGE BLANKET LEVEL	I			I	0 - 3m
S702-LI	CLAR. #2 SLUDGE BLANKET LEVEL	I			I	0 - 3m
S104-AI	RAS SUSPENDED SOLIDS LEVEL	I			I	5000 - 15000 mg/L

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 5-10.

TABLE 5-3

CLARIFIER NO. 3 RAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S108-HS1	PUMP CONTROL (LOS)	S				
S108-HS3	PUMP CONTROL (E-STOP)			S		
S108-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S108-HS4	PUMP CONTROL (CONV./OFF/BYPASS)			C		
S108-MN	PUMP CONTROL (RUN)				C	
S108-SC	PUMP CONTROL (SPEED)				C	
S108-MM	PUMP STATUS - RUN			I	I	
S108-ST	PUMP STATUS - SPEED				I	
S108-XM1	PUMP CONTROL STATUS - BYPASS			I		
S108-XM2	PUMP CONTROL STATUS - CONV.			I		
S108-PAL	LOSS OF SEAL WATER			A		
S108-QF	DRIVE FAILURE			Q	Q	
S108-HS5	FAILURE RESET			R		
S108-PG1	PUMP SUCTION PRESSURE	I				-100 - 100 kPa
S108-PG2	PUMP DISCHARGE PRESSURE	I				0 - 400 kPa
S110-FI	RAS FLOW	I			I	0 - 30 ML/d
S109-HS1	PUMP CONTROL (LOS)	S				
S109-HS3	PUMP CONTROL (E-STOP)			S		
S109-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S109-HS4	PUMP CONTROL (CONV./OFF/BYPASS)			C		
S109-MN	PUMP CONTROL (RUN)				C	
S109-SC	PUMP CONTROL (SPEED)				C	
S109-MM	PUMP STATUS - RUN			I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 5-11.

(continued)

TABLE 5-3 (continued)

CLARIFIER NO. 3 RAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S109-ST	PUMP STATUS - SPEED				I	
S109-XM1	PUMP CONTROL STATUS - BYPASS			I		
S109-XM2	PUMP CONTROL STATUS - CONV.			I		
S109-PAL	LOSS OF SEAL WATER			A		
S109-QF	DRIVE FAILURE			Q	Q	
S109-HS5	FAILURE RESET			R		
S109-PG1	PUMP SUCTION PRESSURE	I				-100 - 100 kPa
S109-PG2	PUMP DISCHARGE PRESSURE	I				0 - 400 kPa
S111-FI	RAS FLOW	I			I	0 - 30 ML/d
S703-LI	CLAR. #3 SLUDGE BLANKET LEVEL	I			I	0 - 3m

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 5-11.

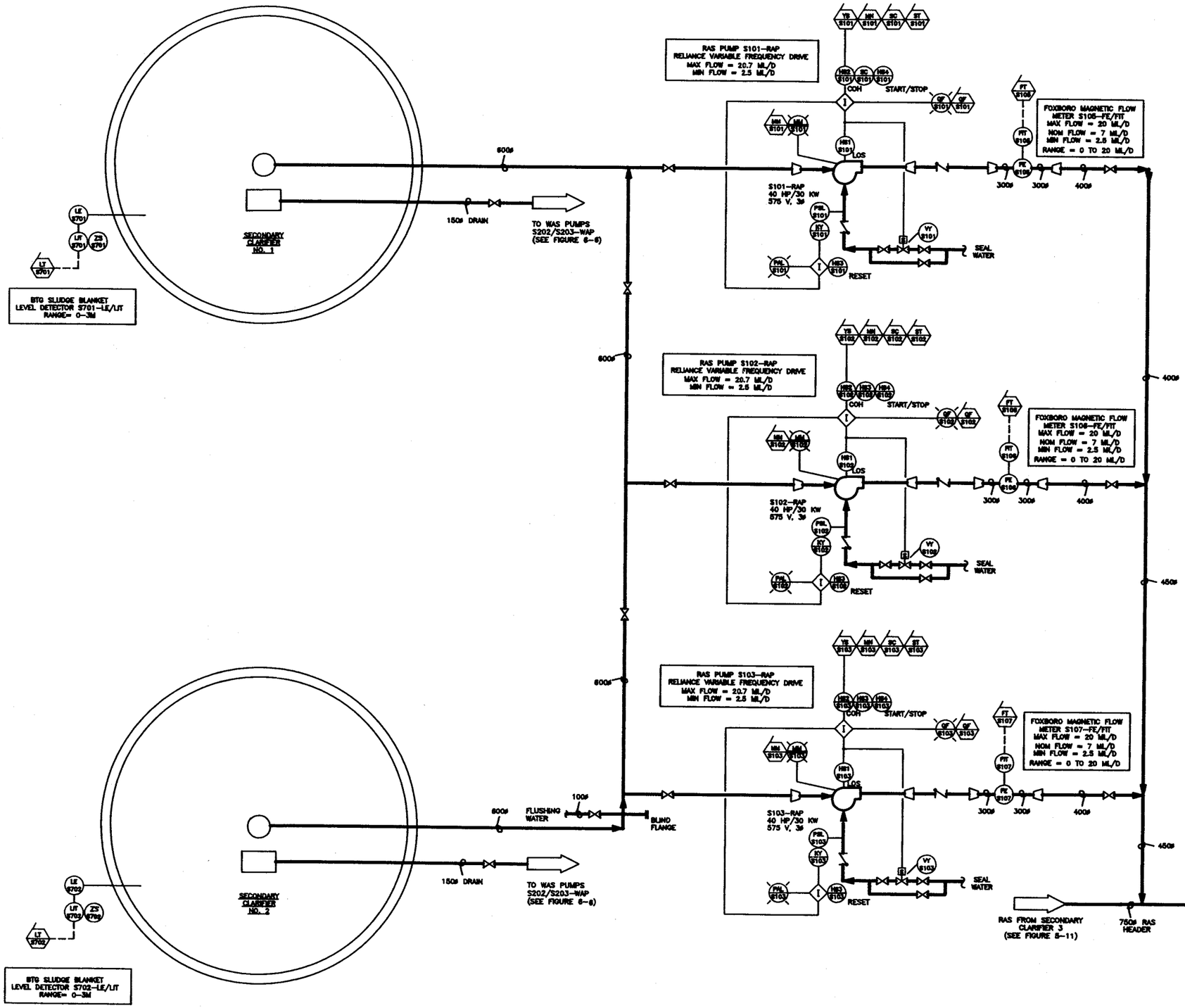
TABLE 5-4

RAS FLOW TO REACTORS EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S121-HS1	TRAIN NO. 1 VALVE CONTROL (REM/LOC)		C		I	
S121-HS2	TRAIN NO. 1 VALVE CONTROL (OPEN)		C		C	
S121-HS3	TRAIN NO. 1 VALVE CONTROL (CLOSE)		C		C	
S121-ZI	TRAIN NO. 1 VALVE STATUS - POSITION	I			I	0 to 100%
S122-HS1	TRAIN NO. 2 VALVE CONTROL (REM/LOC)		C		I	
S122-HS2	TRAIN NO. 2 VALVE CONTROL (OPEN)		C		C	
S122-HS3	TRAIN NO. 2 VALVE CONTROL (CLOSE)		C		C	
S122-ZI	TRAIN NO. 2 VALVE STATUS - POSITION	I			I	0 to 100%
S123-HS1	TRAIN NO. 3 VALVE CONTROL (REM/LOC)		C		I	
S123-HS2	TRAIN NO. 3 VALVE CONTROL (OPEN)		C		C	
S123-HS3	TRAIN NO. 3 VALVE CONTROL (CLOSE)		C		C	
S123-ZI	TRAIN NO. 3 VALVE STATUS - POSITION	I			I	0 to 100%
S124-HS1	TRAIN NO. 4 VALVE CONTROL (REM/LOC)		C		I	
S124-HS2	TRAIN NO. 4 VALVE CONTROL (OPEN)		C		C	
S124-HS3	TRAIN NO. 4 VALVE CONTROL (CLOSE)		C		C	
S124-ZI	TRAIN NO. 4 VALVE STATUS - POSITION	I			I	0 - 100%
S125-FI	TRAIN NO. 1 RAS FLOW	I			I	0 - 20 ML/d
S126-FI	TRAIN NO. 2 RAS FLOW	I			I	0 - 20 ML/d
S127-FI	TRAIN NO. 3 RAS FLOW	I			I	0 - 20 ML/d
S128-FI	TRAIN NO. 4 RAS FLOW	I			I	0 - 20 ML/d

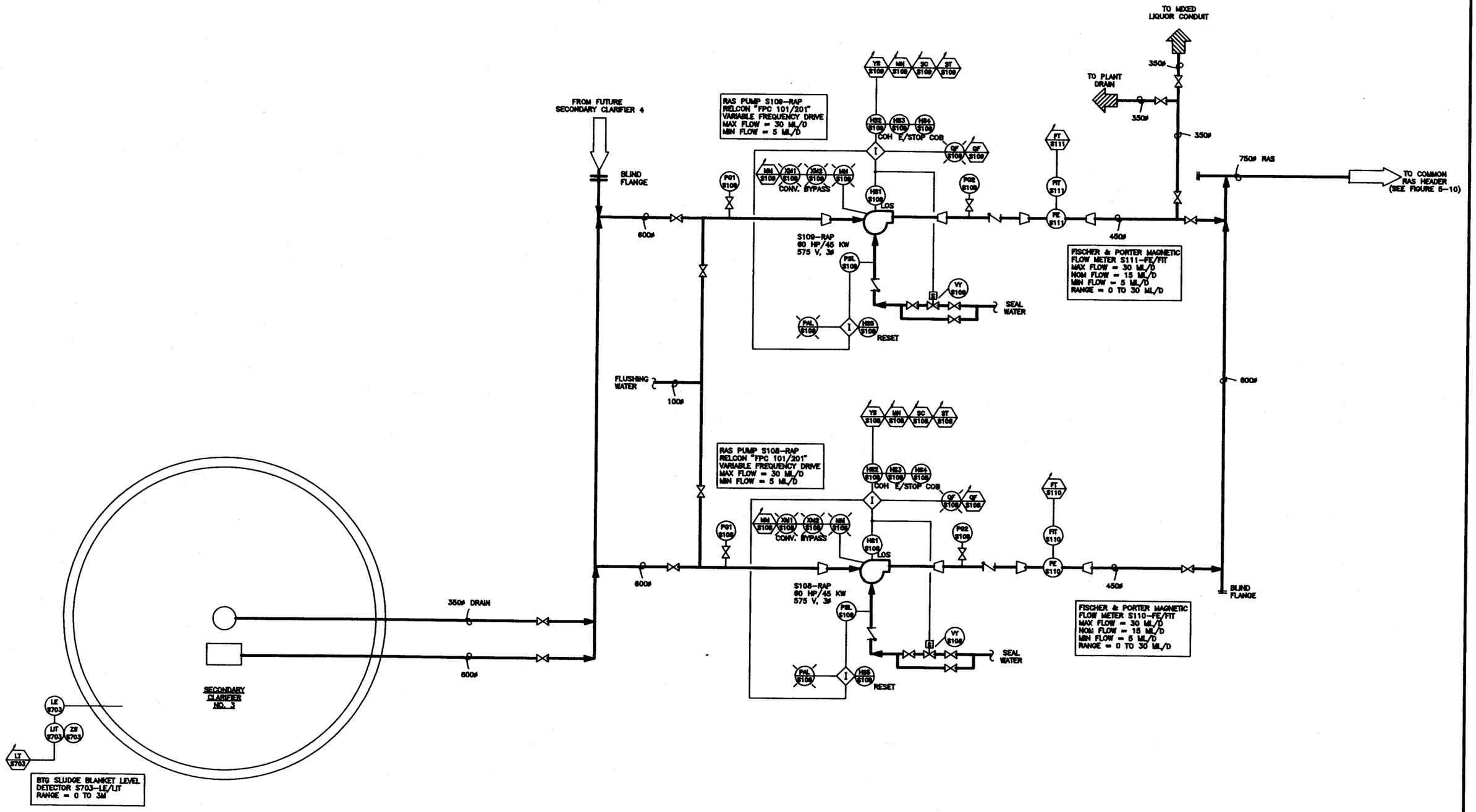
S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 5-12.



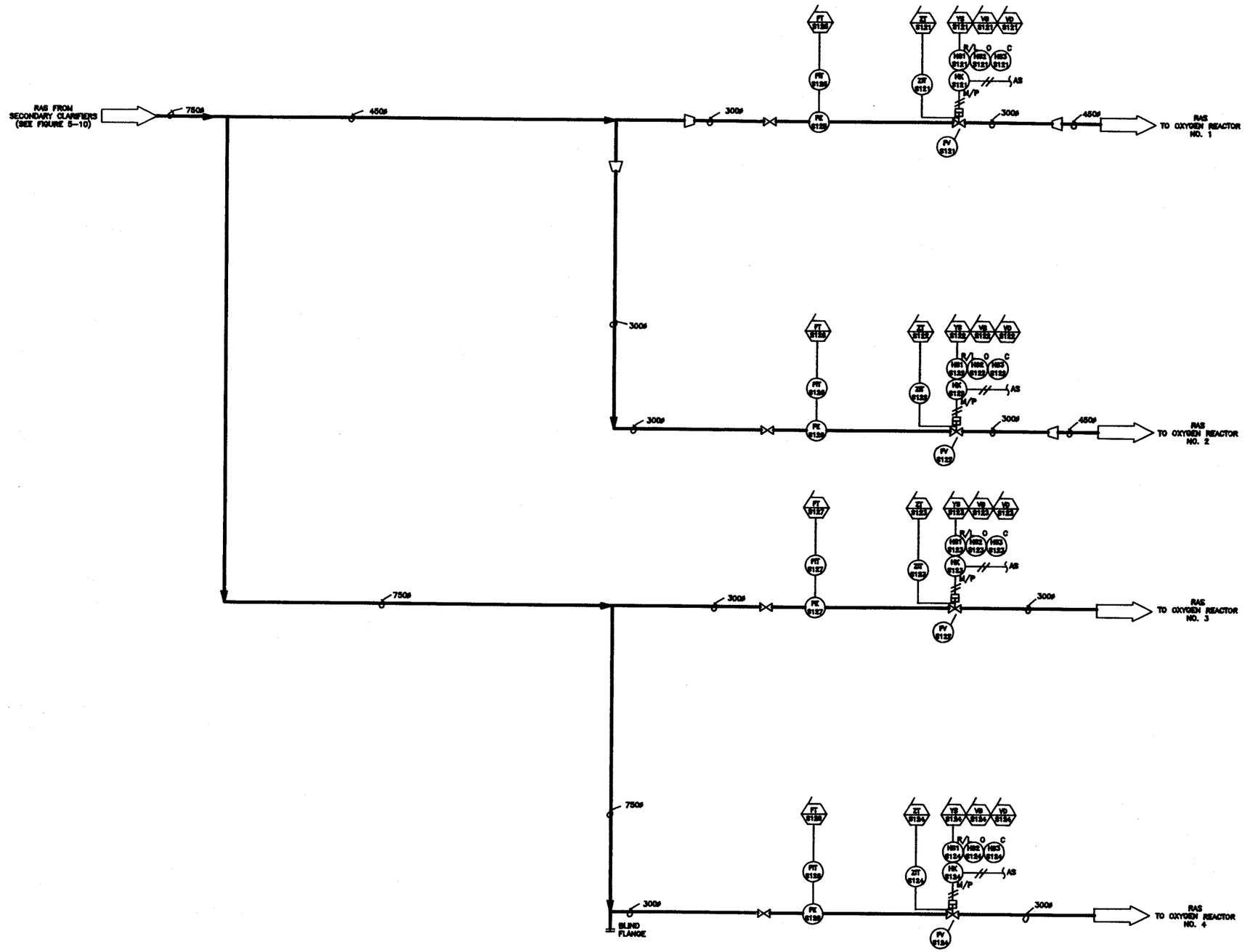
SECONDARY CLARIFIERS No.1 & No.2
RAS SYSTEM PROCESS & INSTR. DIRAGRAM

Date : September 1993
Figure 5-10



SECONDARY CLARIFIER No.3
RAS SYSTEM PROCESS & INSTR. DIAGRAM

Date : September 1993
Figure 5-11



FISCHER & PORTER
RAS SPLIT MAGNETIC FLOW METERS
8126/8125/8127/8128-FE/FIT

MAXIMUM FLOW= 15 MG/D
NOMINAL FLOW= 7.5 MG/D
MINIMUM FLOW= 2.5 MG/D
RANGE = 0 TO 20 MG/D

RAS FLOW TO REACTORS PROCESS & INSTR. DIAGRAM

Date : September 1993
Figure 5-12

The Operator can select S108-RAP or S109-RAP as lead pump from Clarifier #3; the other is to operate as standby. The computer will start the standby pump whenever the lead pump fails. Restarts are limited to protect the equipment. Normally, S101-RAP will pump from Clarifier #1 and S103-RAP will pump from Clarifier #2. Should either of these pumps fail, then S102-RAP will be the duty pump. The Operator assigns S102-RAP as standby to either S101 or S103. When S101-RAP or S103-RAP fails, whichever is the lead pump to S102, the computer will perform the following:

1) Start S102-RAP;

2) Set its flow controller setpoint (if in cascade) to the calculated setpoint that its lead pump tracks.

One hundred percent (100%) of the RAS from the secondary clarifiers is equally distributed to all "in service" reactors utilizing a most open valve (MOV) strategy. The MOV strategy uses an Operator-selected valve to act as the "Most open valve". The MOV is usually in the process line with the highest inherent head loss. The INFI 90 opens the selected MOV to 95% and measures the actual flow through the valve. This measured flow is biased by an Operator entered factor for a desired flow split, then becomes the setpoint for the remaining valves in the system. The INFI 90 then modulates the remaining valves to maintain these setpoints, which are based on the flow rate through the MOV.

Automatic MOV selection of another RAS control valve occurs when the flow through the RAS control valve selected to be used as the "most open valve" exceeds the capacity of the valve. If all RAS control valves in turn have been selected because of flows exceeding capacity then TOV is selected.

The Primary Effluent flow control also effects the operation of this system and therefore, some parameters must also be set. An operator adjustable bias used to compensate for differences between reactors must be set.

5.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific screen graphic displays noted here and summarized in Bridging Table 5-1.

Manual control consists of Operator-initiated commands to:

1) Select pump flow controllers into manual or automatic;
2) Select manual for each pump;
3) Open/close and adjust the position of each RAS split flow valve.

RAS pumping group displays are used to access all three secondary clarifiers and include all monitored and controlled points.

Using the displays and control keyboard, the Operator is able to adjust the following controls:

1) Select either percent of flow or constant solids control mode for each clarifier;

2) Set RAS flow setpoint minimum value for each clarifier;

3) Set percent of RAS flow for each clarifier;

4) Standby assignment of pump S102-RAP - Graphic 5E;

5) Lead/standby assignment for pumps S108-RAP and S109-RAP - Graphic 5F.

Operating Procedures - Graphics 5E and 5F:

1) Verify the status of the bridges are "ON". They should be red. S765-BDM = Clarifier #1 and S766-BDM = Clarifier #2. On Graphic 5F: S767-BDM = Clarifier #3 for all "in service" clarifiers;

2) Verify that all RAS pumps are in "COMPUTER" for all "in service" clarifiers;

3) Press 1P and verify that RAS Pump S101-RAP is in "auto", Press 1S and verify that the pump speed controller is in "auto & cascade".

Follow the above procedure and verify the status of all RAS pumps.

Select: 2P and 2S for RAS Pump S102-RAP;
3P and 3S for RAS Pump S103-RAP.

On Graphic 5F, 1S and 2S for RAS Pump S109-RAP;
1T and 2T for RAS Pump S108-RAP;

4) Select 1X and select % of PE Flow or Mass.

NOTE: Percent of Flow Mode
Total RAS flow rate is calculated as:
RAS Flow = TOTAL PE x K
Where
K = Operator Entered % of Flow
Mass Balance Mode
Total RAS Flow is calculated as:
FRA = FML x MLSS/RASSS where
FRAS = Calculated RAS flow rate required
FML = Mixed liquor flow to a clarifier
MLSS = Mixed liquor suspended solids value
(Operator-entered or metered)
RASSS = RAS suspended solids value (Operator-entered or metered)

From Graphic 5F, select 5S and repeat as above;

5) The Operator has the option to periodically ramp the pumps up to maximum speed for an operator set time. The ramping time interval at operator adjusted speed is tunable. The start time and number of cycles that each RAS pump ramps is also operator adjustable.

Press 1R and enter the RAS pump S101-RAP ramp speed in percent.

NOTE: e.g., enter 50% every hour. On a constant basis, the pump will automatically speed up to 50% of rated flow. This is a line and pump cleaning feature.

Repeat the above for each RAS Pump - 2R for Pump S102-RAP
3R for Pump S103-RAP
On Graphic 5F, 3S for Pump S109-RAP
3T for Pump S108-RAP;

6) Select 1N and enter a minimum flow setpoint for RAS Pump S101-RAP,

NOTE: e.g. This represents the minimum flow setpoint. A 5% value means the pump will not pump lower than 5% flow. This can be used to maintain a minimum return rate even though the PE (Primary Effluent) flow is low and return may be nil.

Repeat the above for each RAS Pump - 2N for Pump S102-RAP
3N for Pump S103-RAP
On Graphic 5F, 4S for Pump S109-RAP
4T for Pump S108-RAP;

7) Press 7U on Graphic 5E and assign S102-RAP as standby pump to: Pump #1 = S101-RAP or Pump #3 = S103-RAP.

NOTE: Your can assign S102-RAP to be the lead to either RAS Pump S101-RAP for Clarifier #1 or RAS Pump S103-RAP for Clarifier #2. If S101-RAP or S103-RAP fails, whichever is the lead pump, S102-RAP will set its flow controller setpoint to the value as calculated for the clarifier to which it is assigned.

On Graphic 5F, press 7T and select lead pump. Pump #4 - S109-RAP or Pump #5 - S108-RAP.

NOTE: If Pump #4 (S109-RAP) is selected as duty, RAS Pump #5 (S108-RAP) will be on standby. If the duty pump fails, the standby pump will start. If the standby pump fails along with the duty pump, the entire pump system will go to manual and alarm.

NOTE: DO NOT SELECT 6U FROM GRAPHIC 5E OR 6T FROM GRAPHIC 5F AT THIS TIME.

Operating Procedures: Automatic Start-up

1) From Graphic 5E, select "6U" and select "autostart".

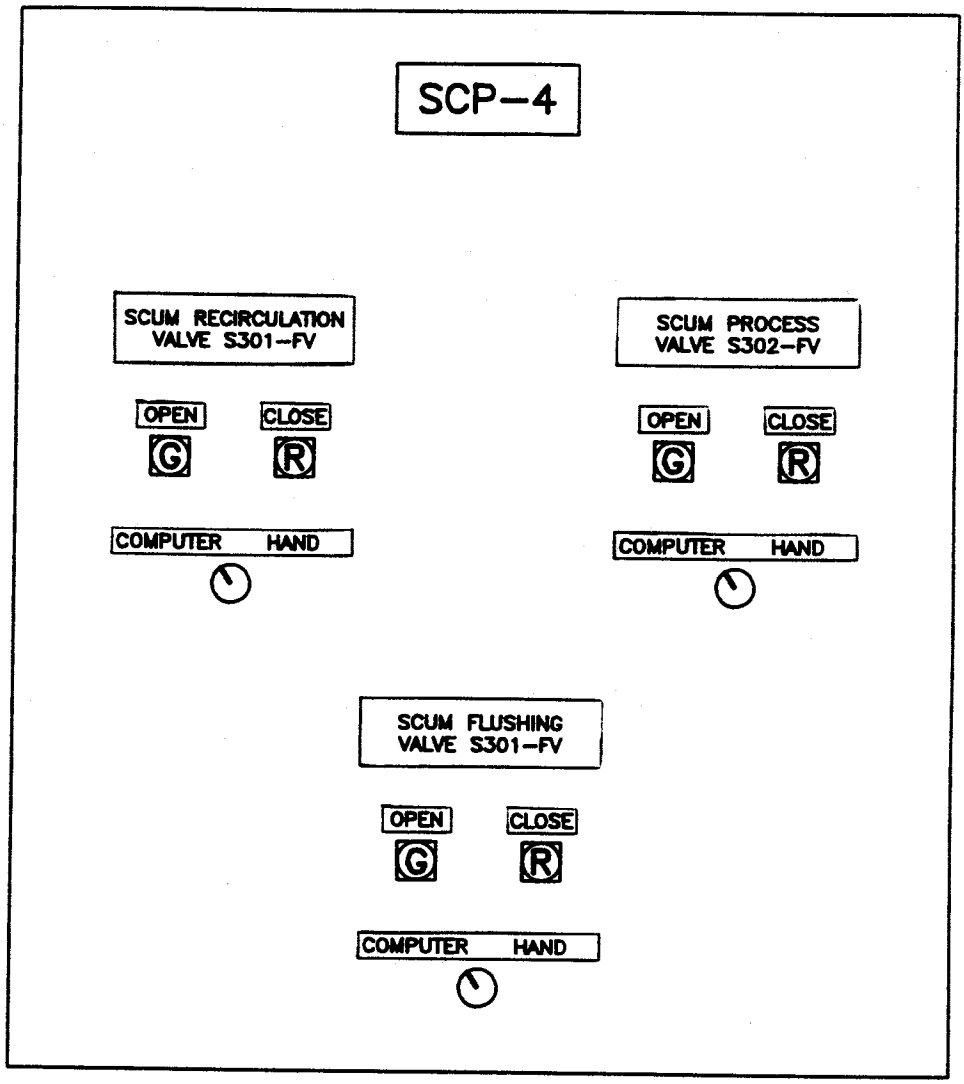
NOTE: RAS Pumps #1, #2, and #3 will start "automatic operation";

2) From Graphic 5F, select "6T" and select "autostart".

NOTE: RAS Pumps #4 and #5 will start "automatic operation".

RAS split group displays are used to access all four reactors and include all monitored and controlled points. Using the displays and control keyboard, the Operator is able to adjust the following controls:

1) Select automatic or manual control for each valve;



SIMILAR FOR PANEL SCP-5 UTILIZING THE FOLLOWING VALVES:

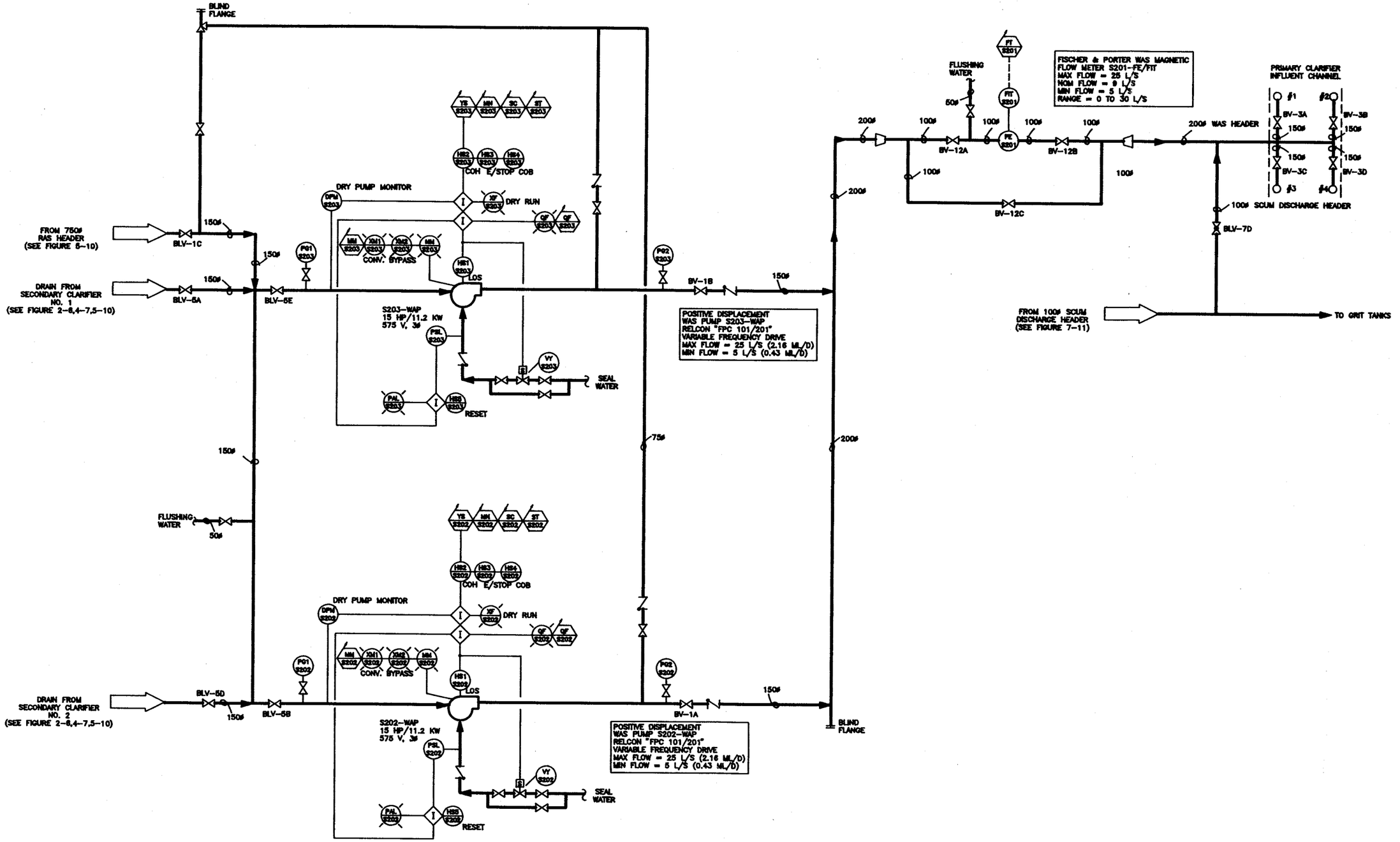
SCUM RECIRCULATION VALVE S310-FV
SCUM PROCESS VALVE S311-FV
SCUM FLUSHING VALVE S313-FV

LEGEND

- G GREEN PUSHBUTTON
- R RED PUSHBUTTON
- 2 POSTION SELECTOR SWITCH

LOCAL PANELS SCP-4 & SCP-5 TYPICAL LAYOUT

Date : January 1994
Figure 7-10



WAS SYSTEM
PROCESS & INSTR. DIAGRAM

Date : December 1993
Figure 6-6

5.5 EQUIPMENT DATA

1. **RAS Pumps:** S101-RAP, S102-RAP, and S103-RAP

Location:	Secondary Pump Room	
Purpose:	To pump Return Activated Sludge from clarifiers No. 1 and No. 2 to the reactors.	
Manufacturer:	Pump:	Worthington Canada Ltd., 12 MC-1
		Capacity - 3170 IGPM @ 25 ft head
	Motor:	Tamper AC Motor, Model # 364T-DGS
		30 kw (40hp), 575V, 3ph, 60 Hz
		1175 rpm, 38.0 FLA
	VFD:	Reliance Electric
		A-C V/S Drive

2. **RAS Pumps:** S108-RAP and S109-RAP

Location:	Basement area of Clarifier No.3	
Purpose:	To pump Return Activated Sludge from Clarifier No. 3 to the reactors.	
Manufacturer:	Pump:	Fairbanks Morse Pump Corporation
		Model K3X1 - 604151-1
	Motor:	GEC Alsthom, Model # PH69
		45kw (60hp), 575V, 3ph, 60 Hz
		886 rpm, 60.0 FLA
	VFD:	Teledrive Systems Inc.

3. **Automatic Positioning Valves:** S121-FV, S122-FV, S123-FV, and S124-FV

Location:	Gallery No. 5 and Pipe Gallery of Primary Clarifier Area	
Purpose:	To modulate RAS flow from clarifier to reactor trains.	
Manufacturer:	Valve:	Keystone
	Actuator:	ACCORD 1000

4. **Magnetic Flowmeters:** S105-FE/FIT, S106-FE/FIT, and S107-FE/FIT

Location:	Secondary Pump Room	
Purpose:	Monitor flow from clarifiers No. 1 and No. 2 RAS pumps.	
Manufacturer:	Flowmeter	- Foxboro, Model # 8012 - BTR-G
	Transmitter	- Foxboro, Model # 8000 - SA10-D
	Range:	0 - 20 ML/d
	Input:	120 VAC, 60 Hz; Output: 4 - 20 mADC

5. **Magnetic Flowmeters:** S110-FE/FIT and S111-FE/FIT

Location:	Basement Area of clarifier No. 3	
Purpose:	Monitor flow from clarifier No. 3 RAS pumps.	
Manufacturer:	Fischer and Porter, MAG-XM	
	Range:	0 - 30 ML/d
	Input:	120 VAC, 60 Hz; Output: 4 - 20 mADC

6. **Magnetic Flowmeters:** S125-FE/FIT, S126-FE/FIT, S127-FE/FIT, & S128-FE/FIT

Location:	Gallery No. 5 and Pipe Gallery of Primary Clarifier Area	
Purpose:	Monitor RAS flow to reactors	
Manufacturer:	Fischer and Porter, MAG-XM	
	Range:	0 - 20 ML/d
	Input:	120 VAC, 60 Hz; Output: 4 - 20 mADC

7. **Sludge Blanket Level Detectors:** S701-LE/LIT, S702-LE/LIT, & S703-LE/LIT

Location:	Ground floor on bridge walkway of each clarifier	
Purpose:	To monitor sludge blanket depth level in each clarifier	
Manufacturer:	BTG Solids Level Detector SLD-1	
	Range:	0 - 3000 mm
	Input:	120 VAC, 60 Hz; Output: 4 - 20 mADC

8. **Suspended Solids Analyzer:** S104-AE/AIT

Location:	Secondary Pump Room
Purpose:	To monitor suspended solids level in RAS header.
Manufacturer:	BTG Suspended Solids Meter SMS-3000
	Range: 5000 - 15000 mg/l
	Input: 120 VAC, 60 Hz; Output: 4 - 20 mADC

6.0 WASTE ACTIVATED SLUDGE SYSTEM

6.1 PURPOSE

More sludge is produced in the clarifiers than is required by the oxygen reactors. This excess sludge is known as Waste Activated Sludge (WAS) and is removed from the system by a line off the RAS header. The excess sludge is pumped to the primary clarifiers for co-thickening with the primary sludge.

6.2 SYSTEM DESCRIPTION

The WAS system consists of two variable speed positive displacement progressive clarity pumps, S202-WAP and S203-WAP, aligned in a duty/standby arrangement. The pumps withdraw excess sludge from the 750 mm diameter RAS header (see Section 5) at a drawoff point downstream of the RAS pumps. In addition, the pumps also draw WAS directly from clarifiers No. 1 and 2 via two 150 mm diameter drain lines.

The pumps convey the WAS to the primary clarifiers through a 200 mm diameter header. The WAS is then discharged into the influent channel from four 150 diameter ports. A 100 mm diameter line between the WAS header and the scum discharge header allows scum to be discharged into the primary clarifiers as well. A complete description of the scum system is provided in Section 7.

The header contains a magnetic flowmeter which monitors the WAS flow to the primary clarifiers.

A summary of the equipment described in this section is as follows:

1. Two variable speed WAS pumps: S202-WAP and S203-WAP;
2. One magnetic flowmeter: S201-FE/FIT.

WAS equipment locations are found on the basement floor plans shown in Figures 6-1 and 6-2. A sectional view of the WAS pumps is provided in Figure 6-3.

6.3 MONITORING AND CONTROL

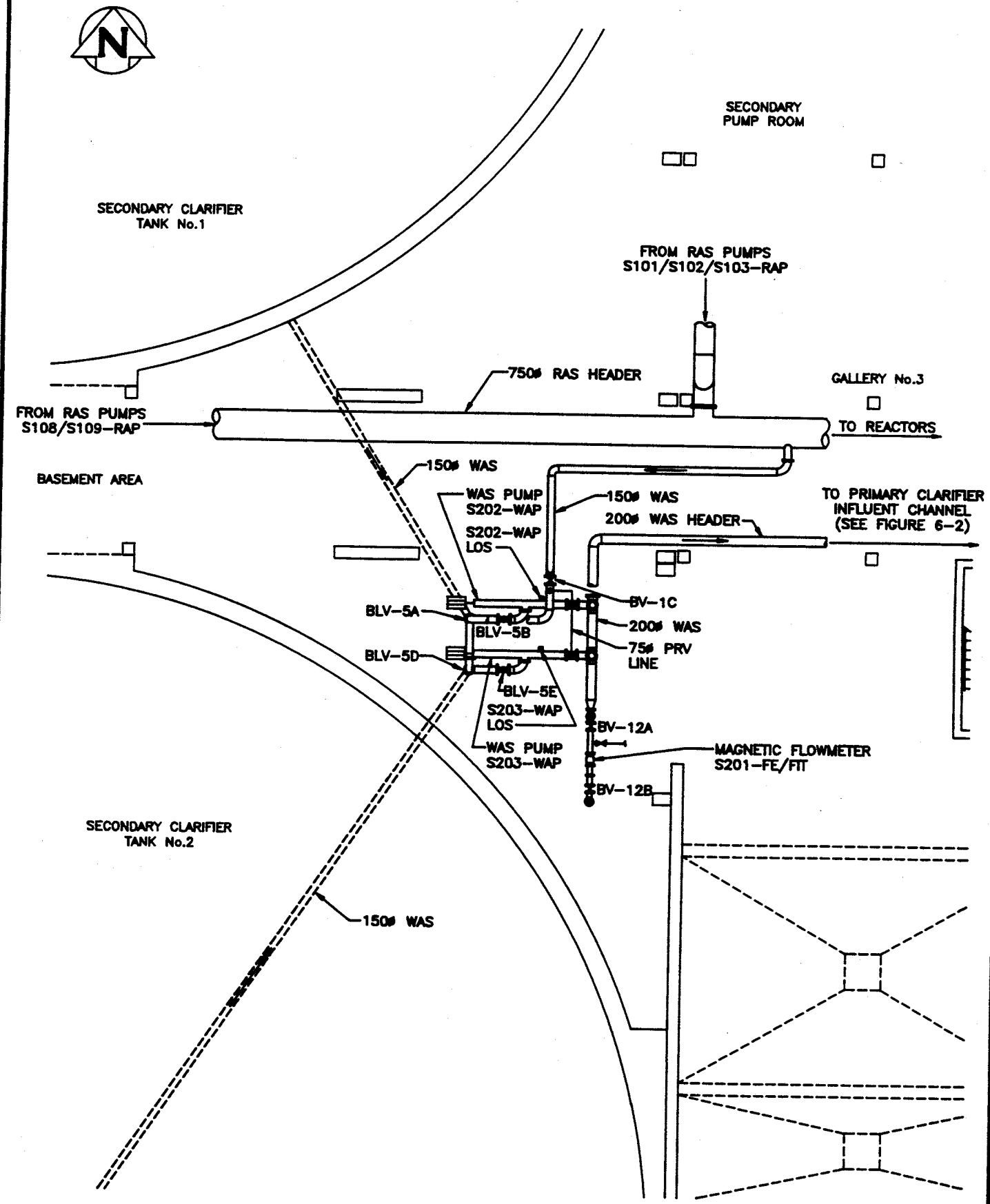
6.3.1 Process Equipment

The two WAS pumps are monitored and controlled from individual Variable Frequency Drive (VFD) panels located in the Electrical Room on the ground floor as shown in Figure 6-4. A typical layout of the two VFD panels is provided in Figure 6-5.

Each of the two WAS pumps, S202-WAP and S203-WAP, is controlled from a "COMP/OFF/HAND" switch at its respective VFD panel. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. While in the "HAND" position an operator can control pump operation from a "CONVERTER/OFF/BYPASS" switch. In the "CONVERTER" position the pump is controlled from the programming console keypad at the panel. In the "BYPASS" position the pump runs at full speed. The pump will not operate in the "OFF" position. An operator can monitor "VARIABLE SPEED SELECTED", "BYPASS SELECTED", and "MOTOR RUNNING" statuses at the panel. "LOW WATER SEAL PRESSURE", "DRY PUMP RUN", and "DRIVE MALFUNCTION" alarm conditions are also monitored and are cleared using the "RESET" push button.

The INFI 90 monitors the following pump parameters:

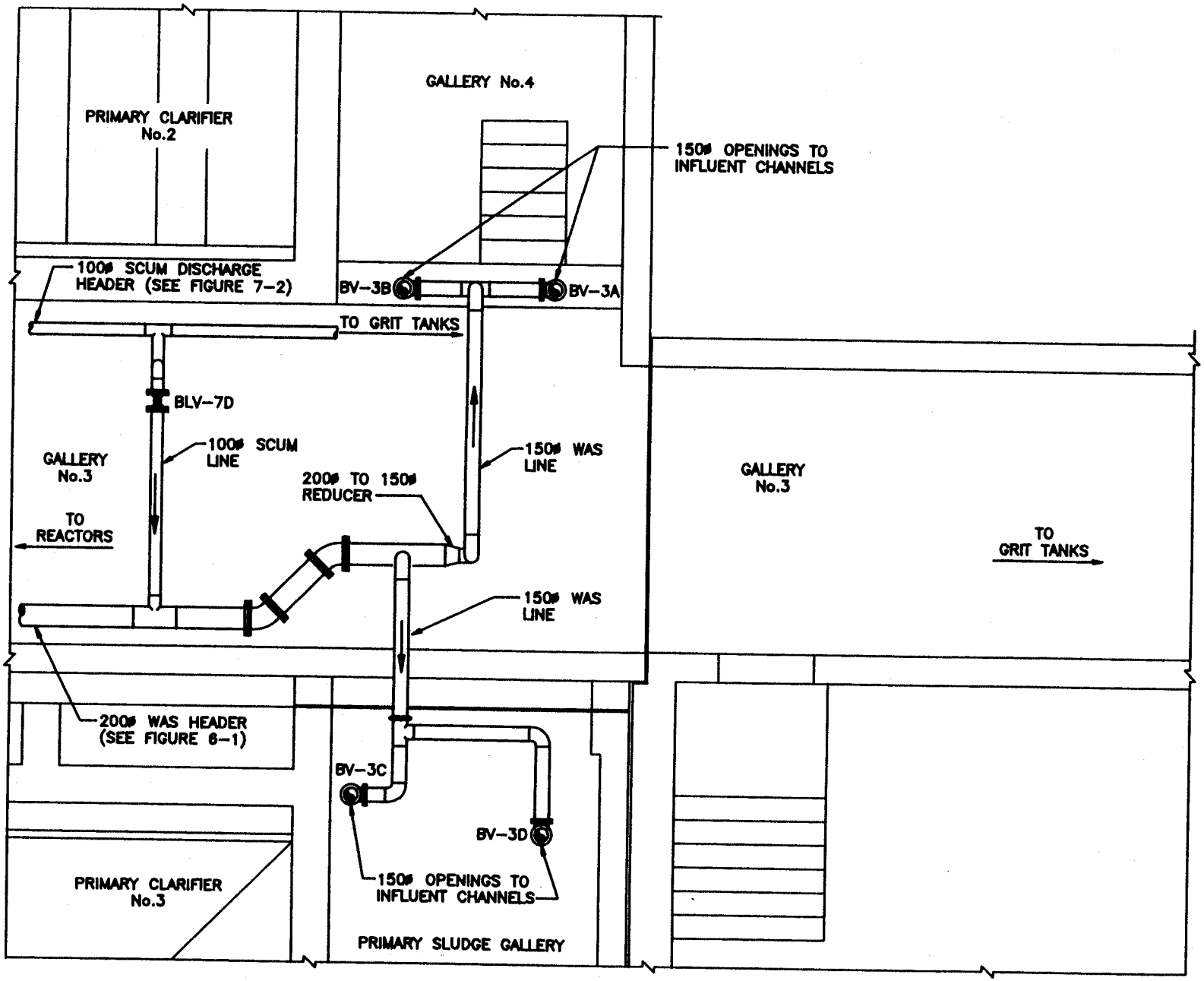
1. Pump "COMP/OFF/HAND" control switch status;
2. Motor "RUN" status;
3. Motor speed;
4. "DRIVE MALFUNCTION" common alarm.



BASEMENT FLOOR PLAN

WAS SYSTEM EQUIPMENT LOCATIONS

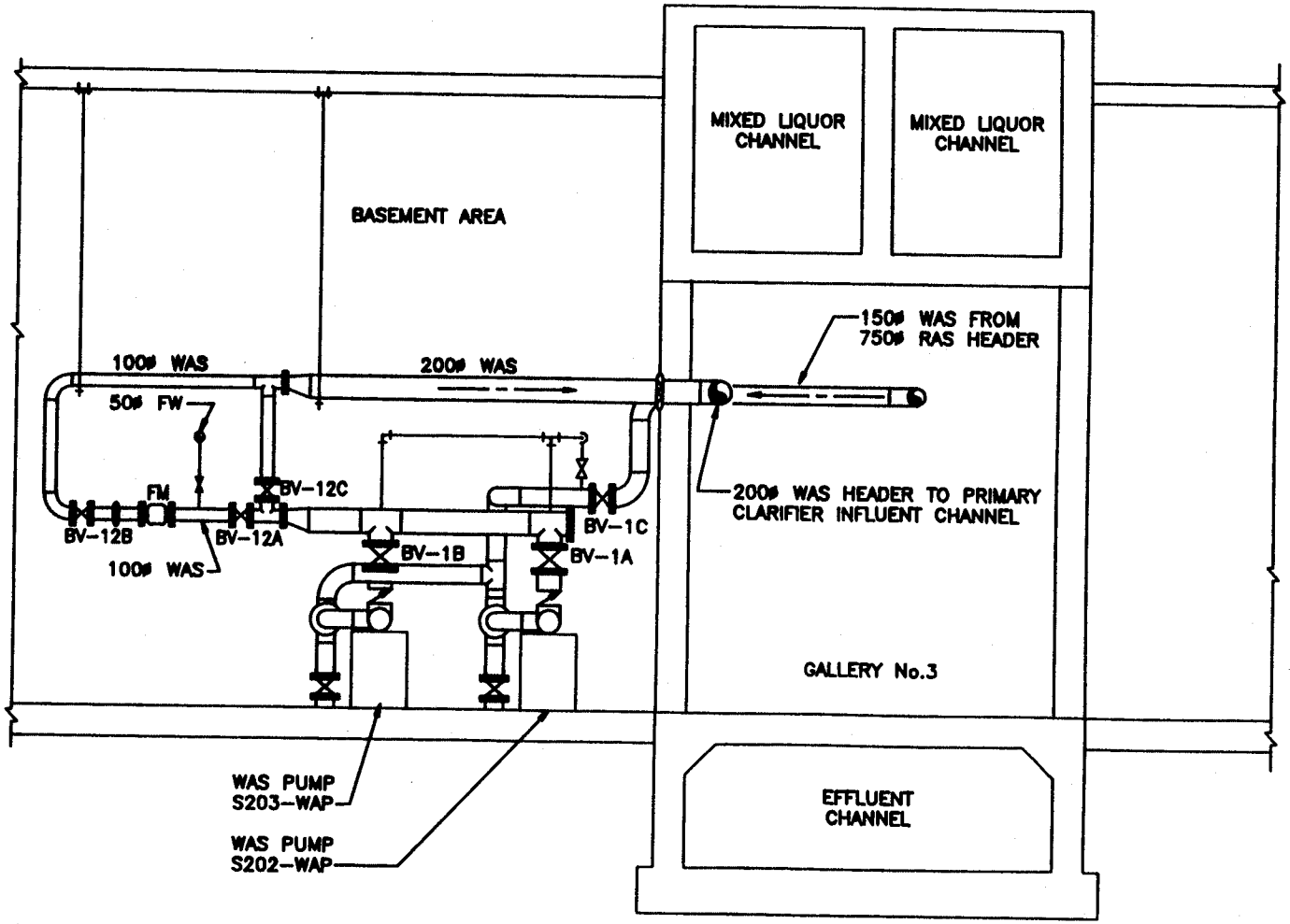
Date : January 1994
Figure 6–1



BASEMENT FLOOR PLAN

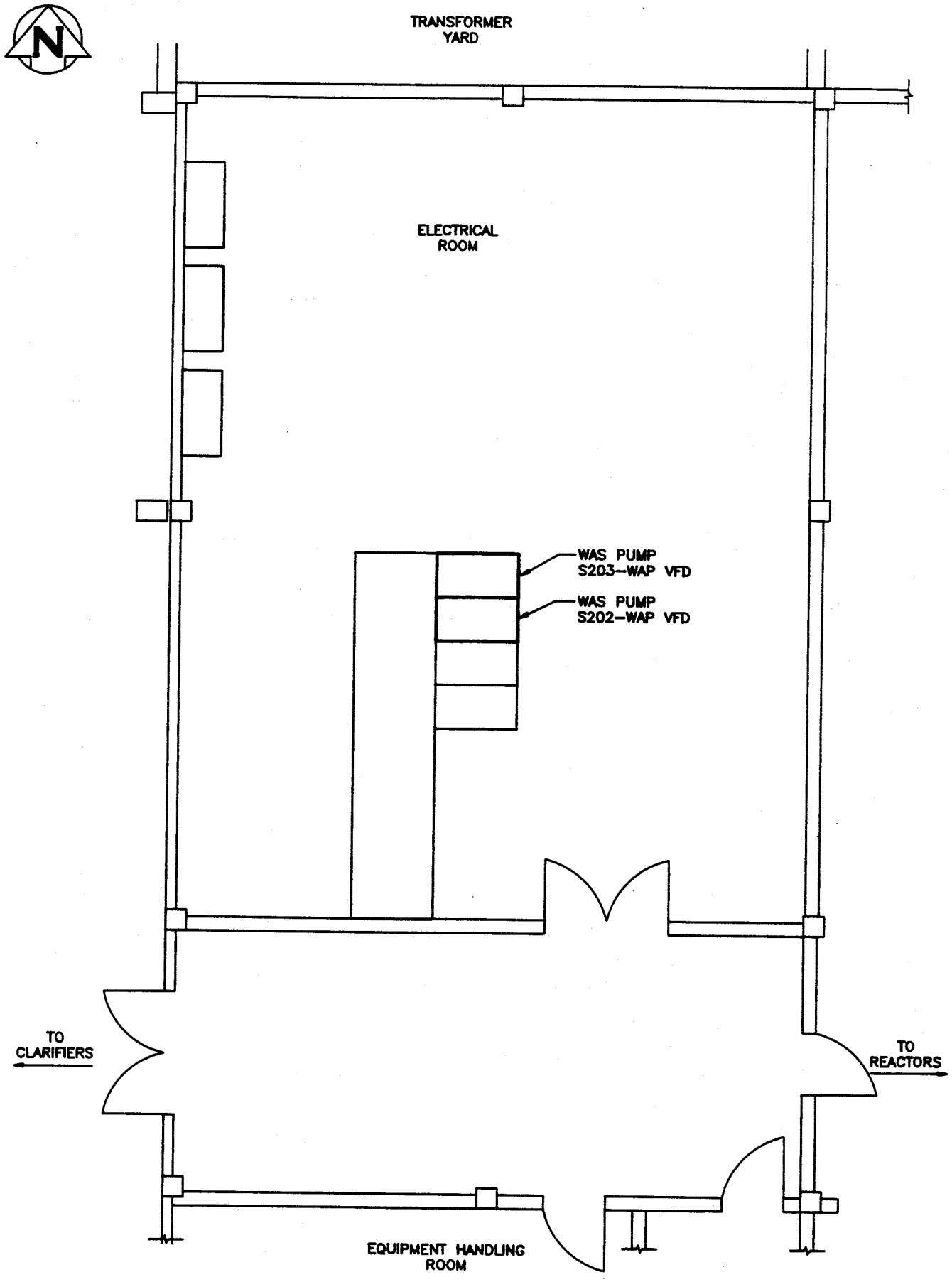
WAS SYSTEM EQUIPMENT LOCATIONS

Date : December 1993
Figure 6-2



WAS PUMPING SYSTEM SECTIONAL VIEW

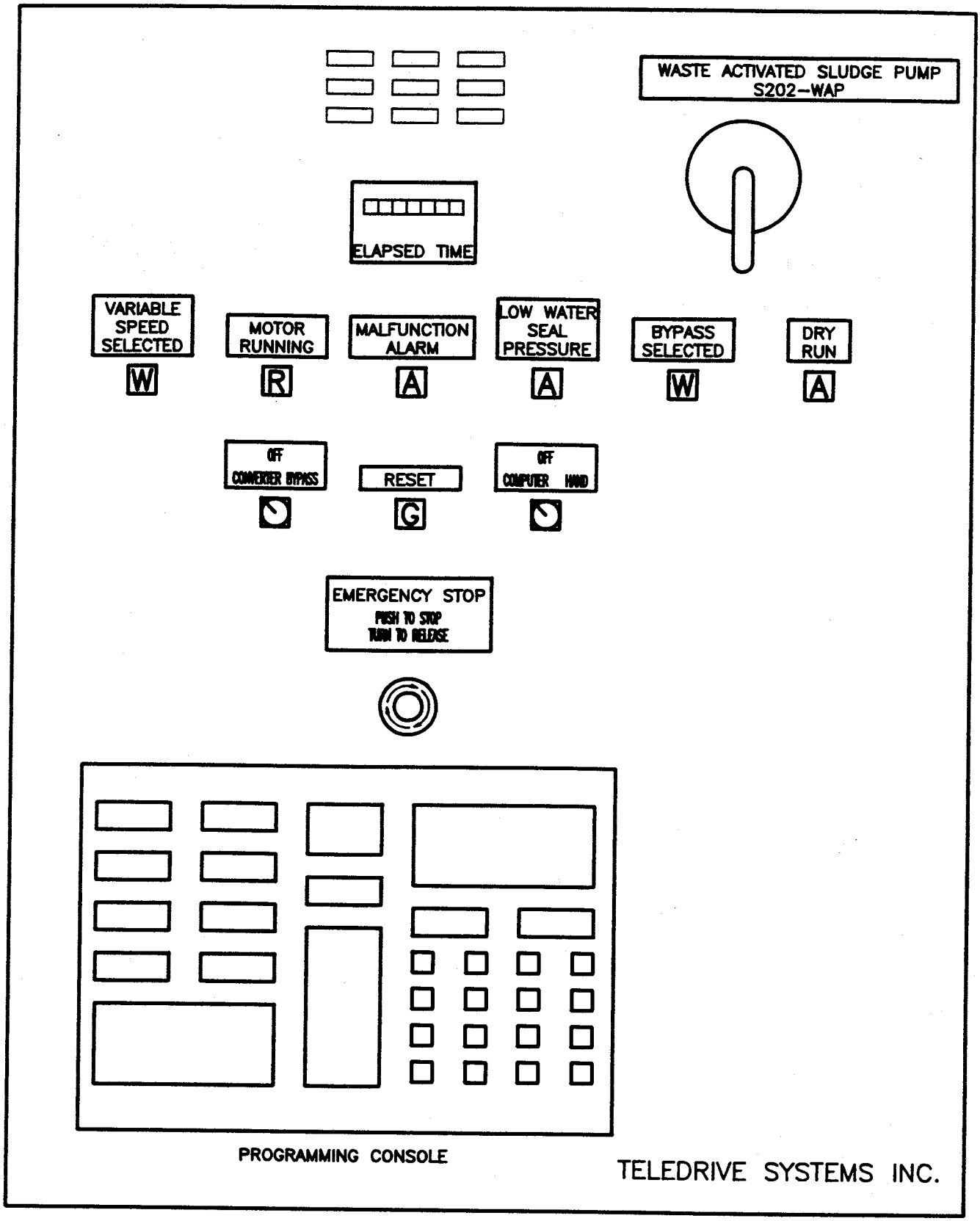
Date : December 1993
Figure 6-3



GROUND FLOOR PLAN

WAS PUMP VFD LOCATIONS

Date : December 1993
Figure 6–4



WAS PUMP S202-WAP VARIABLE FREQUENCY DRIVE

(SIMILAR FOR WAS PUMP S203-WAP)

WAS PUMPS VFD LAYOUT

Date : December 1993
Figure 6-5

Each pump may be shutdown and locked-out using the "EMERGENCY STOP" pushbutton at the panel or the "LOS" switch field located near each unit. The latter are shown in Figure 6-1.

Flow through the WAS header is monitored by magnetic flowmeter S201-FE/FIT. The flow rate is displayed at a local indicating transmitter and also reported to the INFI 90. The location of the flowmeter and indicator is also shown in Figure 6-1.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 6-1. Equipment/Instrument Summary Table 6-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Process Alarms Summary Table 1-3. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 6-6.

6.3.2 Automatic Control

Automatic control consists of computer adjustment of WAS pump speed to maintain a WAS flow setpoint calculated from one of two Operator-selected models: Solids Retention Time and Total Mass Removal.

1) **Solids Retention Time model (SRT)**

The WAS flow setpoint is calculated using:

FWAS	=	K [(MLSS x VOLREAC x NR) / SRT / RASSS where:
FWAS	=	Calculated WAS flow rate required (l/s)
K	=	Unit conversion constant
MLSS	=	Mixed liquor suspended solids value (mg/l)
VOLREACT	=	Volume of one reactor
NR	=	Number of reactors in service (an Operator entry)
SRT	=	Operator-entered solids retention time (days)
RASSS	=	RAS suspended solids value (mg/l);

TABLE 6-1

WAS SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S202-WAP	5-H	5S, 6S, 7S, 8S	5-H	5-H	5-H	5-H
S203-WAP	5-H	1S, 2S, 3S, 4S	5-H	5-H	5-H	5-H
S201-FI	5-A, H, OVERVIEW		5-H			5-A, H

TABLE 6-2

WAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S202-HS1	PUMP CONTROL (LOS)	S				
S202-HS3	PUMP CONTROL (E-STOP)			S		
S202-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S202-HS4	PUMP CONTROL (CONV./OFF/BYPASS)			C		
S202-MN	PUMP CONTROL (RUN)				C	
S202-SC	PUMP CONTROL (SPEED)				C	
S202-MM	PUMP STATUS - RUN			I	I	
S202-ST	PUMP STATUS - SPEED				I	
S202-XM1	PUMP CONTROL STATUS - BYPASS			I		
S202-XM2	PUMP CONTROL STATUS - CONV.			I		
S202-PAL	LOSS OF SEAL WATER			A		
S202-XF	PUMP DRY RUN			A		
S202-QF	DRIVE FAILURE			Q	Q	
S202-HS5	FAILURE RESET			R		
S202-PG1	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S202-PG2	PUMP DISCHARGE PRESSURE	I				0 to 400 kPa
S203-HS1	PUMP CONTROL (LOS)	S				
S203-HS3	PUMP CONTROL (E-STOP)			S		
S203-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S203-HS4	PUMP CONTROL (CONV./OFF/BYPASS)			C		
S203-MN	PUMP CONTROL (RUN)				C	
S203-SC	PUMP CONTROL (SPEED)				C	
S203-MM	PUMP STATUS - RUN			I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 6-6.

(continued)

TABLE 6-2 (continued)

WAS SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	VFD PANEL	INFI 90	REMARKS NORMAL RANGE SET POINT
S203-ST	PUMP STATUS - SPEED				I	
S203-XM1	PUMP CONTROL STATUS - BYPASS			I		
S203-XM2	PUMP CONTROL STATUS - CONV.			I		
S203-PAL	LOSS OF SEAL WATER			A		
S203-XF	PUMP DRY RUN			A		
S203-QF	DRIVE FAILURE			Q	Q	
S203-HS5	FAILURE RESET			R		
S203-PG1	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S203-PG2	PUMP DISCHARGE PRESSURE	I				0 to 400 kPa
S201-FI	WAS FLOW TO PRIMARY CLARIFIERS	I			I	0 to 30 L/S

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 6-6.

6.4 ROUTINE CHECKS

1. WAS Pumps S202-WAP and S203-WAP:

Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;
Check seal water flow when pumps are running;
Lubricate pump regularly.

6.5 EQUIPMENT DATA

1. WAS Pumps: S202-WAP and S203-WAP

Location:	Basement Area between clarifiers No. 1 and 2	
Purpose:	To pump WAS from clarifiers No. 1 and 2 and the RAS header to the primary clarifiers influent channel	
Manufacturer:	Pump: Netzsch Incorporated Type NE100A	
	Gear Reducer:	Nord Gear Ltd. Ratio - 4.58
	Motor:	Siemens 11.2 kw (15 hp), 332/575V, 3ph, 60 Hz 1765 rpm, 26.0/15.0 FLA
	VFD:	Teledrive Systems Inc.

2. Magnetic Flowmeter: S201-FE/FIT

Location:	Basement Area between clarifiers No. 1 and 2	
Purpose:	Monitor WAS flow to primary clarifiers	
Manufacturer:	Sensor:	Fischer & Porter - Model #10014
	Transmitter:	Fischer & Porter - MAG-XM
	Range:	0 to 30 L/S
	Input:	120 VAC, 60 Hz
	Output:	4 - 20 mADC

7.0 SCUM REMOVAL SYSTEM

7.1 PURPOSE

The scum removal system is designed to remove collected scum from the liquid surface of each clarifier and convey it to the sludge storage tanks or the headworks of the plant.

7.2 SYSTEM DESCRIPTION

Scum is collected in the clarifiers with each revolution of the bridge drive mechanism as described in Section 4.0. The scum is swept into a collection trough and flushed to a scum holding tank. Clarifiers No. 1 and No. 2 share a common scum tank designated Scum Tank No. 1 while clarifier No. 3 has a similar tank designated Scum Tank No. 2. The levels in each tank are monitored by level sensors.

Collected scum is continuously removed from each tank by scum pumps. Tank No. 1 is drained by two constant speed scum pumps designated S307-SP and S308-SP, aligned in a duty/standby arrangement. Similarly, tank No. 2 is drained by one constant speed pump designated S309-SP.

The scum tank and scum pump subsystems all have motorized routing valves to direct pumped scum to a common 100 mm diameter scum header or to a recirculation pipeline. Each scum tank is equipped with a solenoid operated flushing water inlet valve located in the pump suction line. Each clarifier has a flushing water solenoid for scum trough flushing. Pumped scum from the common scum header is routed either to the primary clarifiers or to the sludge storage tanks by means of hand operated valves.

A summary of the equipment described in this section is as follows:

1. Three constant speed scum pumps: S307-SP, S308-SP, & S309-SP;
2. Three scum trough flushing water solenoid valves: S303-FV, S304-FV, & S312-FV;
3. Two scum line flushing water solenoid valves: S306-FV & S313-FV;

4. Two scum line recirculation solenoid valves: S301-FV & S310-FV;
5. Two scum line system solenoid valves: S302-FV & S311-FV;
6. Two scum tank level sensors: S305-LE/LIT & S314-LE/LIT.

Scum system equipment locations are found on the ground floor and basement floor plans shown in Figures 7-1 and 7-2. Figure 7-3 shows a detailed layout of the scum removal system for clarifiers No. 1 and No. 2. Similarly, Figure 7-4 shows a detailed layout of the system for clarifier No. 3. Sectional views of both systems are provided in Figures 7-5 and 7-6. A typical sectional view of a scum trough and baffle is shown in Figure 7-7.

7.3 MONITORING AND CONTROL

7.3.1 Process Equipment

Each of the three scum pumps, S307-SP, S308-SP, and S309-SP, is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. Pump "RUN" status indication is available at the MCC and FDP-S. In addition, a "LOSS OF SEAL WATER" alarm condition is also monitored at FDP-S.

The pumps are interlocked with level sensors on the scum tanks to prevent pumping during low tank scum levels.

The section of FDP-S dedicated to the monitoring and control of these pumps is shown in Figure 7-8.

The INFI 90 monitors the following pump parameters:

1. Pump "COMP/OFF/HAND" control switch status;
2. Pump "RUN" status;
3. "LOSS OF SEAL WATER" alarm.

TABLE 7-1

SCUM REMOVAL SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S307-SP	5-I	2S		5-I	5-I	5-I
S308-SP	5-I	3S		5-I	5-I	5-I
S309-SP	5-J	7S			5-J	5-J
S303-FV	5-I	1C		5-I	5-I	5-I
S304-FV	5-I	1O		5-I	5-I	5-I
S306-FV	5-I	5S		5-I	5-I	5-I
S312-FV	5-J	1S		5-J	5-J	5-J
S313-FV	5-J	6S		5-J	5-J	5-J
S301-FV	5-I	1Y		5-I	5-I	5-I
S310-FV	5-J	5S		5-J	5-J	5-J
S302-FV	5-I	3V			5-I	5-I
S311-FV	5-J	8S			5-J	5-J
S305-LI	5-I		5-I	5-I		5-I
S314-LI	5-J		5-J	5-J		5-J

TABLE 7-2

CLARIFIERS NO. 1 & 2 SCUM REMOVAL SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S307-HS1	PUMP CONTROL (LOS)	S				
S307-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S307-MN	PUMP CONTROL (START/STOP)				C	
S307-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S307-QF	LOSS OF SEAL WATER			Q	Q	
S307-PG1	PUMP DISCHARGE PRESSURE	I				0 to 400 kPa
S307-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S308-HS1	PUMP CONTROL (LOS)	S				
S308-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S308-MN	PUMP CONTROL (START/STOP)				C	
S308-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S308-QF	LOSS OF SEAL WATER			Q	Q	
S308-PG1	PUMP DISCHARGE PRESSURE	I				0 to 400 kPa
S308-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S303-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S303-HS2	VALVE CONTROL (CLOSE)		C		C	
S303-HS3	VALVE CONTROL (OPEN)		C		C	
S303-ZB	VALVE STATUS - CLOSED			I	I	
S303-ZD	VALVE STATUS - OPEN			I	I	
S303-ZY	SCUM TROUGH FLUSH STATUS				I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 7-11

(continued)

TABLE 7-2 (Continued)

CLARIFIERS NO. 1 & 2 SCUM REMOVAL SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S304-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S304-HS2	VALVE CONTROL (CLOSE)		C		C	
S304-HS3	VALVE CONTROL (OPEN)		C		C	
S304-ZB	VALVE STATUS - CLOSED			I	I	
S304-ZD	VALVE STATUS - OPEN			I	I	
S304-ZY	SCUM TROUGH FLUSH STATUS				I	
S301-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S301-HS2	VALVE CONTROL (CLOSE)		C		C	
S301-HS3	VALVE CONTROL (OPEN)		C		C	
S301-ZB	VALVE STATUS - CLOSED			I	I	
S301-ZD	VALVE STATUS - OPEN			I	I	
S302-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S302-HS2	VALVE CONTROL (CLOSE)		C		C	
S302-HS3	VALVE CONTROL (OPEN)		C		C	
S302-ZB	VALVE STATUS - CLOSED			I	I	
S302-ZD	VALVE STATUS - OPEN			I	I	
S306-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S306-HS2	VALVE CONTROL (CLOSE)		C		C	
S306-HS3	VALVE CONTROL (OPEN)		C		C	
S306-ZB	VALVE STATUS - CLOSED			I	I	
S306-ZD	VALVE STATUS - OPEN			I	I	
S305-LI	SCUM TANK #1 LEVEL INDICATION	I			I	0 to 3.3 m

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 7-11

2) Set individual RAS flow setpoints;

3) Select which valve is MOV;

4) Select manual biasing on or off;

5) Enter bias factors for each valve;

6) Select PE flow;

7) Select bias factor;

8) Select bias mode on or off;

9) Select instantaneous maximum flow.

Operating Procedures:

1) Verify that all valves are in "COMPUTER", including all PE valves for "in service" clarifiers.

NOTE: The primary effluent flow system is a critically inherent part of the RAS pumping strategy. It also has MOV and TOV features similar to the RAS pumping. Therefore, these features must also be set up prior to start of operations if correct and accurate operations are to be achieved and maintained;

2) Verify that all RAS flow control valves are in "cascade" and select the following:

1L - RAS Flow Valve S121-FV;

1M - RAS Flow Valve S122-FV;

1N - RAS Flow Valve S123-FV;

1P - RAS Flow Valve S124-FV.

NOTE: Select "cascade" by pressing the key marked "cascade" on the Operator keyboard. By selecting cascade for these valves, they will automatically modulate to evenly split RAS coming from the RAS pumps;

3) Verify that all PE flow control valves are in "cascade" and select the following:

4L - PE Flow Valve P401-FV;
4M - PE Flow Valve P402-FV;
4N - PE Flow Valve P407-FV;
4P - PE Flow Valve P408-FV.

NOTE: As per Item 2), verify that the valves are in "cascade". This can also be done by transferring to Area 3 and selecting:

Graphic 3B for P401-FV, Clarifier #1;
Graphic 3C for P402-FV, Clarifier #2;
Graphic 3D for P407-FV, Clarifier #3A
Graphic 3D for P408-FV, Clarifier #3B.

By selecting "cascade" for these valves, they will automatically modulate to evenly split PE from the Clarifiers;

4) Select 1G and select the RAS operating mode. MOV (most open valve) or setpoint.

NOTE: MOV (most open valve) - the value chosen as MOV is opened 95% and the actual flow through the valve is measured. This measured flow value is used as a flow rate setpoint for a desired flow split for the remaining valves. The INFI 90 then modulates the remaining valves to maintain the setpoint.

Setpoint mode - the bias entered by the Operator is used as a setpoint for the RAS controller to correspond to the calculated RAS flow rate, but not lower than the Operator-set minimum value. The selected operating mode will be displayed;

5) Press 1H and select which RAS flow valve is to be assigned as MOV (most open valve) - if you selected "most open valve mode" in Step 4);

6) Select the bias factor for each RAS value.

2L - for RAS Flow Valve S121-FV;
2M - for RAS Flow Valve S122-FV;
2N - for RAS Flow Valve S123-FV;
2P - for RAS Flow Valve S124-FV;

7) Select the bias mode for each RAS valve "ON" or "OFF".

3L - for RAS Flow Valve S121-FV;
3M - for RAS Flow Valve S122-FV;
3N - for RAS Flow Valve S123-FV;
3P - for RAS Flow Valve S124-FV;

8) The PE selections will also have to be setup before putting the sequence into automatic operation. Press 2A and select the PE operating mode MOV (most open valve) mode or TOV (totally open valve) mode.

NOTE: In MOV mode, the valve selected is opened 95% and the actual flow is measured. The measured flow value is used as a flow rate setpoint for the remaining valves. The INFI 90 then modulates the remaining valves to maintain the same flow rate as that passing through the MOV selected valve.

TOV Mode - all valves will be opened 95%;

9) Press 2H and assign the valve to be "most open valve" - if you selected MOV mode in Step 8) above;

10) Select the bias % for each PE valve as follows:

6L for PE Flow Valve P401-FV;
6M for PE Flow Valve P402-FV;
6N for PE Flow Valve P407-FV;
6P for PE Flow Valve P408-FV;

11) Select the bias mode for each PE valve to be "ON" or "OFF".

5L for PE Flow Valve P401-FV;
5M for PE Flow Valve P402-FV;
5N for PE Flow Valve P407-FV;
5P for PE Flow Valve P408-FV.

5.4 ROUTINE CHECKS

1. RAS Pumps S101-RAP, S102-RAP, S103-RAP, S108-RAP, and S109-RAP:

   Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;
   Check seal water flow when pumps are running;
   Lubricate pump regularly.

2. Automatic Valves S121-FV, S122-FV, S123-FV, and S124-FV:
   Check that valves are not leaking;
   Check pneumatic actuators for proper operation.

3. Regularly check suspended solids analyzer for calibration.

2) **Total Mass Removal model**

The WAS flow setpoint is calculated by the computer using:

FWAS	=	K x TMASS/RASSS

where:

FWAS	=	Calculated WAS flow rate required (l/s)
K	=	Unit conversion constant
TMASS	=	Operator-entered total WAS mass to be removed per day (kg)
RASSS	=	RAS suspended solids value (mg/l)

The calculated WAS flow rate from either model is modified by one of three Operator-set withdrawal modes: 1 "continuous" withdrawal mode or 2 timed-withdrawal modes, "interval" or "intermittent".

1) Continuous mode:
WAS is removed as long as one RAS pump is operating;

2) First timed mode - "Interval":
The lead WAS pump runs for an Operator-set time interval, at a modified WAS flow setpoint (as calculated from SRT model or Total Mass model). Start WAS pumping each day at the Operator entered starting time. The Operator-set time interval is setable from 6 to 24 hours;

The modified WAS flow rate is calculated as follows:

FWAS	=	(Calc. FWAS) x 24 hrs./Int.

Where:

FWAS	=	WAS flow rate required
Calc. FWAS	=	WAS value from SRT model or Total Mass model.
Int.	=	Operator set time interval for pumping (6-24 hrs);

3) Second time mode - "Intermittent":

Will consist of intermittent cycle pumping e.g. 30 out of 60 minutes. The pumping time is Operator-selected.

The modified WAS flow rate is calculated as follows:

FWAS	=	(Calculated FWAS) x 60 min./Int.

Where:

FWAS	=	WAS flow rate required
Calc. FWAS	=	WAS value from SRT model or Total Mass Model
Int.	=	Operator set time interval for pumping.

For both the times "interval" and "intermittent" cycle pumping modes, if the calculated WAS flow rate is outside of the pump range (5 - 29 l/s), a message to the Operator is generated stating the problem. The Operator adjusts the interval or duration as required. Until such adjustments are made, operate the pumps at the nearest range limit.

Computer monitoring and control of secondary clarifier WAS pumping control is provided by this strategy.

Select:
- SRT/Mass retention model;
- Number of "in-service reactors";
- Time interval to start WAS pumping (days);
- Total WAS Mass to be removed each day;
- WAS mode 0 = Continuous
  1 = Interval
  2 = Intermittent;
- WAS pumping interval (hours);
- WAS pumping intermittent interval (minutes);
- Duty pump;
- Start time.

When in automatic control mode, the lead and standby pumps are automatically reassigned whenever the lead pump stops. If the lead pump fails, the standby pump is reassigned and started as the new lead pump.

6.3.3 Workstation Station Control

To assist in understanding the following control descriptions, refer to the specific screen graphic displays noted here and summarized in Bridging Table 6-1.

Using Display 5H and the control keyboard, the Operator is able to manually control the following equipment:

1) Start/stop WAS pumps;

Using the displays and control keyboard, the Operator is able to adjust the following controls:

1) Adjust speed WAS pumps;
2) Select lead WAS pump;
3) Select either total mass or solids retention time control model;
4) Set solids retention time setpoint;
5) Set total mass to be wasted from the secondary clarifiers;
6) Select either continuous or one of two timed withdrawal modes;
7) Select time interval for limited withdrawal mode (6 - 24 hours)
8) Select intermittent time for timed withdrawal mode;
9) Enter number of "in-service" reactors;
10) Enter maximum and minimum WAS flow limits (L/S) for each pump.

WAS Pumping - Graphic 5H

Operating Procedures:

1) Verify that WAS pumps, S203-WAP and S202-WAP are in "auto" and that the speed controllers are in "cascade",

   Select: 1S "WAS Pump S203-WAP" - Enter "auto"

   2S "WAS Pump S203-WAP" - Enter "cascade"

5S "WAS Pump S202-WAP" - Enter "auto"

6S "WAS Pump S202-WAP - Enter "cascade";

2) Press 2T and select the duty pump,

Pump #1 = S203-WAP Pump #2 = S202-WAP

Note: If the lead pump fails, the standby pump will be reassigned to duty and start as lead pump;

3) Enter the maximum flow limits for WAS Pumps S203-WAP and S202-WAP,

3S - Minimum flow for S203-WAP - Enter value

4S - Maximum flow for S203-WAP - Enter value

7S - Minimum flow for S202-WAP - Enter value

8S - Maximum flow for S202-WAP - Enter value;

4) Press 1C and select retention model SRT (Solids Retention Time) or Total Mass;

5) If "SRT" was selected in Step 4) above, press 2C "number of reactors in service" and enter the number;

6) Press 3C "Solid Retention Time in Days" and enter the number of days;

7) If "Total Mass" was selected in Step 4) above, press 4C "Total WAS Mass to be Removed per Day" and enter a value (Kg/d);

8) In either mode selected, press 5C and select the WAS mode:

0 = Continuous

1 = Interval

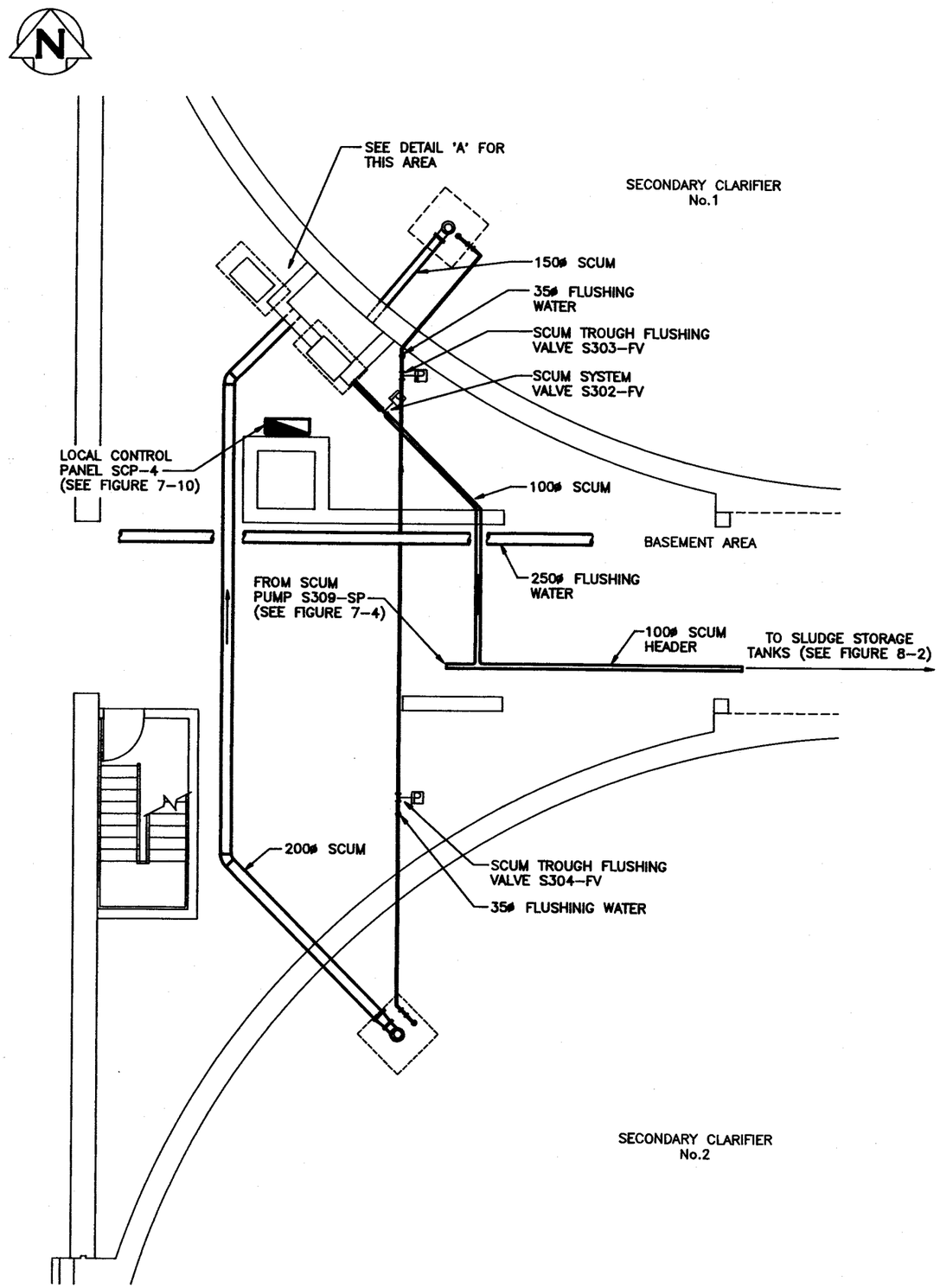
2 = Intermittent;

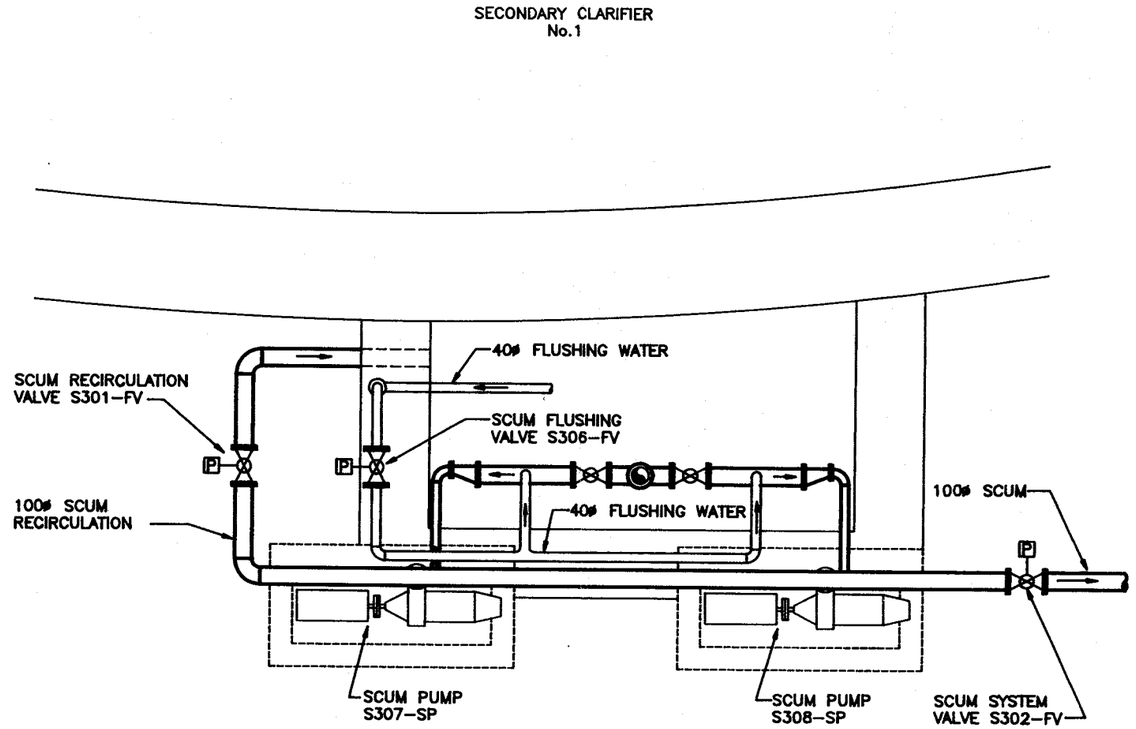
9) If "Interval = 1" was selected in Step 8) above, press 6C and enter the time interval in hours for withdrawal mode;

10) If "Intermittent" was selected in Step 8) above, press 7C and enter the intermittent time for timed withdrawal mode;

11) Verify that the RAS pumping system is in operation on Graphic 5E, 5F and 5G;

12) From Graphic 5H, start the automatic WAS pumping sequence by pressing "1T" and entering the "start time".

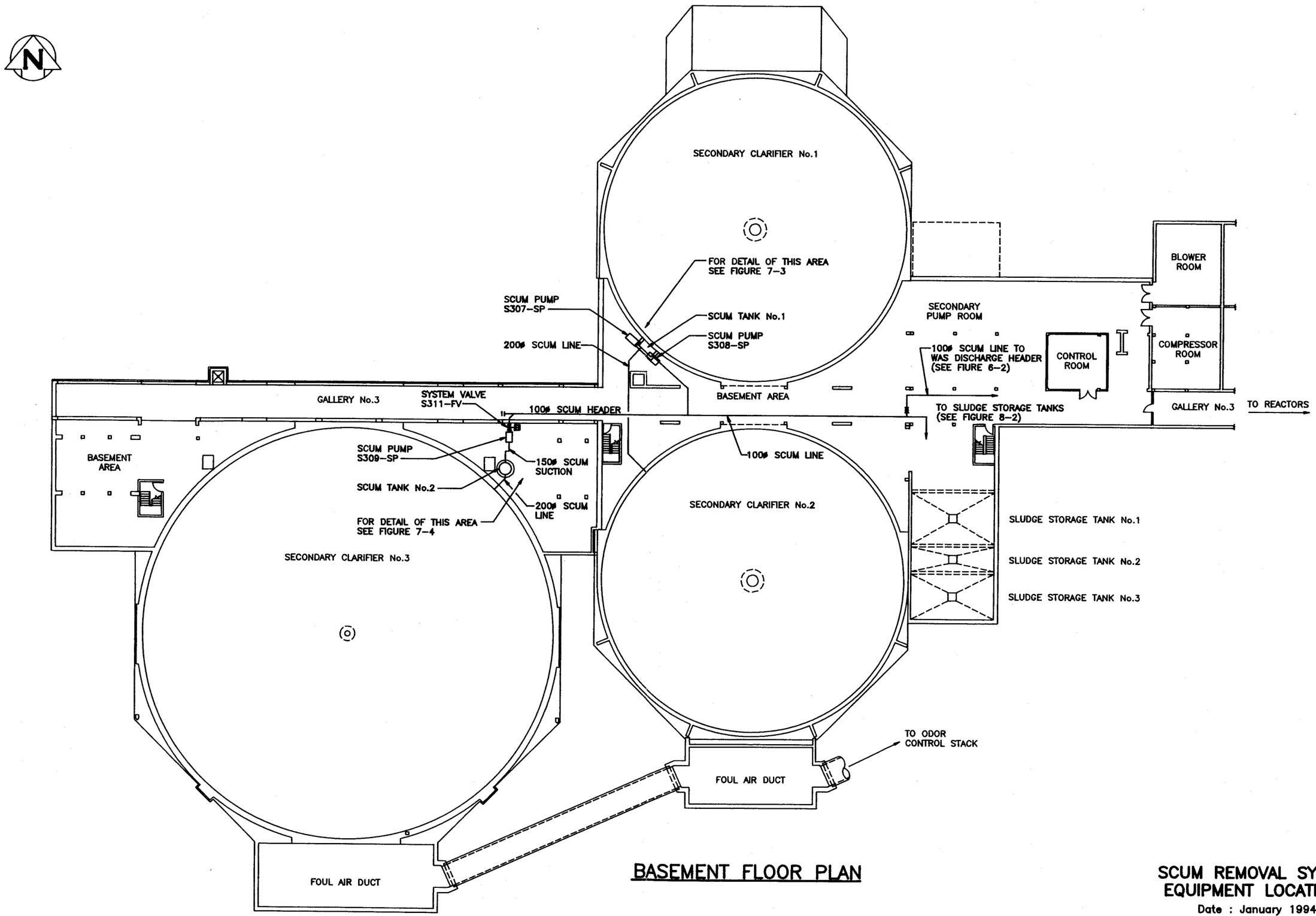




DETAIL A

CLARIFIERS No.1 & 2 SCUM REMOVAL SYSTEM EQUIPMENT LOCATIONS

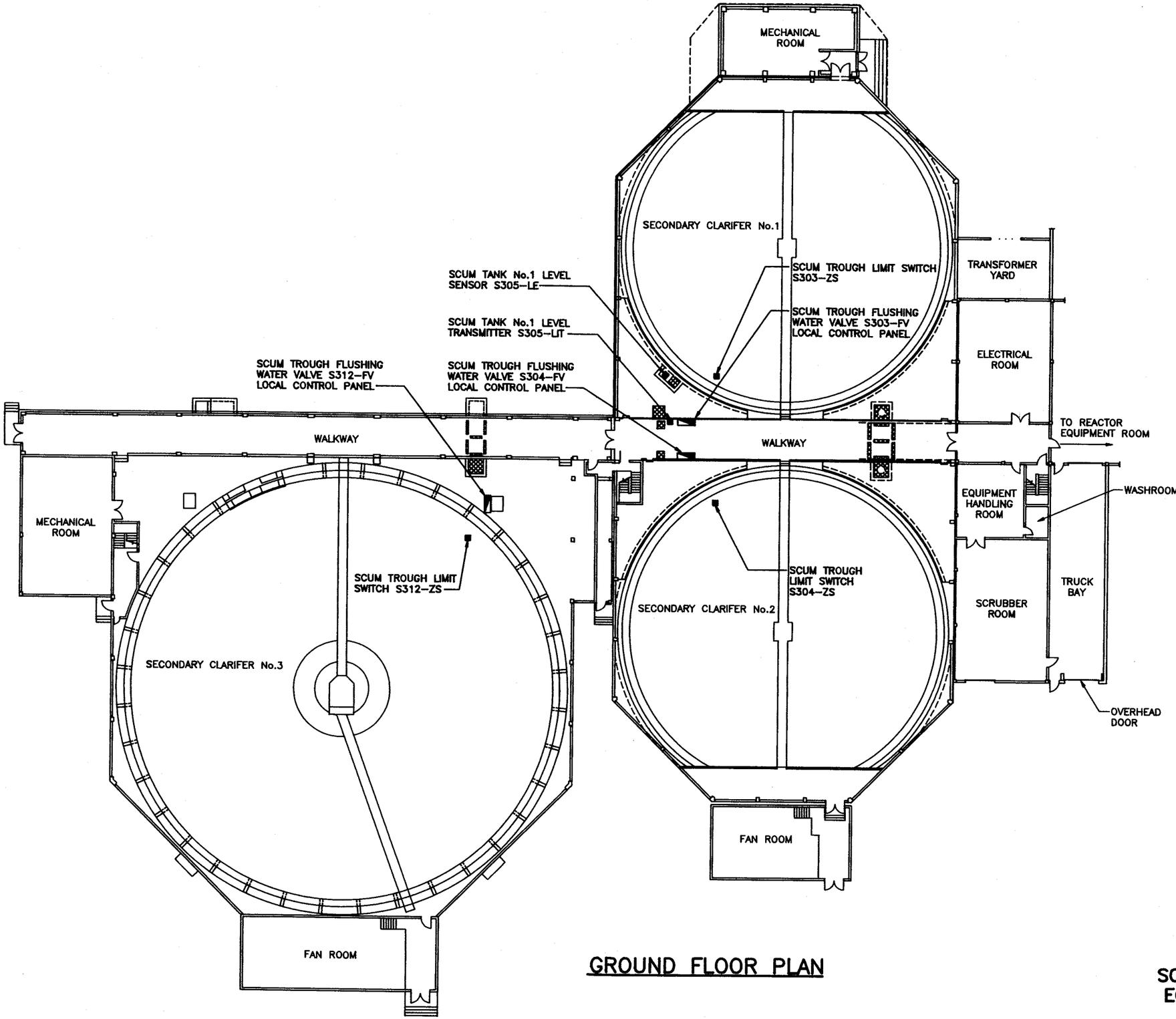
Date : January 1994
Figure 7-3



BASEMENT FLOOR PLAN

SCUM REMOVAL SYSTEM EQUIPMENT LOCATIONS

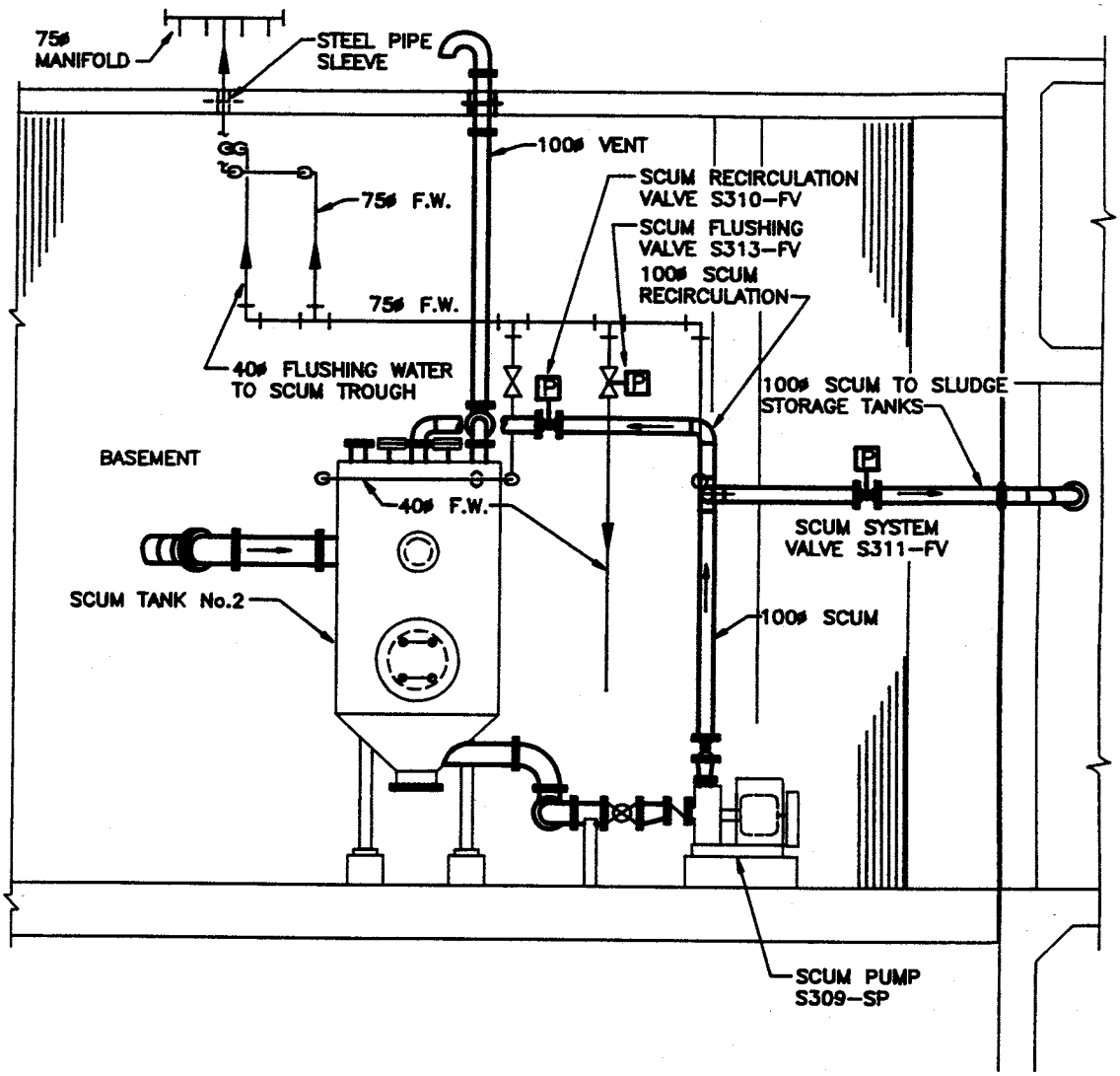
Date : January 1994
Figure 7-2



GROUND FLOOR PLAN

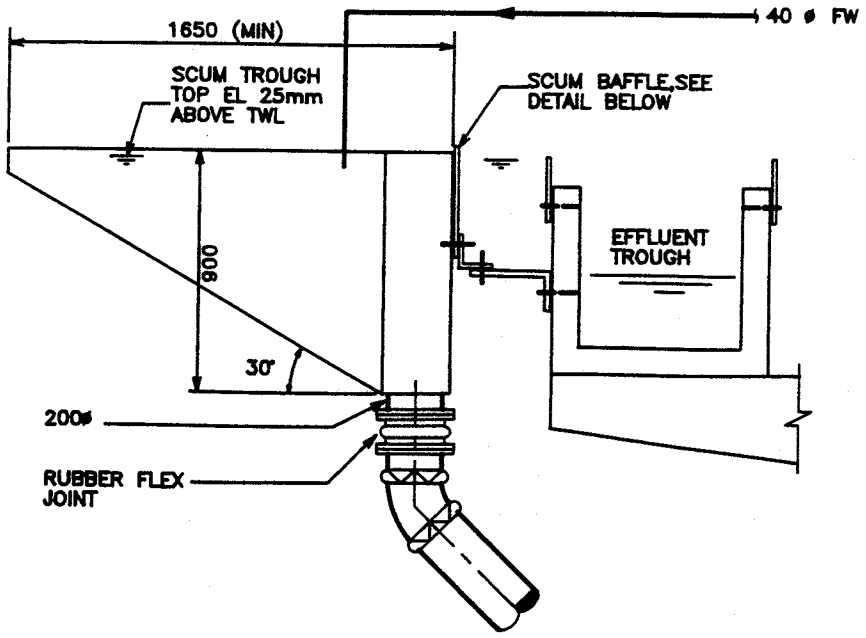
SCUM REMOVAL SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 7-1

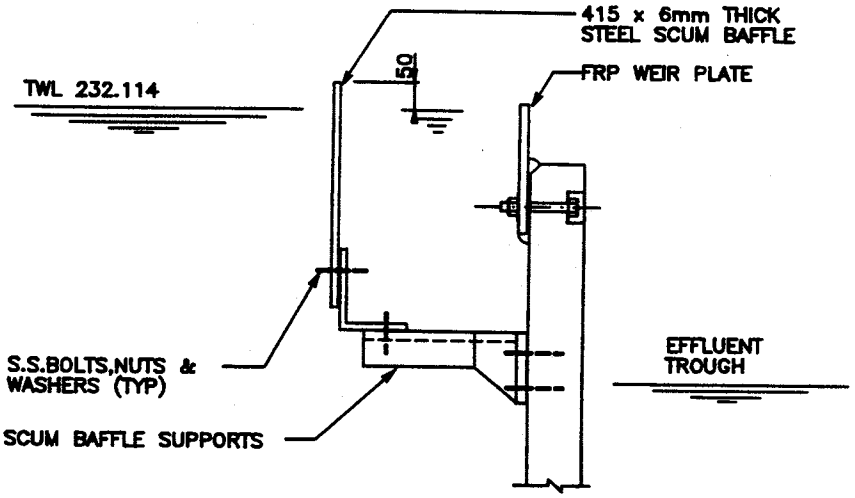


CLARIFIER No.3 SCUM PUMP SECTIONAL VIEW

Date : January 1994
Figure 7-6



SCUM TROUGH DETAILS



TYPICAL SCUM BAFFLE DETAILS

SCUM TROUGH & BAFFLE SECTIONAL VIEW

Date : January 1994
Figure 7–7

TABLE 7-3

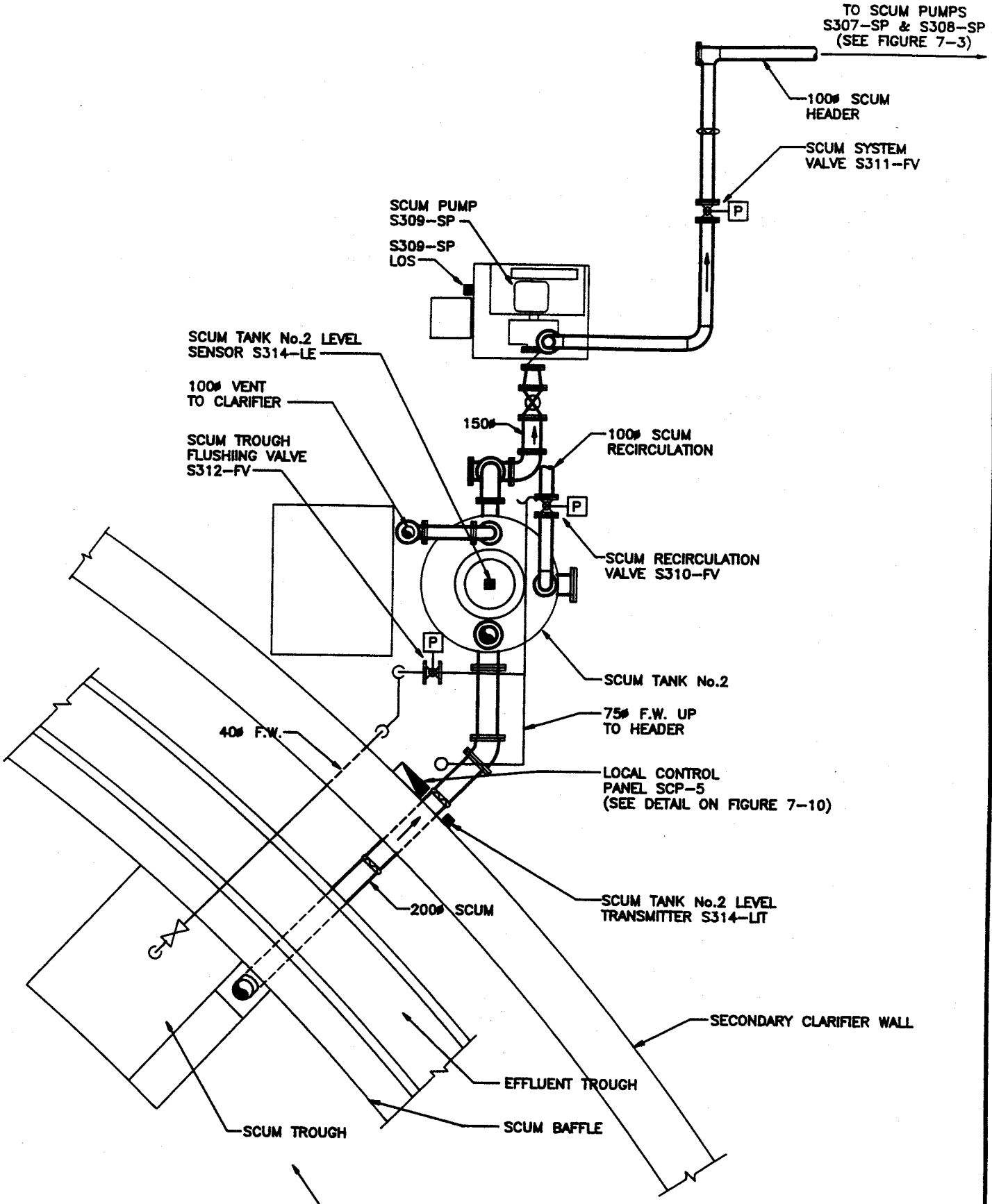
CLARIFIER NO. 3 SCUM REMOVAL SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S309-HS1	PUMP CONTROL (LOS)	S				
S309-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S309-MN	PUMP CONTROL (START/STOP)				C	
S309-MM	PUMP STATUS - RUN	I*		I	I	* AT MCC
S309-QF	LOSS OF SEAL WATER			Q	Q	
S309-PG1	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S309-PG2	PUMP DISCHARGE PRESSURE	I				0 to 400 kPa
S312-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S312-HS2	VALVE CONTROL (CLOSE)		C		C	
S312-HS3	VALVE CONTROL (OPEN)		C		C	
312-ZB	VALVE STATUS - CLOSED			I	I	
S312-ZD	VALVE STATUS - OPEN			I	I	
S312-ZY	SCUM TROUGH FLUSH STATUS				I	
S310-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S310-HS2	VALVE CONTROL (CLOSE)		C		C	
S310-HS3	VALVE CONTROL (OPEN)		C		C	
S310-ZB	VALVE STATUS - CLOSED			I	I	
S310-ZD	VALVE STATUS - OPEN			I	I	
S311-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S311-HS2	VALVE CONTROL (CLOSE)		C		C	
S311-HS3	VALVE CONTROL (OPEN)		C		C	
S311-ZB	VALVE STATUS - CLOSED			I	I	
S311-ZD	VALVE STATUS - OPEN			I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 7-12

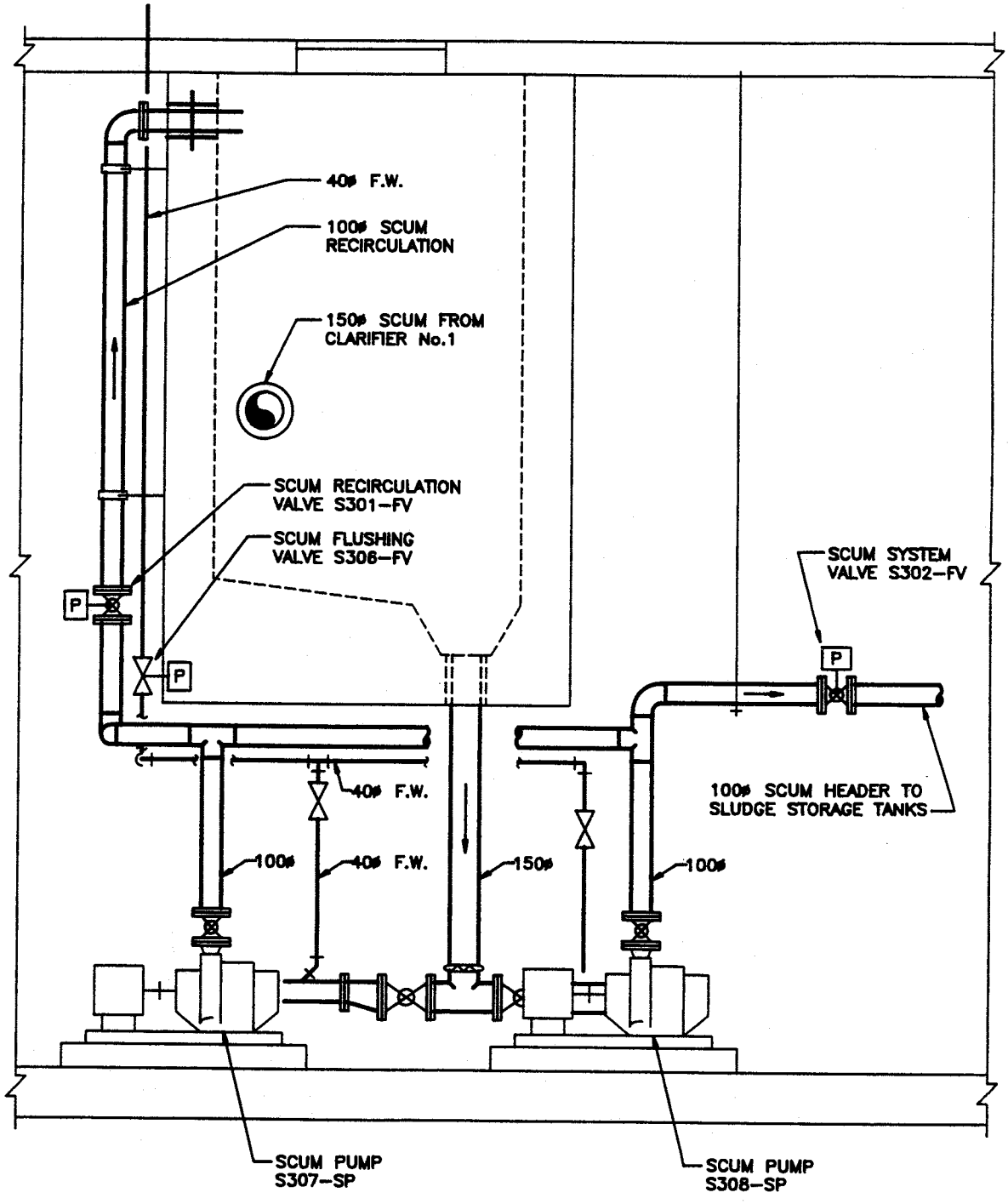
(continued)



BASEMENT FLOOR PLAN

CLARIFIER No.3
SCUM REMOVAL SYSTEM
EQUIPMENT LOCATIONS

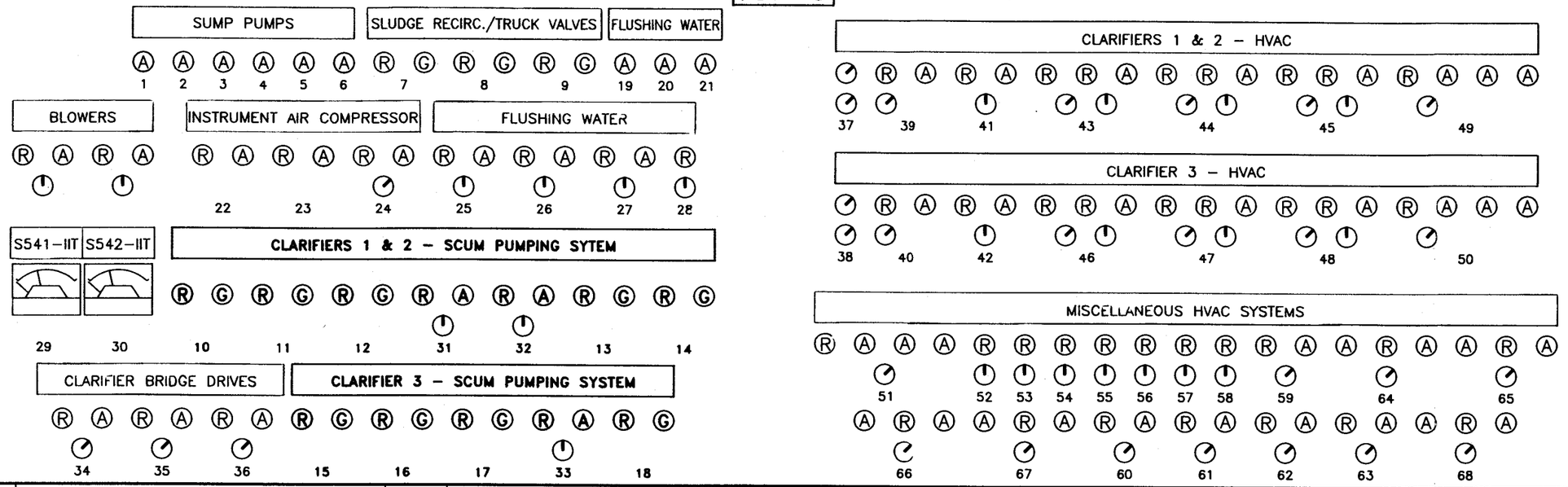
Date : January 1994
Figure 7-4



CLARIFIERS No.1 & 2
SCUM PUMPS SECTIONAL VIEW

Date : January 1994
Figure 7-5

FDP-S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ⏻ – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION

A
Ⓐ A – HIGH LEVEL

No. 1–6

1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

A B
Ⓡ Ⓖ A – **OPEN**
B – **CLOSED**

No. 7–18

7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	**RECIRCULATION VALVE – S301–FV**
11	**SYSTEM VALVE – S302–FV**
12	**FLUSHING WATER CLEANING VALVE – S306–FV**
13	**SCUM TROUGH No.1 CLEANING VALVE – S303–FV**
14	**SCUM TROUGH No.2 CLEANING VALVE – S304–FV**
15	**RECIRCULATION VALVE – S310–FV**
16	**SYSTEM VALVE – S311–FV**
17	**FLUSHING WATER CLEANING VALVE – S313–FV**
18	**SCUM TROUGH CLEANING VALVE – S312–FV**

A
Ⓐ A – LOSS OF SEAL WATER

No. 19–21

19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION

A B
Ⓡ Ⓐ A – RUN
B – FAIL

No. 22–23

22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

A B
Ⓡ Ⓐ A – RUN
C⊘ B – LOSS OF FLOW
C – OFF/ON

No.24

24	COMPRESSOR COOLING FAN – S537–FN

A B
Ⓡ Ⓐ A – RUN
C⏻ B – PUMP FAIL
C – COMP/OFF/HAND

No. 25–27

25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

A Ⓡ A – RUN
B⏻ B – COMP/OFF/HAND

No. 28

28	FLUSHING WATER PUMP – S553–FWP

A B
Ⓡ Ⓐ A – RUN
C⏻ B – FAIL
C – COMP/OFF/HAND
D – CURRENT

No. 29–30

29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION

A B
Ⓡ Ⓐ **A – RUN**
B – LOSS OF SEAL WATER
C⏻ **C – COMP/OFF/HAND**

No. 31–33

31	**SCUM PUMP – S307–SP**
32	**SCUM PUMP – S308–SP**
33	**SCUM PUMP – S309–SP**

A B
Ⓡ Ⓐ A – RUN
C⊘ B – HIGH TORQUE FAIL
C – OFF/ON

No. 34–36

34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

A⊘ A – COMP/HAND
B⊘ B – SUMMER/WINTER

No. 37–38

37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

A B
Ⓡ Ⓐ A – RUN
C⊘ B – LOSS OF FLOW
C – OFF/ON

No. 39–40

39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

A B
Ⓡ Ⓐ A – RUN
C⏻ B – LOSS OF FLOW
C – COMP/OFF/HAND

No. 41–42

41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION

A B C A – SLOW
Ⓡ Ⓡ Ⓐ B – FAST
C – LOSS OF FLOW
D⊘ ⊘E D – SLOW/FAST
E – COMP/OFF/HAND

No. 43–48

43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

A B C D A – RUN
Ⓡ Ⓐ Ⓐ Ⓐ B – GLYCOL FLOW FAIL
C – FLUSH WATER FLOW FAIL
E⊘ D – LOW TEMP
E – OFF/ON

No. 49–51

49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

A Ⓡ A – RUN
B⏻ B – COMP/OFF/HAND

No. 52–58

52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

A B
Ⓡ Ⓐ A – RUN
C⊘ B – LOSS OF FLOW
C – OFF/ON

No. 59–63

59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION

A B C A – LOSS OF FLOW
Ⓐ Ⓡ Ⓐ B – RUN
C – LOW TEMP
D⊘ D – OFF/ON

No. 64–68

64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

SCUM REMOVAL SYSTEM
FIELD DEVICE PANEL FDP-S

Date : January 1994
Figure 7-8

TABLE 7-3 (continued)

CLARIFIER NO. 3 SCUM REMOVAL SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S313-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S313-HS2	VALVE CONTROL (CLOSE)		C		C	
S313-HS3	VALVE CONTROL (OPEN)		C		C	
S313-ZB	VALVE STATUS - CLOSED			I	I	
S313-ZD	VALVE STATUS - OPEN			I	I	
S314-LI	SCUM TANK #2 LEVEL INDICATION	I			I	0 to 2.365 m

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 7-12

Each pump can be shut down and locked-out using the "LOS" pushbutton field located near each unit. These pushbuttons are shown in Figures 7-3 and 7-4.

Flushing water lines at each of the clarifiers are used to clean out the scum troughs. Solenoid valves S303-FV, S304-FV, and S312-FV serve to regulate the flow. Each valve is controlled from a "COMP/HAND" switch located on a local control panel. The "HAND" position allows for manual control of the valve from the "OPEN" and "CLOSE" pushbuttons also located on this panel. The "COMP" position surrenders all valve control to the INFI 90. An operator can monitor valve "OPEN" and "CLOSE" positions from indicating lights at FDP-S.

The locations of the three local panels are found on the ground floor plan shown in Figure 7-1 while a typical panel layout is provided in Figure 7-9. The section of FDP-S dedicated to the monitoring of these valves is shown in Figure 7-8.

Each scum trough has a limit switch mounted near it which trips whenever the travelling mechanism passes over it. This signal is monitored by the INFI 90 to initiate automatic flushing of the trough. Automatic operation is fully described in Section 7.3.2.

The INFI 90 monitors the following valve parameters:

1. Valve "COMP/HAND" control switch status;
2. Valve "OPEN" and "CLOSE" status;
3. Tripping of scum trough limit switch.

The three remaining solenoid valves associated with the scum removal system for clarifiers No. 1 and No.2, S301-FV, S302-FV, and S306-FV, are controlled from a local control panel designated SCP-4. The control description is similar for all three valves. Each valve is controlled from a "COMP/HAND" switch located on SCP-4. The "HAND" position allows for manual control of the valve from the "OPEN" and "CLOSE" pushbuttons also located on SCP-4. The "COMP" position surrenders all valve control to the INFI 90.

An operator can monitor valve "OPEN" and "CLOSE" positions from indicating lights at FDP-S.

The location of SCP-4 is found in Figure 7-3 while a panel layout is provided in Figure 7-10. The section of FDP-S dedicated to the monitoring of these valves is shown in Figure 7-8.

The INFI 90 monitors the following valve parameters:

1. Valve "COMP/HAND" control switch status;
2. Valve "OPEN" and "CLOSE" status.

The three remaining solenoid valves associated with the scum removal system for clarifier No. 3, S310-FV, S311-FV, and S313-FV are controlled from a second local control panel designated SCP-5 in a manner similar to the one just described for SCP-4.

The location of SCP-5 is found in Figure 7-4 while a panel layout is provided in Figure 7-10. The section of FDP-S dedicated to the monitoring of these valves is shown in Figure 7-8.

The level in each scum tank is monitored by level sensors S305-LE/LIT and S314-LE/LIT. The level is displayed at a local indicating transmitter and also reported to the INFI 90. The locations of both sensors and transmitters are shown in Figures 7-1 and 7-4.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 7-1. Equipment/Instrument Summary Tables 7-2 and 7-3 provide a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Process Alarms Summary Table 1-3. Further control information is provided in the Process and Instrumentation Diagrams shown in Figures 7-11 and 7-12.

7.3.2 Automatic Control

Automatic control of the scum trough flushing valve consists of a timed open and close.

1) When the collector position switch trips a limit switch the computer will do the following:

   a) Open a respective trough flushing valve for an operator selectable time.

Automatic control of the scum pumping equipment consists of an automatic withdrawal cycle, initiated when the respective scum holding tank reaches a preset high level. The pumping routine for each tank is the same with provisions for Operator-selection of duty and standby pumps. The duty and standby pumps are switched by the computer after a tunable number of cycles or at any time by the Operator. The pumping routine for each scum tank includes the following steps:

1) Open recirculation valve;
2) Start scum pump;
3) Continue pumping for Operator-set time interval;
4) Open system valve;
5) Close recirculation valve;
6) Continue pumping until tank low level switch activates;
7) Stop scum pump;
8) Close system valve;
9) Open flushing water valve for Operator-set time interval;
10) Close flushing water valve;
11) Open recirculation valve;
12) Start scum pump;
13) Continue pumping for Operator-set time interval;
14) Open system valve;
15) Close recirculation valve;
16) Continue pumping until tank low level switch activates;

17) Stop scum pump;

18) Close system valve.

If the duty pump fails, the computer automatically starts the standby pump for Clarifiers #1 and #2. Clarifier #3 operates with a single scum pump until additional clarifiers are built.

Each time the collector sweeps scum into the trough, the computer automatically opens the collection scum trough solenoid operated flushing water valve for an Operator-set time interval.

7.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific graphic displays noted here and summarized in Bridging Table 7-1.

Manual control consists of Operator-initiated commands to:

1) Start/stop scum pumps;
2) Open/close routing valves;
3) Open/close flushing water valves.

Secondary Clarifier Scum Pumping - Displays 5I & 5J
Operating Procedures:

1) Open recirculation valve S310/S301;
2) Start pump S309/S307-S308;
3) Pump for selected recirculation time period;
4) Close recirculation valve S310/S301;
5) Open discharge valve S311/S302;
6) Level in tank will fall to selected low level;
7) Stop pump S309/S307-S308;

8) Close discharge valve S311/S302;
9) Open flushing water valve S313/S306;
10) Flush for selected time period;
11) Close flushing water valve S313/S306;
12) Open recirculation valve S310/S301;
13) Start pump S309/S307-S308;
14) Pump for selected recirculation time period;
15) Close recirculation valve S310/S301;
16) Open discharge valve S311/S302;
17) Level in tank will fall to selected low level;
18) Close discharge valve S311/S302;
19) Stop pump S309/S307-S308;
20) Sequence should remain "enabled" to begin when next high level is reached.

Secondary Clarifier Scum Pumping - Graphic 5J
Start-Up Procedures:

1) Press 2S "Scum Trh Flsh Time" and select length of time to flush through. Press "Esc" once;
2) Press 3S "SC Flsh Time" and select the flushing cycle time. Press "Esc" once;
3) Press 4S "SC Reco Time" and select the recirculation cycle time. Press "Esc" once;
4) Press 1T "SC Tk2 Lvl Hi Set" and select the hi level of the tank. Press "Esc" once;
5) Press 2T "SC Tk2 Lvl Lo Set" and select the low level of the tank. Press "Esc" once;
6) Verify that the recirculation valve S310 is in "COMPUTER". Select 5S and verify that the valve is in "auto". Press "Esc" once;
7) Verify that the flushing water valve S313 is in "COMPUTER". Select 6S and verify that the valve is in "auto". Press "Esc" once;
8) Verify that the scum pump S309 is in "COMPUTER". Select 7S and verify that the pump is in "auto". Press "Esc" once;

9) Verify that the discharge valve S311 is in "COMPUTER". Select 8S and verify that the valve is in "auto". Press "Esc" once;

10) Press 3T "SC PP Auto Seq" and select "enable", Press "Esc" once;

11) Press 5T "SC PP Override" and select "start", Press "Esc" once;

12) Press 4T "SC PP RST" and select "start", (Only if there is a permissive and you cannot enable the pump - Note: Pump stopped on low flow). Press "Esc" once. The automatic operations will begin.

7.4 ROUTINE CHECKS

1. Scum Pumps S307-SP, S308-SP, and S309-SP:

Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;
Check seal water flow when pumps are running;
Lubricate pumps regularly.

2. Solenoid Valves S301-FV, S302-FV, S303-FV, S304-FV, S306-FV, S310-FV, S311-FV, S312-FV, and S313-FV:

Check that valves are not leaking;
Check pneumatic actuators for proper operation.

3. Level Sensors S305-LE/LIT & S314-LE/LIT:

Periodically inspect level sensor head and clean, if necessary.

In general, wash down scum troughs and hoppers whenever scum build-up occurs as the scum trough flushing water lines are not sufficient to keep troughs free from scum.

7.5 EQUIPMENT DATA

1. **Scum Pumps: S307-SP and S308-SP**

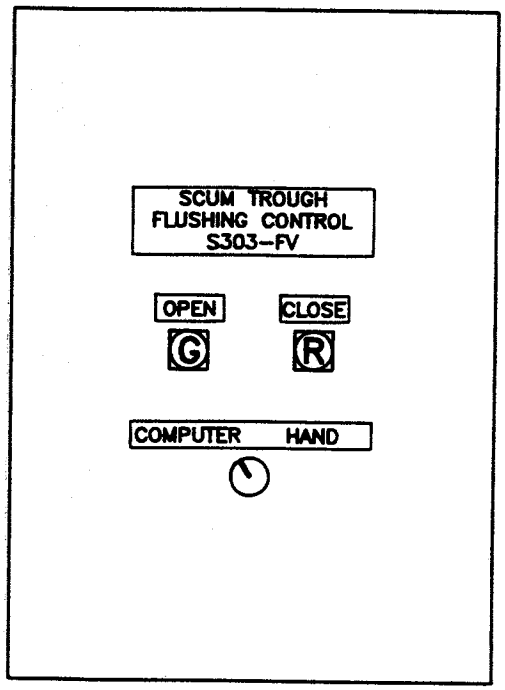
Location:	Basement Area between clarifiers No. 1 and 2	
Purpose:	To pump scum from scum tank No. 1 into scum header	
Manufacturer:	Pump -	Chicago Pump P2161
	Motor -	Robbins & Meyers
		3.73 kw (5hp), 575V, 3ph, 60Hz
		1150 rpm, 5.7 FLA

2. **Scum Pump: S309-SP**

Location:	Basement Area of clarifier No. 3	
Purpose:	To pump scum from scum tank No. 2 into scum header	
Manufacturer:	Pump -	Hayward Gordon Ltd. Torus Recessed Impeller
		Pump Model # XR3-10
		5 L/s at 7.3 m of head
	Motor -	Hawker - Siddeley Electric Motors
		5.6 kw (7.5hp), 575V, 3ph, 60Hz
		1170 rpm, 7.7 FLA

3. **Level Sensors: S305-LE/LIT & S314-LE/LIT**

Location:	Scum tanks No. 1 & 2
Purpose:	Monitor scum level in each respective tank
Manufacturer:	Bestobell MSP 90
	Measurement & Calibration System
	Range - 0 to 3.3 m (S305); 0 to 2.365 m (S314)
	Input: 120VAC, 60Hz; Output: 4 to 20 mADC



SIMILAR FOR FLUSHING VALVES S304-FV & S312-FV

LEGEND

- G GREEN PUSHBUTTON
- R RED PUSHBUTTON
- 2 POSTION SELECTOR SWITCH

SCUM TROUGH FLUSHING VALVES
TYPICAL LOCAL CONTROL PANEL LAYOUT

Date : January 1994
Figuer 7-9

BESTOBELL SCUM TANK LEVEL DETECTOR S305–LE/LIT RANGE = 0 TO 3.3M

LT S306

LE S306 LIT S305 LSL S305

(1) TO LOOP S307

(1) TO LOOP S308

SCUM TANK NO. 1

SECONDARY CLARIFIER NO. 1

FLUSHING WATER 40ø

FV S303

SCUM TROUGH

VD S303 YS S303 VB S303 O C/H C HS3 S303 HS1 S303 HS2 S303 VY2 S303 AS VY1 S303 EXH ZSB S303 ZB S303 ZB S303 ZD S303 ZD S303 ZSD S303 ZY S303 ZS S303

200ø

SECONDARY CLARIFIER NO. 2

FLUSHING WATER 40ø

FV S304

SCUM TROUGH

VD S304 YS S304 VB S304 O C/H C HS3 S304 HS1 S304 HS2 S304 VY2 S304 AS VY1 S304 EXH ZSB S304 ZB S304 ZB S304 ZD S304 ZD S304 ZSD S304 ZY S304 ZS S304

VD S308 YS S308 VB S308 O C/H C HS3 S308 HS1 S308 HS2 S308 VY2 S308 AS VY1 S308 EXH ZSB S308 ZB S308 ZB S308 ZD S308 ZD S308 ZSD S308

FLUSHING WATER

40ø

150ø

YS S307 MN S307 COH HS2 S307 (1) FROM LOOP S305 LOS HS1 S307 PG2 S307 MM S307 MM S307 MM S307 PG1 S307

S307–SP 5 HP/3.75 KW 575V, 3ø

PSL S307 KY S307 VY S307 SEAL WATER

QF S307 QF S307

100ø

PV S301

RECIRCULATION VALVE

VD S301 YS S301 VB S301 O C/H C HS3 S301 HS1 S301 HS2 S301 VY2 S301 AS VY1 S301 EXH ZSB S301 ZB S301 ZB S301 ZD S301 ZD S301 ZSD S301

YS S308 MN S308 COH HS2 S308 (1) FROM LOOP S305 LOS HS1 S308 PG2 S308 MM S308 MM S308 MM S308 PG1 S308

150ø

S308–SP 5 HP/3.75 KW 575V, 3ø

PSL S308 KY S308 VY S308 SEAL WATER

QF S308 QF S308

100ø

PV S302

SYSTEM VALVE

VD S302 YS S302 VB S302 O C/H C HS3 S302 HS1 S302 HS2 S302 VY2 S302 AS VY1 S302 EXH ZSB S302 ZB S302 ZB S302 ZD S302 ZD S302 ZSD S302

100ø

SCUM FROM SECONDARY CLARIFIER No.3 (SEE FIGURE 7–12)

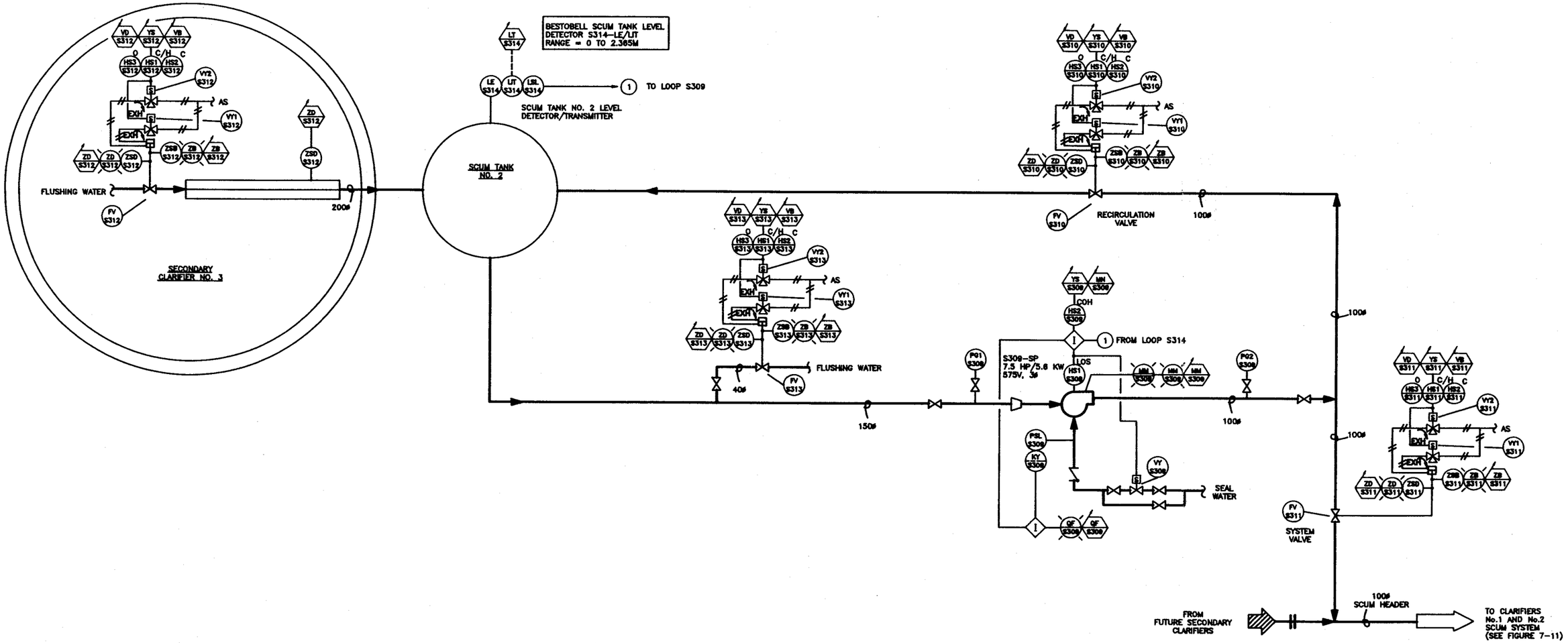
100ø SCUM HEADER

100ø WAS DISCHARGE HEADER (SEE FIGURE 8–8)

100ø TO SLUDGE/SCUM STORAGE TANKS (SEE FIGURE 8–8)

CLARIFIER No.1 & 2 SCUM REMOVAL SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 7–11



CLARIFIER No.3
SCUM REMOVAL SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 7–12

8.0 SLUDGE RECIRCULATION AND TRUCK LOADING SYSTEM

8.1 PURPOSE

The sludge recirculation and truck loading system is designed to temporarily store sludge and scum from the primary and secondary clarifier systems in tanks. The stored material is pumped into tanker trucks which haul it to the North End Water Pollution Control Centre where it is digested, dewatered, and finally applied to agricultural lands or landfill.

8.2 SYSTEM DESCRIPTION

Sludge and scum is conveyed to the top of the three sludge holding tanks via two 100 mm diameter headers and one 150 mm diameter header. The tanks are designated Tank No. 1, 2 and 3 have storage capacities of 258, 127 and 225 m^3 respectively. The sludge is pumped out of the bottom of the tanks through a common 250 mm diameter discharge pipe by one of the sludge transfer pumps. The two constant speed pumps are designated S401-STP and S402-STP and operate in a duty/standby arrangement. Sludge is pumped either directly to a truck located in the Truck Bay or recirculated back to the storage tanks. This operation is controlled by truck fill valve S403-FV and recirculation valve S404-FV. A flushing water line controlled by flushing valve S419-FV allows for cleaning out of the 150 mm diameter truck fill line.

The level in each tank is monitored by one level sensor. Each tank also contains a high level float switch which alarms on excessive tank sludge level. The truck fill header contains a magnetic flowmeter which monitors the sludge discharge flow to a truck.

A summary of the equipment described in this section is as follows:

1. Two constant speed sludge transfer pumps: S401-STP and S402-STP;
2. One sludge recirculation solenoid valve: S403-FV;
3. One sludge truck fill solenoid valve: S404-FV;

4. One truck fill line flushing water solenoid valve: S419-FV;
5. One truck fill sludge magnetic flowmeter: S420-FE/FIT;
6. Three storage tank level sensors: S416-LE/LIT, S417-LE/LIT & S418-LE/LIT;
7. Three tank high level float switches: S413-LSH, S414-LSH, & S415-LSH.

Equipment locations and piping layout are found on the ground floor and basement floor plans shown in Figures 8-1 and 8-2. A sectional view of the storage tanks is provided in Figure 8-3.

8.3 MONITORING AND CONTROL

8.3.1 Process Equipment

The two sludge transfer pumps, S401-STP and S402-STP, are controlled from "COMP/OFF/HAND" switches located on control panel SCP-6 in the Truck Bay. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. Pump "RUN" status indication is available at the MCC and SCP-6.

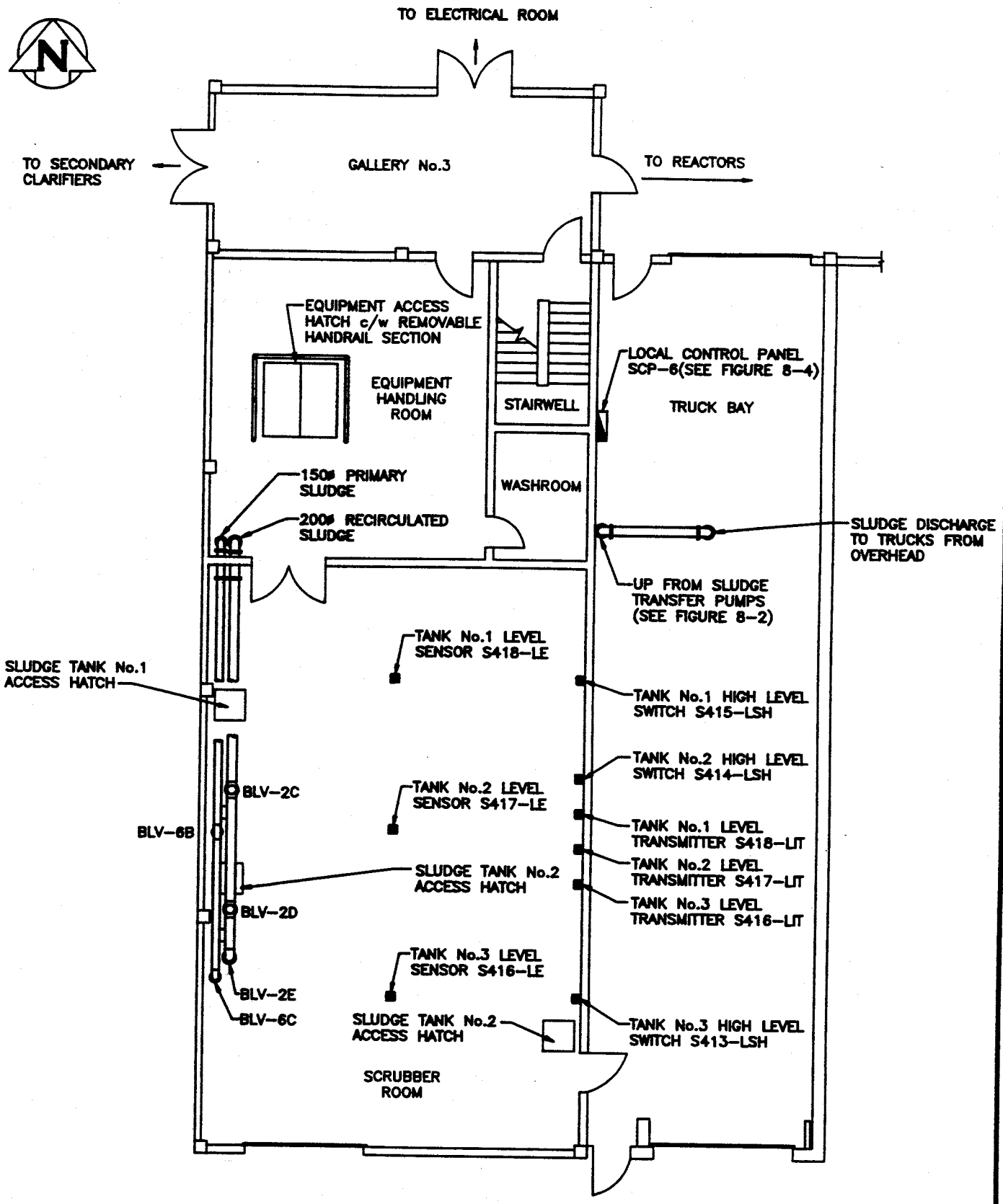
The pumps are interlocked with level sensors on the storage tanks to prevent dry pumping during low tank sludge levels.

The location of SCP-6 is found in Figure 8-1 while a panel layout is provided in Figure 8-4.

The INFI 90 monitors the following pump parameters:

1. Pump "COMP/OFF/HAND" control switch status;
2. Pump "RUN" status.

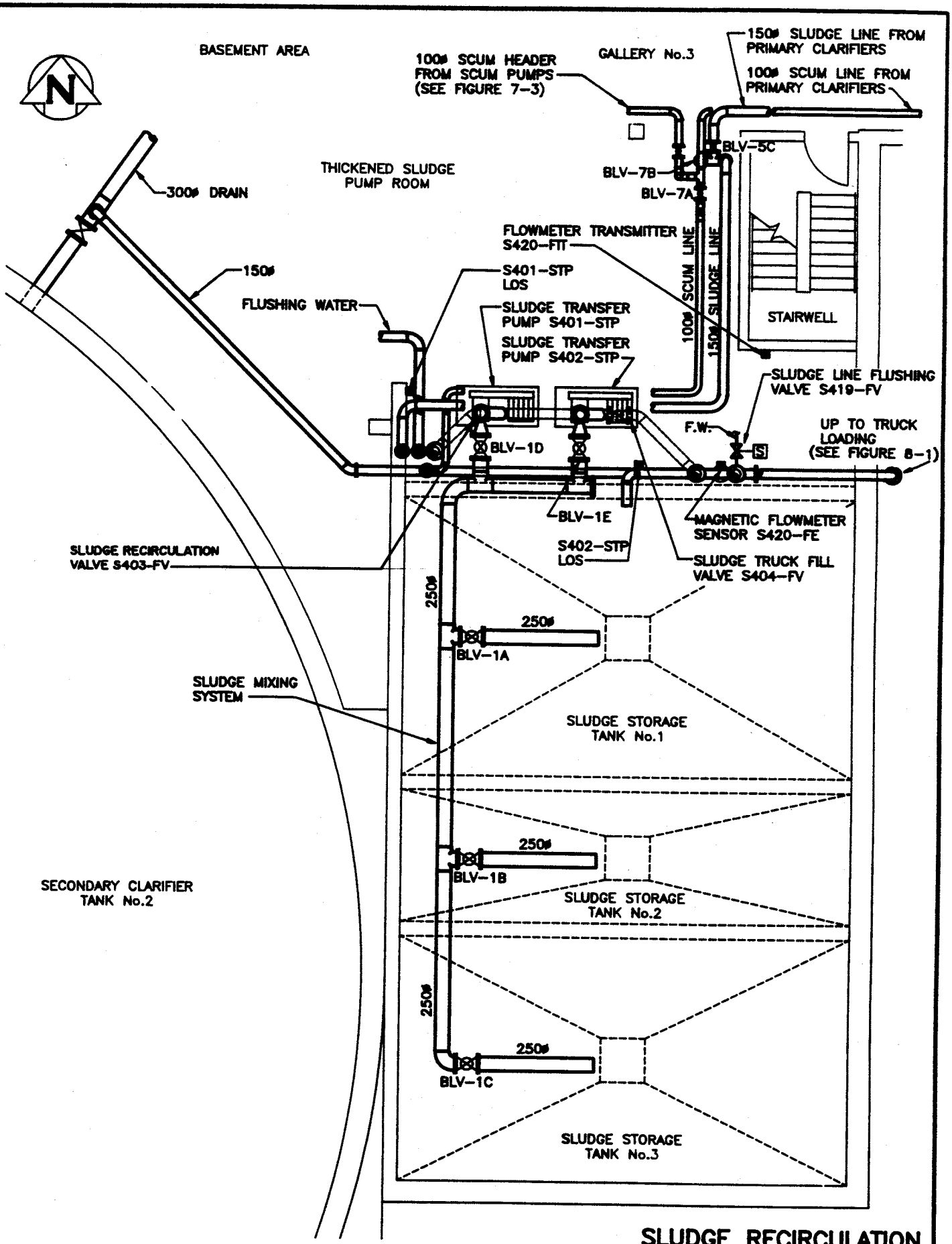
Each pump can be shut down and locked-out using the "LOS" pushbutton field located near each unit. These pushbuttons are shown in Figure 8-2.



GROUND FLOOR PLAN

SLUDGE RECIRCULATIION & TRUCK LOADING EQUIPMENT LOCATIONS

Date : January 1994
Figure 8-1



BASEMENT FLOOR PLAN

SLUDGE RECIRCULATION AND TRUCK LOADING EQUIPMENT LOCATIONS

Date : January 1994
Figure 8-2

Each of the three solenoid valves associated with this system, S403-FV, S404-FV, and S419-FV, is controlled by a "COMP/HAND" switch located on SCP-6. The "HAND" position allows for manual control of the valve using "OPEN" and "CLOSE" pushbuttons also located on SCP-6. The "COMP" position surrenders all valve control to the INFI 90. An operator can monitor valve "OPEN" and "CLOSE" positions from indicating lights at FDP-S.

The location and layout of SCP-6 is found in Figures 8-1 and 8-4 respectively. The section of FDP-S dedicated to the monitoring of these valves is shown in Figure 8-5.

The INFI 90 monitors the following valve parameters:

1. Valve "COMP/HAND" control switch status;
2. Valve "OPEN" and "CLOSE" status.

The level in each sludge storage tank is monitored by level sensors S416-LE/LIT, S417-LE/LIT, and S418-LE/LIT. Tank level is displayed at a local indicating transmitter and on SCP-6 in addition to being reported to the INFI 90. The locations of the sensors and transmitters are shown in Figure 8-1.

In addition to the sensors, a level float switch on each tank provides high tank sludge level alarm to the INFI 90. These alarms will suspend the delivery of any more sludge/scum mixture to the tanks.

Sludge flow to the truck hauler is monitored by magnetic flowmeter S420-LE/LIT. The flow rate is displayed at a local indicating transmitter and on SCP-6 in addition to being reported to the INFI 90. The locations of the sensors and transmitters are shown in Figure 8-1. The INFI 90 calculates the volume of sludge loaded from the flow rate and displays it at SCP-6. Total flow is also displayed at SCP-6.

The sludge hauling controls for truck loading are all located at SCP-6. A driver can select the operating mode using a "TRUCK/RECIRC." switch and initiate or terminate loading using the "START" and "LOAD INTERRUPT" pushbuttons. The INFI 90 automatically

controls the loading operation as described in Section 8.3.2. "SYSTEM READY FOR TRUCK PUMPING" and "LOADING COMPLETE" status indications are available at SCP-6.

The INFI 90 monitors the following truck loading system parameters:

1. "TRUCK/RECIRC." system control switch status;
2. "START" truck pumping signal from SCP-6;
3. "LOAD INTERRUPT" signal from SCP-6.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 8-1. Equipment/Instrument Summary Table 8-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Process Alarms Summary Table 1-3. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 8-6.

8.3.2 Automatic Control

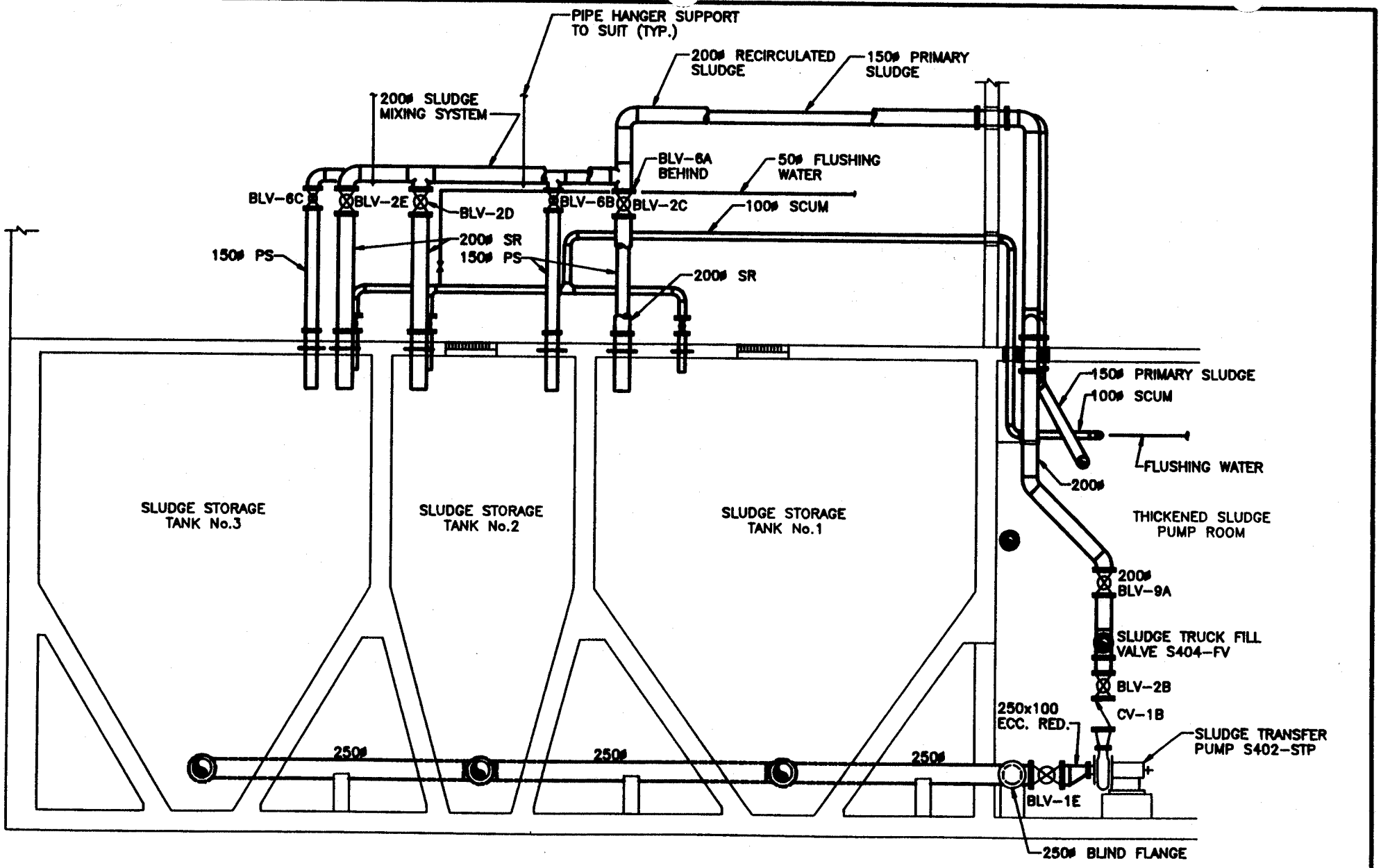
Automatic control consists of two operations: Recirculation and truck loading.

Recirculation Mode:

1) Open recirculation valve - S403-FV;
2) Close truck transfer valve - S404-FV;
3) Start duty pump - S401-STP or S402-STP.

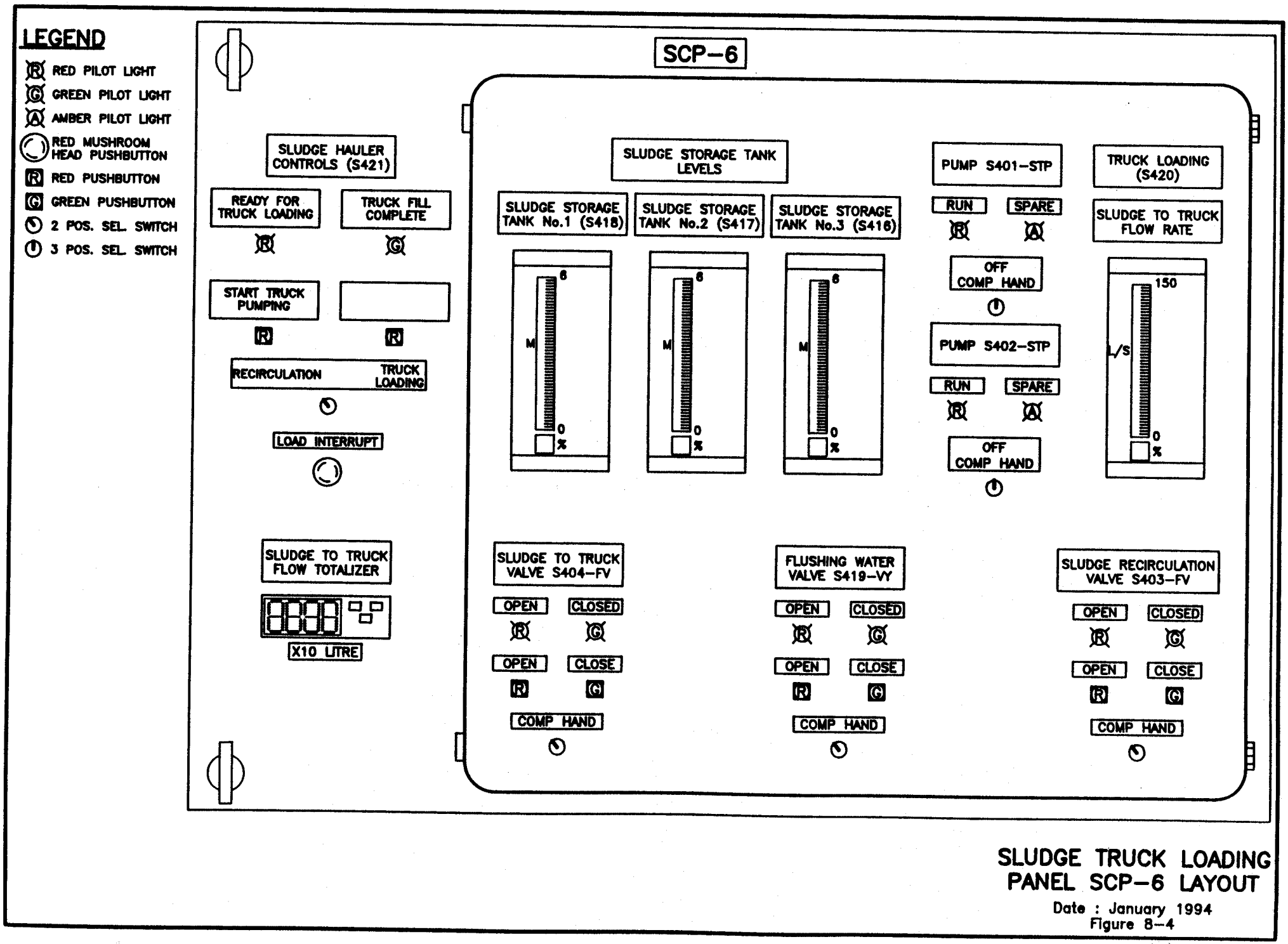
Truck Loading Mode:

1) The level in each sludge holding tank is shown as a percentage at the truck loading local panel SCP-6;
2) A totalize flow of sludge is displayed at the truck loading station on panel SCP-6. The total is reset prior to each truck loading operation by the INFI 90.



SLUDGE RECIRCULATION AND TRUCK LOADING SECTIONAL VIEW

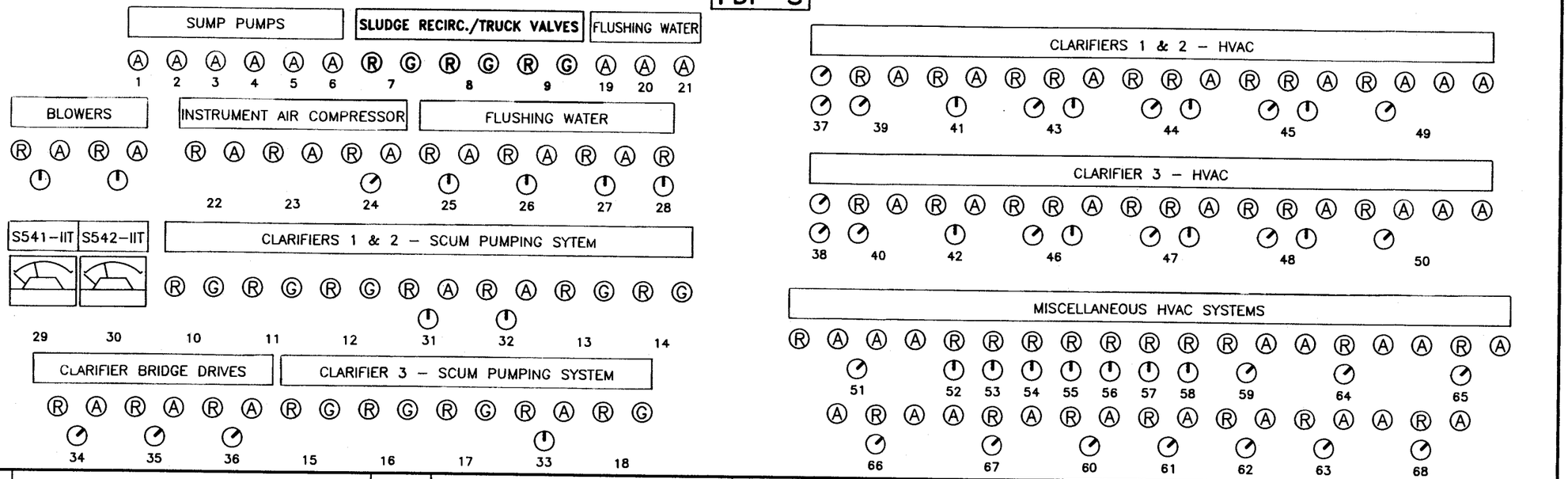
Date : January 1994
Figure 8-3



SLUDGE TRUCK LOADING PANEL SCP-6 LAYOUT

Date : January 1994
Figure 8-4

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION

Ⓐ — A – HIGH LEVEL

No. 1–6

1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

Ⓡ Ⓖ — **A – OPEN, B – CLOSED**

No. 7–18

7	**SLUDGE RECIRCULATION VALVE – S403–FV**
8	**SLUDGE TO TRUCK VALVE – S404–FV**
9	**FLUSHING WATER CLEANING VALVE – S419–FV**
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV

Ⓐ — A – LOSS OF SEAL WATER

No. 19–21

19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION

Ⓡ Ⓐ — A – RUN, B – FAIL

No. 22–23

22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

Ⓡ Ⓐ, C⊘ — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No.24

24	COMPRESSOR COOLING FAN – S537–FN

Ⓡ Ⓐ, C① — A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND

No. 25–27

25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

AⓇ, B① — A – RUN, B – COMP/OFF/HAND

No. 28

28	FLUSHING WATER PUMP – S553–FWP

Ⓡ Ⓐ, C①, D — A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT

No. 29–30

29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION

Ⓡ Ⓐ, C① — A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND

No. 31–33

31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP

Ⓡ Ⓐ, C⊘ — A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON

No. 34–36

34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

A⊘, B⊘ — A – COMP/HAND, B – SUMMER/WINTER

No. 37–38

37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

Ⓡ Ⓐ, C⊘ — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 39–40

39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

Ⓡ Ⓐ, C① — A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND

No. 41–42

41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION

Ⓡ Ⓡ Ⓐ, D⊘ ①E — A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND

No. 43–48

43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

Ⓡ Ⓐ Ⓐ Ⓐ, E⊘ — A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON

No. 49–51

49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

AⓇ, B① — A – RUN, B – COMP/OFF/HAND

No. 52–58

52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

Ⓡ Ⓐ, C⊘ — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 59–63

59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION

Ⓐ Ⓡ Ⓐ, D⊘ — A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON

No. 64–68

64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

SLUDGE RECIRCULATION AND TRUCK LOADING SYSTEM FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 8–5

TABLE 8-1

SLUDGE RECIRCULATION & TRUCK LOADING SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S401-STP	5-K	2S, 6S		5-K	5-K	5-K
S402-STP	5-K	3S, 6S		5-K	5-K	5-K
S403-FV	5-K	1S			5-K	5-K
S404-FV	5-K	5S			5-K	5-K
S419-FV	5-K	4S			5-K	5-K
S416-LI	5-K, OVERVIEW					5-K
S417-LI	5-K, OVERVIEW					5-K
S418-LI	5-K, OVERVIEW					5-K
S413-LA	5-K					5-K
L414-LA	5-K					5-K
S415-LA	5-K					5-K
S420-FI	5-K					5-K
S421	5-K				5-K	5-K

TABLE 8-2

SLUDGE RECIRCULATION & TRUCK LOADING SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-6	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S401-HS1	PUMP CONTROL (LOS)	S				
S401-HS2	PUMP CONTROL (COMP/OFF/HAND)		C		I	
S401-MN	PUMP CONTROL (START/STOP)				C	
S401-MM	PUMP STATUS - RUN	I*	I		I	*AT MCC
S401-PG1	PUMP DISCHARGE PRESSURE	I				0 to 1400 kPa
S401-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S402-HS1	PUMP CONTROL (LOS)	S				
S402-HS2	PUMP CONTROL (COMP/OFF/HAND)		C		I	
S402-MN	PUMP CONTROL (START/STOP)				C	
S402-MM	PUMP STATUS - RUN	I*	I		I	*AT MCC
S402-PG1	PUMP DISCHARGE PRESSURE	I				0 to 1400 kPa
S402-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S403-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S403-HS2	VALVE CONTROL (CLOSE)		C		C	
S403-HS3	VALVE CONTROL (OPEN)		C		C	
S403-ZB	VALVE STATUS - CLOSED		I	I	I	
S403-ZD	VALVE STATUS - OPEN		I	I	I	
S404-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S404-HS2	VALVE CONTROL (CLOSE)		C		C	
S404-HS3	VALVE CONTROL (OPEN)		C		C	
S404-ZB	VALVE STATUS - CLOSED		I	I	I	
S404-ZD	VALVE STATUS - OPEN		I	I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 8-6

(continued)

TABLE 8-2 (continued)

SLUDGE RECIRCULATION & TRUCK LOADING SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-6	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S419-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S419-HS2	VALVE CONTROL (CLOSE)		C		C	
S419-HS3	VALVE CONTROL (OPEN)		C		C	
S419-ZB	VALVE STATUS - CLOSED		I	I	I	
S419-ZD	VALVE STATUS - OPEN		I	I	I	
S418-LI	TANK NO. 1 LEVEL	I	I		I	0 to 5.6 m
S417-LI	TANK NO. 2 LEVEL	I	I		I	0 to 5.6 m
S416-LI	TANK NO. 3 LEVEL	I	I		I	0 to 5.6 m
S415-LA	TANK NO. 1 HIGH LEVEL				A	
S414-LA	TANK NO. 2 HIGH LEVEL				A	
S413-LA	TANK NO. 3 HIGH LEVEL				A	
S420-FI	SLUDGE FLOW TO TRUCKS	I	I		I	0 to 150 L/s
S420-HS	FLOW TOTALIZER RESET		R			
S421-HS1	HAULER CONTROL (TRUCK/RECIRC.)		C		I	
S421-HS2	HAULER CONTROL (START)		C		I	
S421-HS3	HAULER CONTROL (E-STOP)		S		I	
S421-HM	HAULER STATUS - READY		I		C	
S421-XX	HAULER STATUS - COMPLETE		I		C	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 8-6

3) Upon truck driver initiated truck transfer selection (switch S421-HS1):

a) Stop duty transfer pump;
b) Close recirculation valve;
c) Extinguish "LOADING COMPLETE" indicator lamp;
d) Light the "READY FOR TRUCK PUMPING" indicator lamp;

4) Upon truck driver initiated manual start (selection switch S421-HS2):

a) Reset the sludge flow totalizer;
b) Start duty transfer pump;
c) Open truck transfer valve;

5) When the preset totalized sludge flow volume limit (tunable) is reached:

a) Open recirculation valve;
b) Close truck transfer valve;
c) Open flushing valve for a preset time (tunable) and then close it;
d) Light "LOADING COMPLETE" indicator lamp;

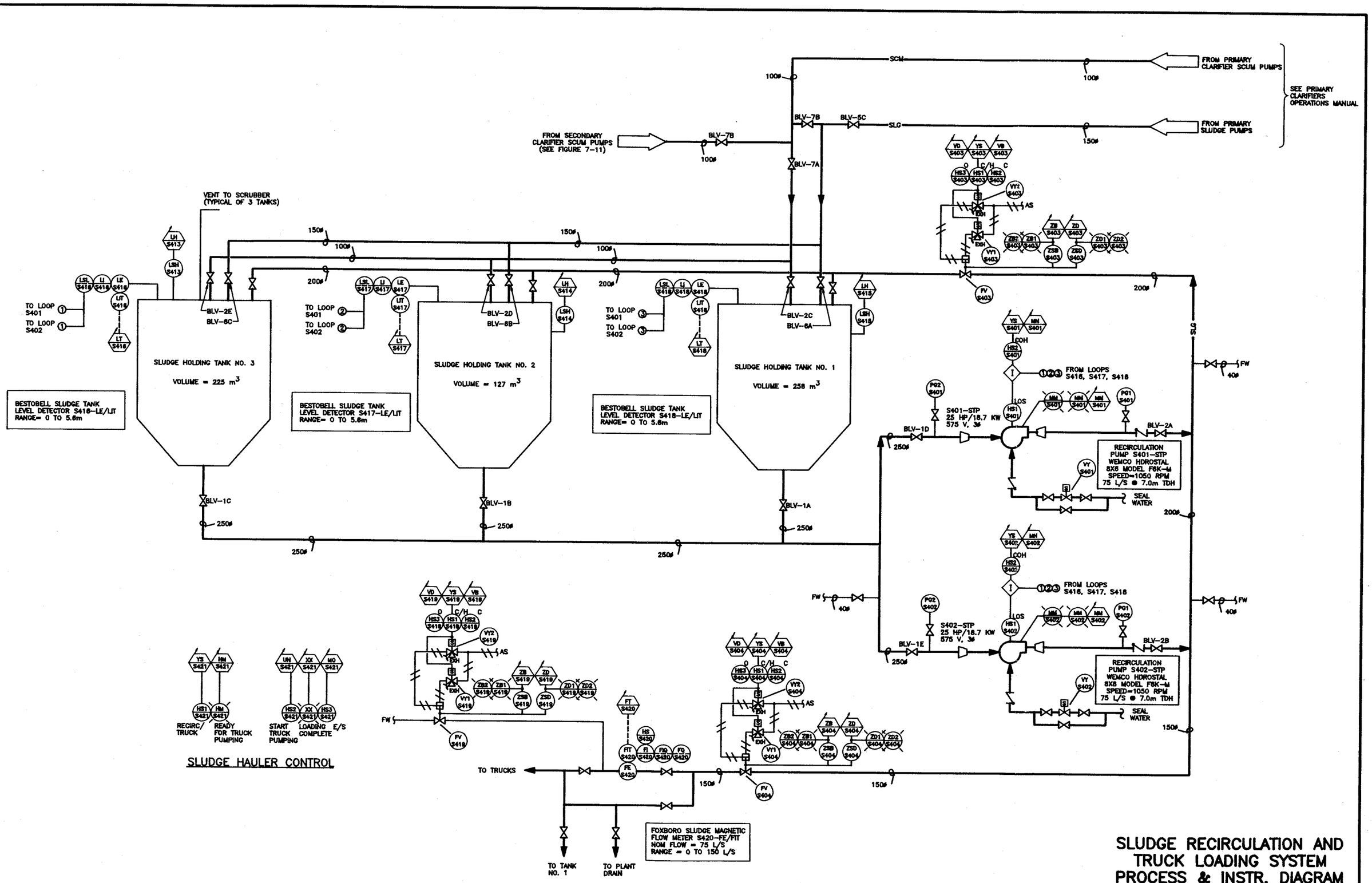
6) Truck driver may manually interrupt truck loading by using the "LOAD INTERRUPT" button (switch S421-HS3):

a) Stop duty transfer pump interrupt;
b) Close the truck transfer valve;

7) When the interrupt button is pulled out:

a) Open truck transfer valve;
b) Start duty transfer pump;

8) Tank low level sludge transfer, perform Step 6;



SLUDGE RECIRCULATION AND TRUCK LOADING SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 8-6

9) Truck driver selects "RECIRCULATION" (selector switch S421-HS1) to resume recirculation modes.

a) Turn off the "READY FOR TRUCK PUMPING" indicator lamp;
b) The computer will open recirculation valve;

10) The computer logs the following data associated with truck withdrawal:

a) Date and time of day;
b) Amount of sludge/scum withdrawn;
c) Daily total withdrawn.

Interface to Other Strategies. This strategy will send the following signals to:

a) Tank high level to Secondary Scum Pump Control;
b) Tank high level to Primary Scum Pump Control;
c) Tank high level to Primary Sludge Pump Control.

8.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific graphic displays noted here and summarized in Bridging Table 8-1.

Manual control consists of Operator-initiated commands to:

1) Open/close recirculation valve - S403-FV;
2) Open/close flushing water valve - S419-VY;
3) Open/close tank transfer valve - S404-FV;
4) Start/stop sludge transfer pumps - S401-STP, S402-STP;
5) Truck loading can only be started manually by truck drivers from a local control panel at the truck loading station.

Sludge Storage and Loading Control - Graphic 5K

Operating Procedures:

1) Verify that all pumps and valves are in "COMPUTER";
2) Press 1S "Sludge Recirculation Valve S403" and verify that it is in "auto";
3) Press 2S "Sludge Recirculation Pump #1, S401" and verify that it is in "auto";
4) Press 3S "Sludge Recirculation Pump #2, S402" and verify that it is in "auto";
5) Press 4S "Flushing Water Valve S419" and verify that it is in "auto";
6) Press 5S "Sludge Transfer Valve S404" and verify that it is in "auto";
7) Press 6S "Sludge Pump Duty Select" and select the duty pump.
   S401 = Pump #1 S402 = Pump #2;
8) Press 8S "Recirculation Run Time" and enter the length of recirculation time: 0-60 minutes - e.g., 15 minutes per hour;
9) Press 9S "Recirculation Stop Time" and enter the length of time recirculation will be stopped - e.g., 45 minutes per hour;
10) Press 7S "Sludge Storage Operating Mode" and select "start";
11) Press 1T "Sludge Tank Hi Level Delay to McPhillips" and select "1-12 hours". The automatic sequence will begin.

8.4 ROUTINE CHECKS

1. **Sludge Transfer Pumps: S401-STP & S402-STP:**
   Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;
   Check seal water flow when pumps are running;
   Lubricate pumps regularly.

2. **Solenoid Valves: S403-FV, S404-FV & S419-FV:**
   Check that valves are not leaking;
   Check pneumatic actuators for proper operation.

3. **Level Sensors: S416-LE, S417-LE, and S418-LE:**
Periodically inspect level sensor head and clean if necessary.

4. **High Level Switches: S413-LSH, S414-LSH, and L415-LSH:**
Periodically inspect and actuate high level float switches to ensure proper operation.

5. **Flowmeter: S420-FE/FIT:**
Periodically check calibration on magnetic flowmeter. Recalibrate if necessary.

8.5 EQUIPMENT DATA

1. **Sludge Transfer Pumps: S401-STP & S402-STP**

Location: Basement Area adjacent to sludge storage tanks.
Purpose: To pump stored sludge/scum from storage tanks to sludge truck.
Manufacturer: Pump - WEMCO Hydrostal Pump
76 L/s @ 14 m TDH
Motor - Hawker - Siddeley Electric Motors
18.6 kw (25 hp), 575V, 3ph, 60 Hz,
1750 rpm, 23.2 FLA.

2. **Magnetic Flowmeter: S420-FE/FIT**

Location: Basement Area adjacent to sludge storage tanks.
Purpose: Monitor sludge/scum flow to truck hauler.
Manufacturer: Foxboro 8006-B TR-6 Custom
Range: 0 to 150 L/s
Input: 120 VAC, 60Hz; Output: 4 to 20 mADC.

3. **Level Sensors: S416-LE/LIT, S417-LE/LIT, & S418-LE/LIT**

Location: Scrubber Room

Purpose: Monitor sludge/scum level in each tank.

Manufacturer: Bestobell MSP 90
Measurement and Calibration System
Range: 0 to 5.6 m
Input: 120 VAC, 60 Hz; Output: 4 to 20 mADC

9.0 EFFLUENT DISCHARGE SYSTEM

9.1 PURPOSE

The effluent discharge system is designed to convey treated effluent from the clarifiers through conduits to an outfall system discharging to the Red River.

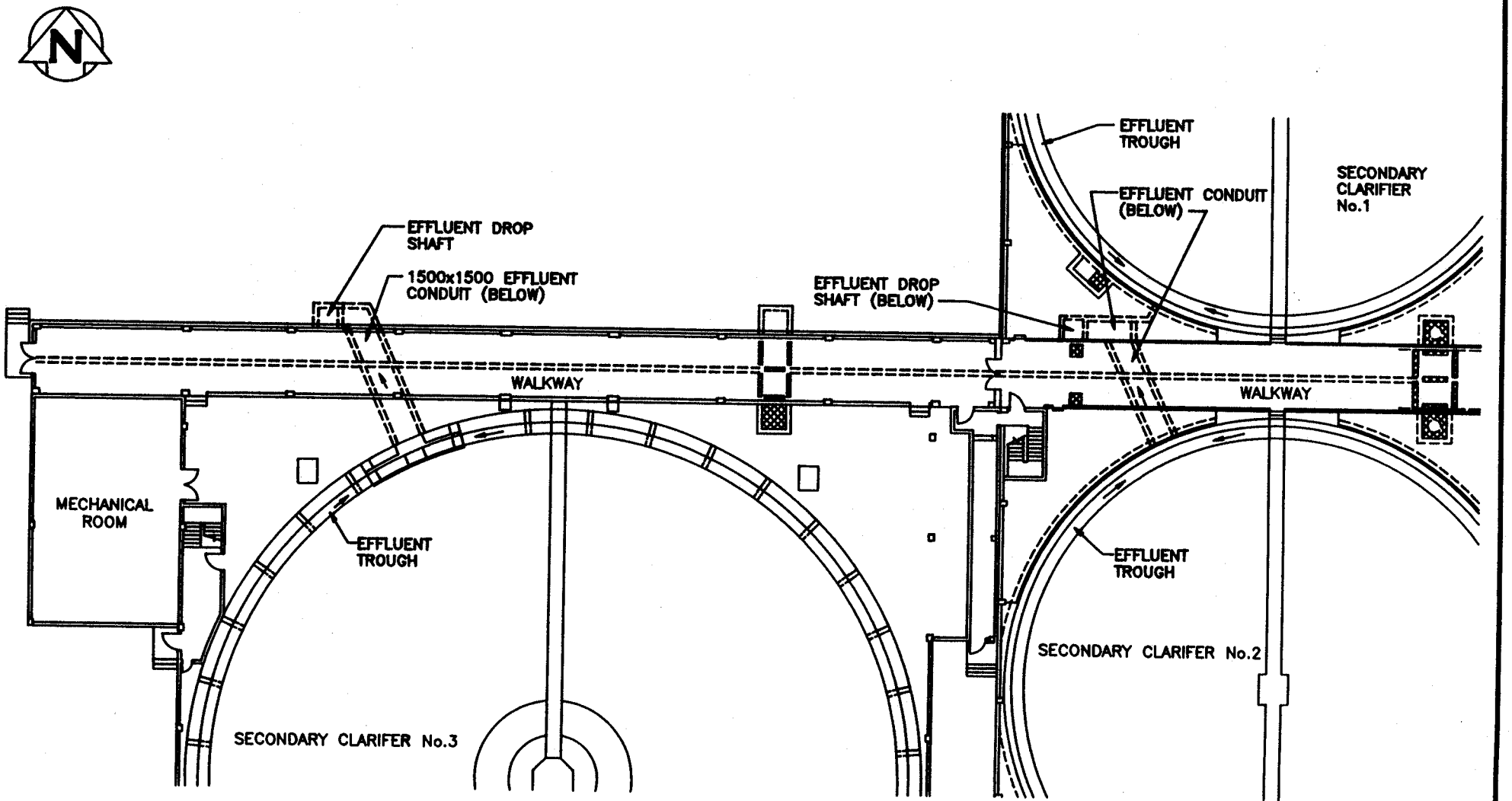
9.2 SYSTEM DESCRIPTION

Effluent flows over V-notch weirs into concrete effluent troughs running along the perimeter of each clarifier. The trough drains to a conduit which discharges into an effluent dropshaft. Conduits from clarifiers No. 1 and 2 share a common dropshaft while clarifier No. 3 effluent drains to a second dropshaft. The two shafts feed an effluent channel running beneath Gallery No. 3 the length of the Secondary Clarifier Area. This channel discharges to an outfall system draining into the Red River.

The layout of this system is shown on the ground floor and basement floor plans provided in Figures 9-1 and 9-2. A sectional view detailing effluent passage over the V-notch weir plates into the trough is shown in Figure 9-3 while a layout of the effluent trough discharge into the effluent conduit and dropshaft is provided in Figure 9-4. Figure 9-5 shows a sectional view illustrating the relationship between the effluent conduit, Gallery No. 3, and the effluent discharge channel.

9.3 MONITORING AND CONTROL

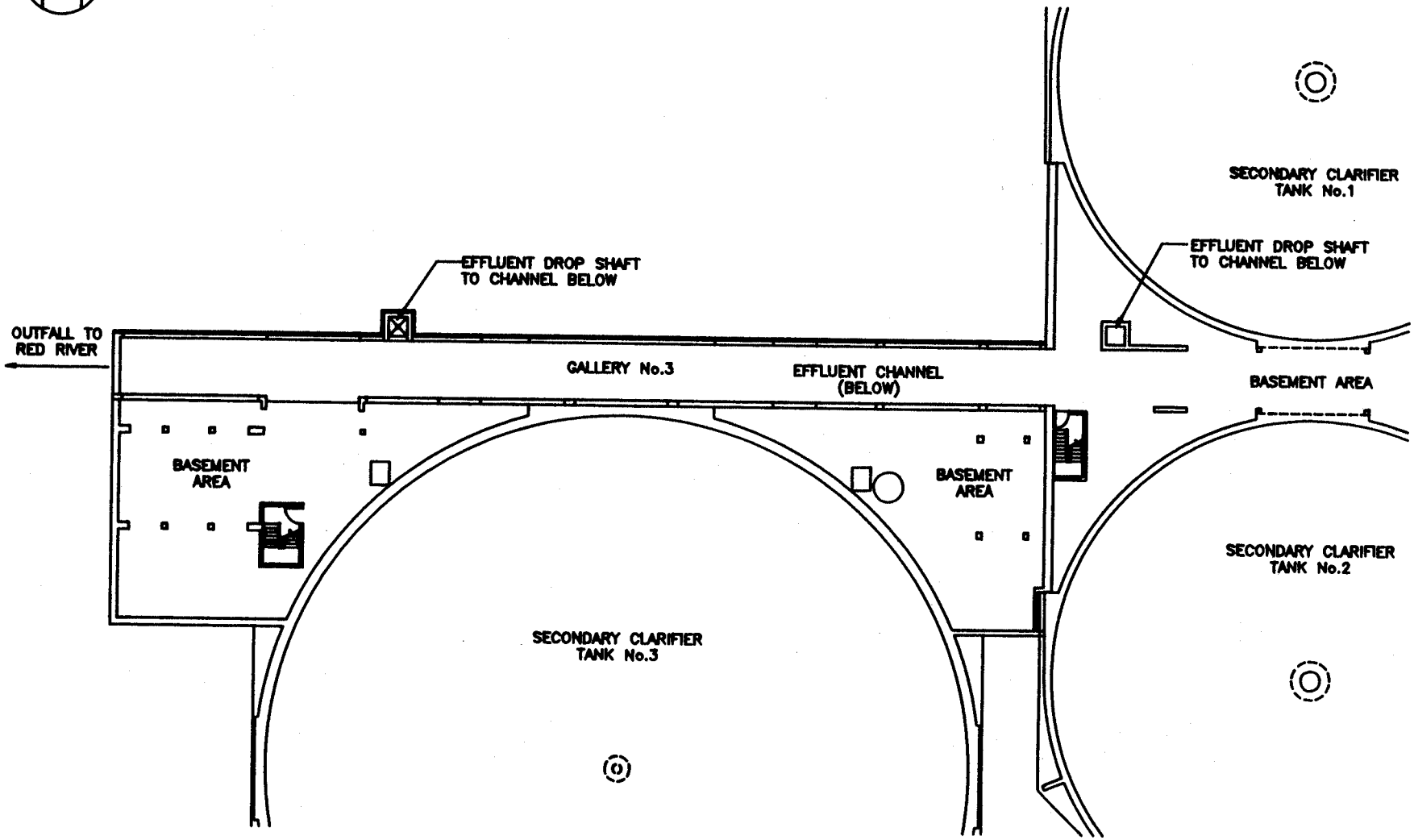
There is no monitoring or control of this system; however, sampling of the effluent at various discharge points is conducted by four sampling stations. A complete description of the sampling system is provided in Section 15.0.



GROUND FLOOR PLAN

EFFLUENT SYSTEM LAYOUT

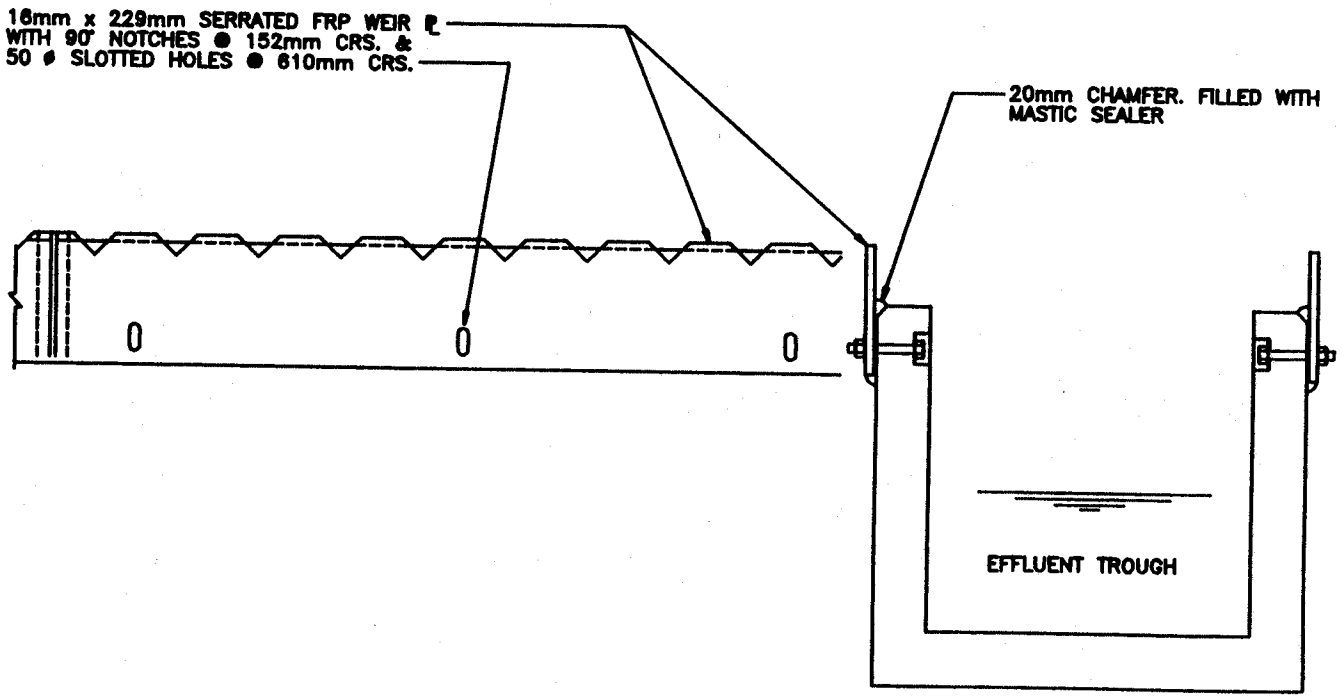
Date : January 1994
Figure 9–1



BASEMENT FLOOR PLAN

EFFLUENT SYSTEM LAYOUT

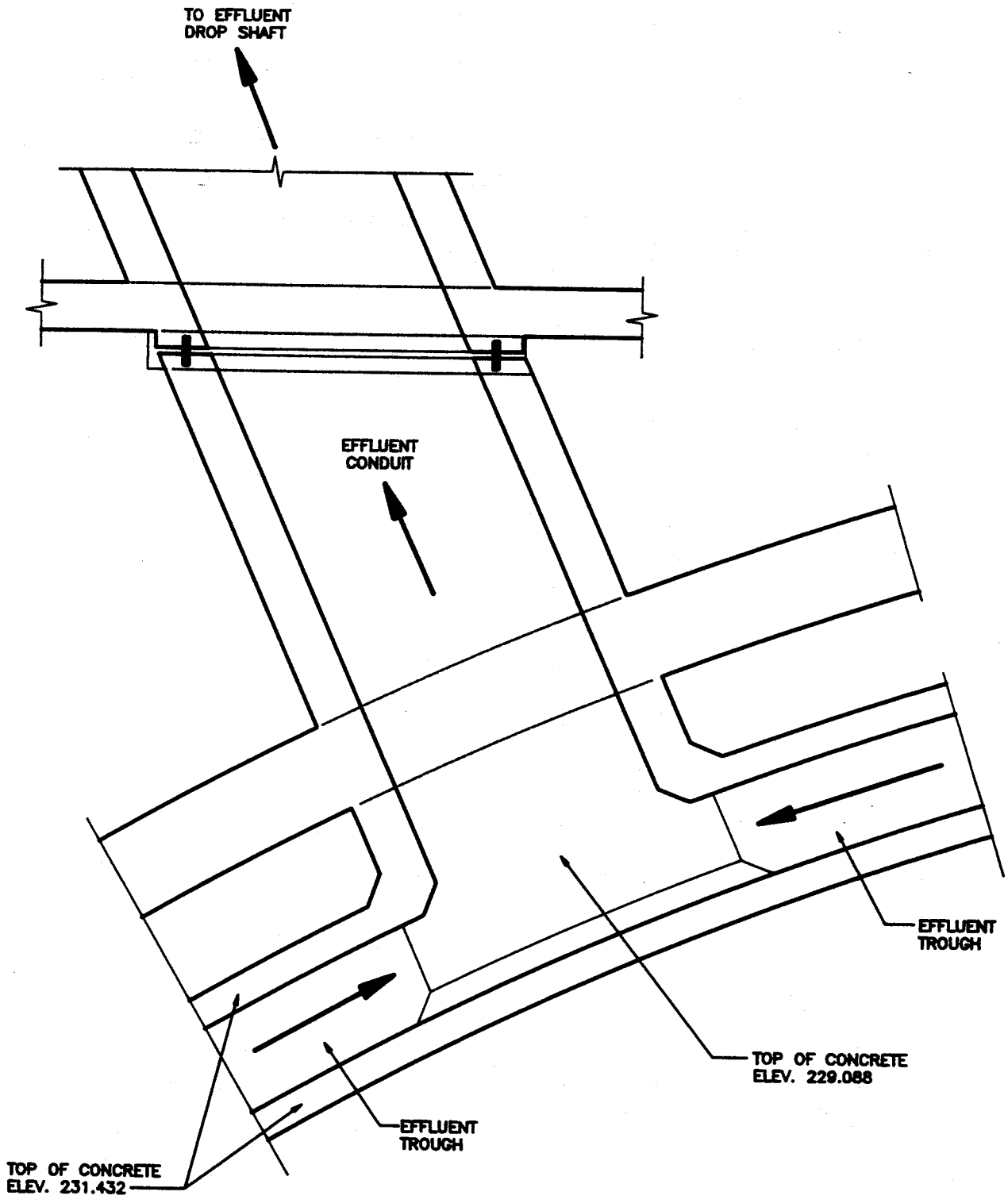
Date : January 1994
Figure 9–2



SECTIONAL VIEW

WEIR PLATE LAYOUT

Date : January 1994
Figure 9-3



EFFLUENT TROUGH DISCHARGE TO CONDUIT LAYOUT

Date : January 1994
Figure 9–4

10.0 FLUSHING WATER SYSTEM

10.1 PURPOSE

The flushing water system is designed to provide flushing water at various locations through out the plant area. It is used mainly for flushing of the sludge and scum lines; however, it is also used by the samplers and provides water for backflushing, general plant clean-up, and the heat recovery system (see Section 18.0).

10.2 SYSTEM DESCRIPTION

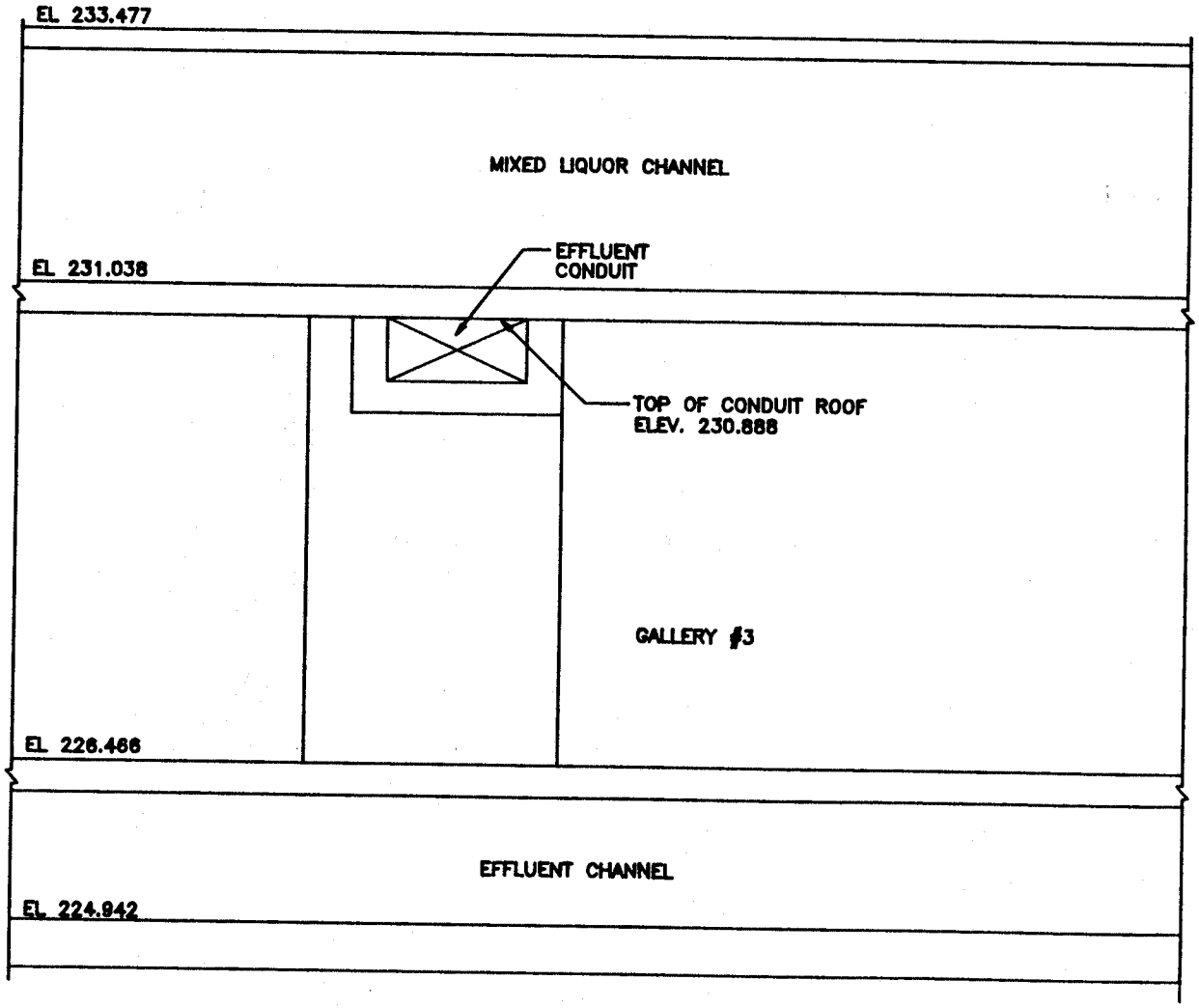
The flushing water system in the Secondary Clarifier Area provides for the flushing water requirements of the entire plant. Four pumps, designated S550-FWP, S551-FWP, S552-FWP, and S553-FWP, draw plant effluent from the dropshaft common to clarifiers No. 1 and No. 2 (see Section 9.0) via a 400 mm diameter pipe. The effluent is pumped through a strainer labelled S554-FWS. The strainer removes particles 1.5 mm and over in size to make the effluent more suitable for flushing water purposes. After passing through the strainer the water is fed into a 300 mm diameter header which runs the length of Gallery No. 3. All subsequent flushing water lines are tapped off this header.

System pressure is monitored by a pressure sensor on the header.

A summary of the equipment described in this section is as follows:

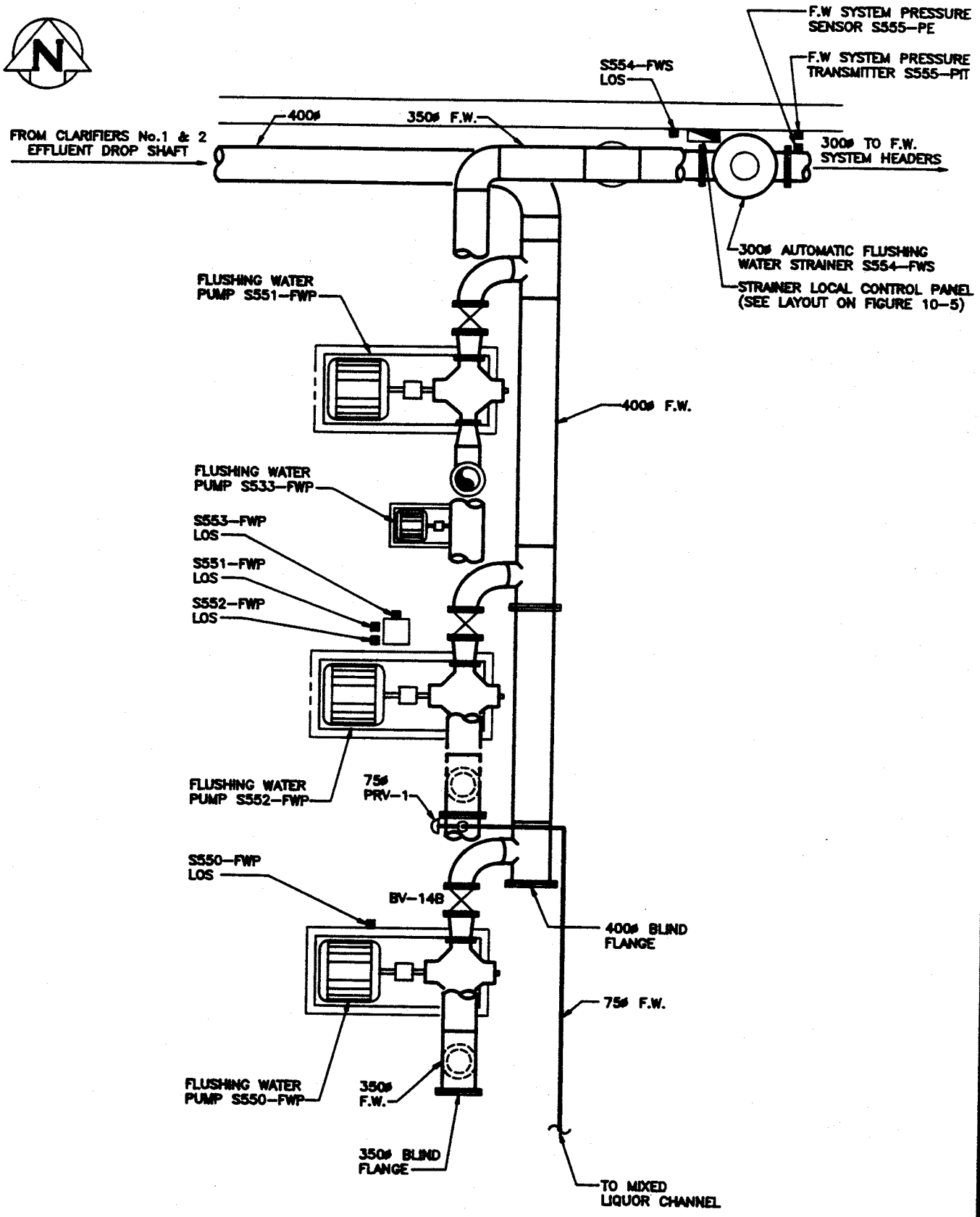
1. Four constant speed flushing water pumps: S550-FWP, S551-FWP, S552-FWP, & S553-FWP;
2. One flushing water strainer: S554-FWS;
3. One pressure sensor/transmitter: S555-PE/PIT.

A schematic of the system is shown in Figure 10-1 while equipment locations and piping layouts are found on the basement floor plan shown in Figure 10-2. Figure 10-3 provides a detailed layout of the pump area.



EFFLUENT CONDUIT SECTIONAL VIEW

Date : January 1994
Figure 9-5



BASEMENT FLOOR PLAN

FLUSHING WATER PUMP AREA LAYOUT

Date : January 1994
Figure 10-3

10.3 MONITORING AND CONTROL

10.3.1 Process Equipment

Each of the four flushing water pumps, S550-FWP, S551-FWP, S552-FWP, and S553-FWP, is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. Pump "RUN" status indication is available at the MCC and FDP-S. A "LOSS OF SEAL WATER" alarm condition for pumps S551, S552, and S553 is monitored at FDP-S. In addition, pump failure resulting from a current overload or ground fault for pumps S550, S551, and S552 is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of these pumps is shown in Figure 10-4.

The INFI 90 monitors the following pump parameters:

1. Pump "COMP/OFF/HAND" control switch status for all four pumps;
2. Pump "RUN" status for all four pumps;
3. Pump "FAIL" alarm due to overcurrent or ground fault for pump S550;
4. General pump "FAIL" alarm due to overcurrent, ground fault, or loss of seal water for pumps S551 and S552.

Each pump can be shut down and locked-out using the "LOS" pushbutton field located near each unit. These pushbuttons are shown in Figure 10-3.

The flushing water strainer, S554-FWS, is controlled from a "ON/OFF/AUTO" switch located on a local strainer control panel. The "ON" and "OFF" positions allow for manual control of the strainer motor while the "AUTO" position surrenders control to the internal circuitry of the panel. "POWER ON" and "BACKWASH ON" status indication is available at the panel. Strainer "RUN" indication is shown at the MCC. In addition, a "HIGH DIFFERENTIAL PRESSURE" alarm condition is also monitored at the panel.

The location of the strainer control panel is shown in Figure 10-3 while a layout is provided in Figure 10-5.

The INFI 90 monitors the following strainer parameters:

1. Strainer motor "RUN" status;
2. Strainer "FAIL" alarm.

The strainer can be shut down and locked-out using the "LOS" pushbutton field located near the unit. The pushbutton is shown in Figure 10-3.

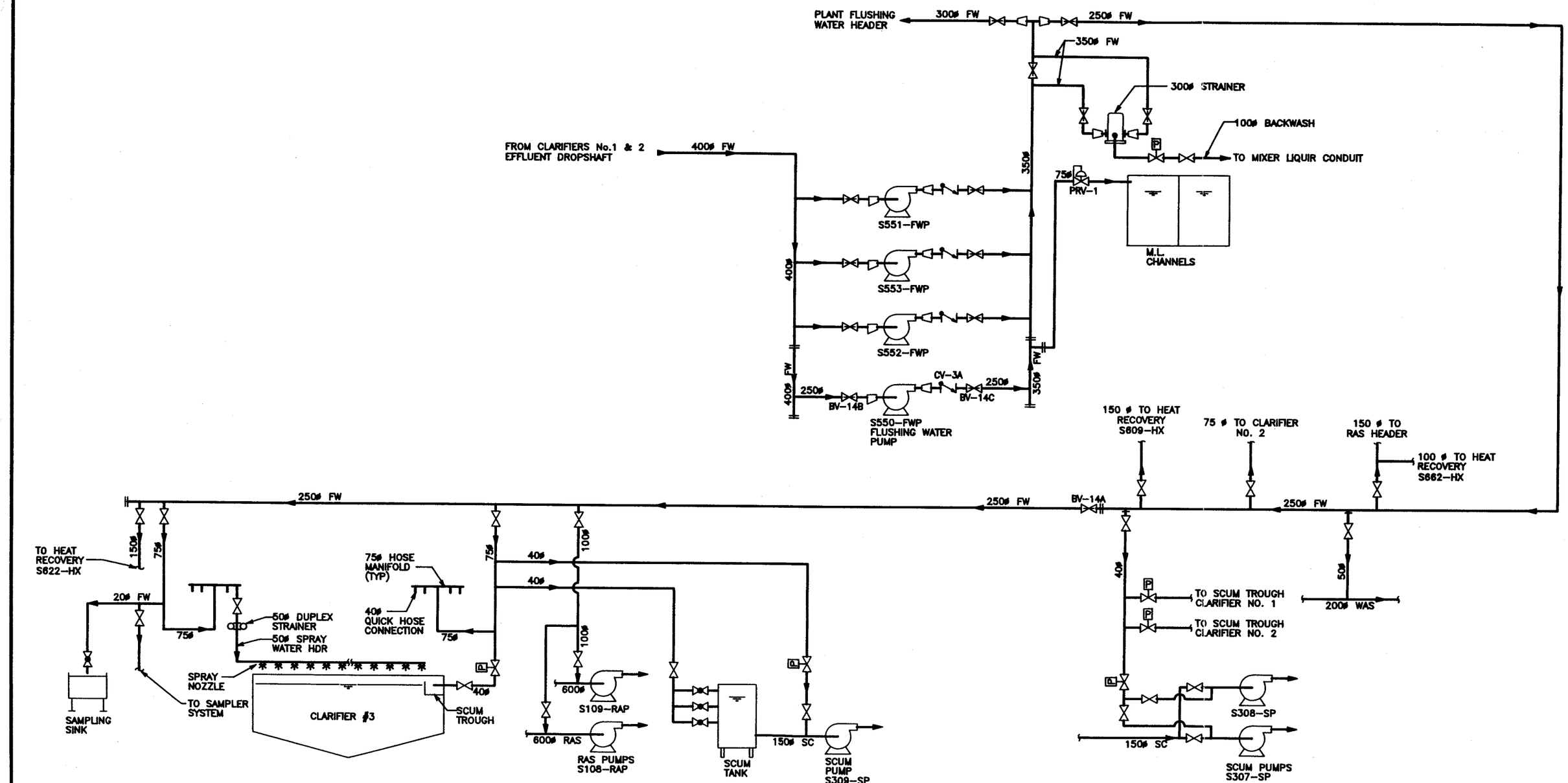
System pressure is monitored by pressure sensor/transmitter S555-PE/PIT. The pressure is displayed at the local indicating transmitter and reported to the INFI 90. The location of this device is also shown in Figure 10-3.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 10-1. Equipment/Instrument Summary Table 10-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 10-6.

10.3.2 Automatic Control

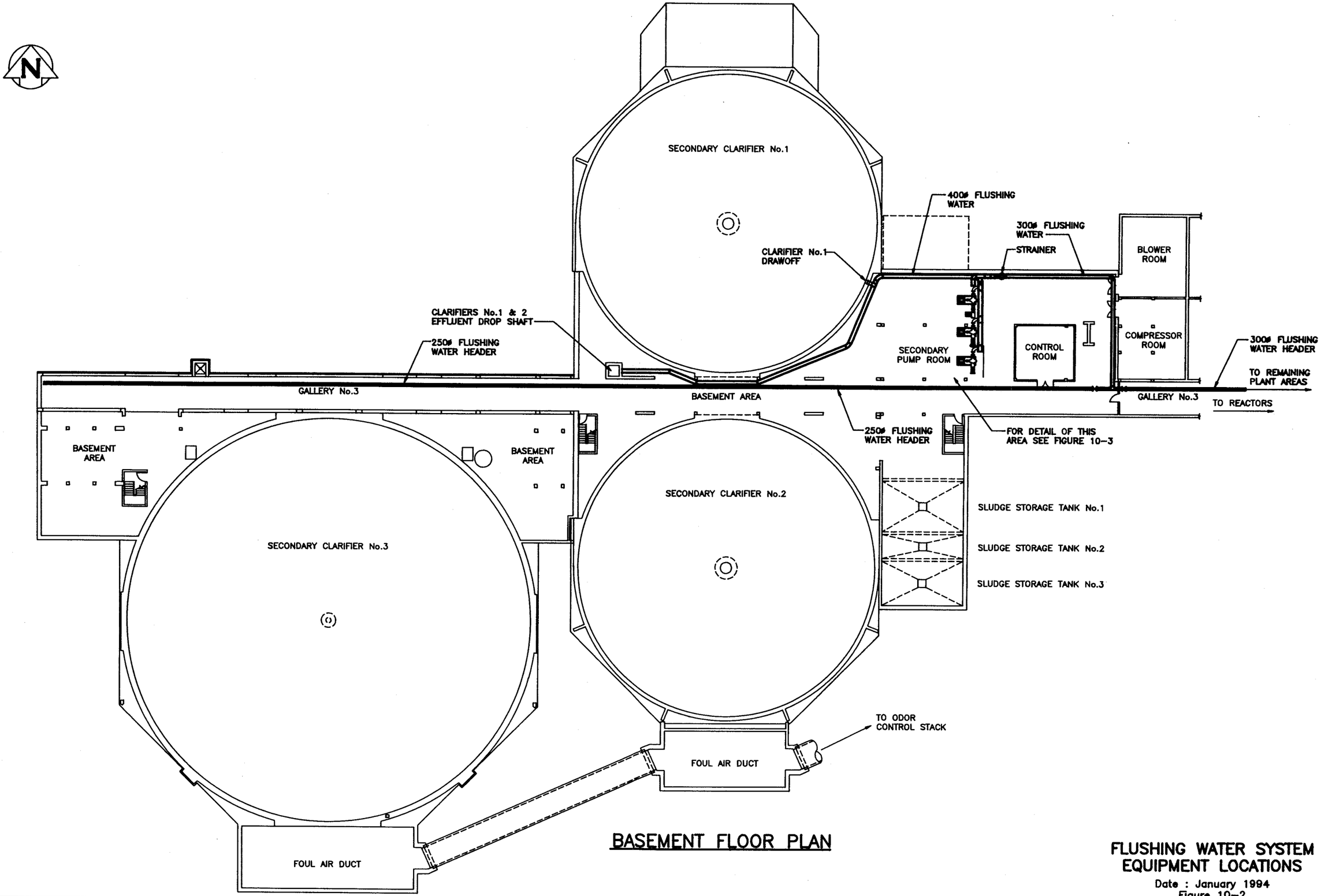
The flushing water is drawn from the effluent of the secondary clarifiers and pumped to the flushing water network by one of four duty pumps. The duty pump is selected by flushing water demand and is as follows:

Low demand	0 L/S to 19 L/S
	Use pump S553-FWP
Intermediate demand	19 L/S to 39 L/S
	Use pump S550-FWP



FLUSHING WATER SYSTEM SCHEMATIC

Date : January 1994
Figure 10-1



BASEMENT FLOOR PLAN

FLUSHING WATER SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 10-2

TABLE 10-1

FLUSHING WATER SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S550-FWP	5-S	4P			5-S	5-S
S551-FWP	5-S	1P, 5P			5-S	5-S
S552-FWP	5-S	3P, 5P			5-S	5-S
S553-FWP	5-S	2P			5-S	5-S
S554-FWS	5-S					5-S
S555-PI	5-S	1S	5-S			5-S

TABLE 10-2

FLUSHING WATER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S550-HS1	PUMP CONTROL (LOS)	S				
S550-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S550-MN	PUMP CONTROL (START)				C	
S550-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S550-QF	PUMP FAILURE			Q	Q	
S550-PG1	PUMP DISCHARGE PRESSURE	I				0 to 1600 kPa
S550-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S551-HS1	PUMP CONTROL (LOS)	S				
S551-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S551-MN	PUMP CONTROL (START)				C	
S551-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S551-PAL	LOSS OF SEAL WATER			A		
S551-QF	PUMP FAIL			Q	Q	
S551-PG1	PUMP DISCHARGE PRESSURE	I				0 to 600 kPa
S551-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa
S552-HS1	PUMP CONTROL (LOS)	S				
S552-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S552-MN	PUMP CONTROL (START)				C	
S552-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S552-PAL	LOSS OF SEAL WATER			A		
S552-QF	PUMP FAIL			Q	Q	
S552-PG1	PUMP DISCHARGE PRESSURE	I				0 to 600 kPa
S552-PG2	PUMP SUCTION PRESSURE	I				-100 to 100 kPa

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 10-6

(continued)

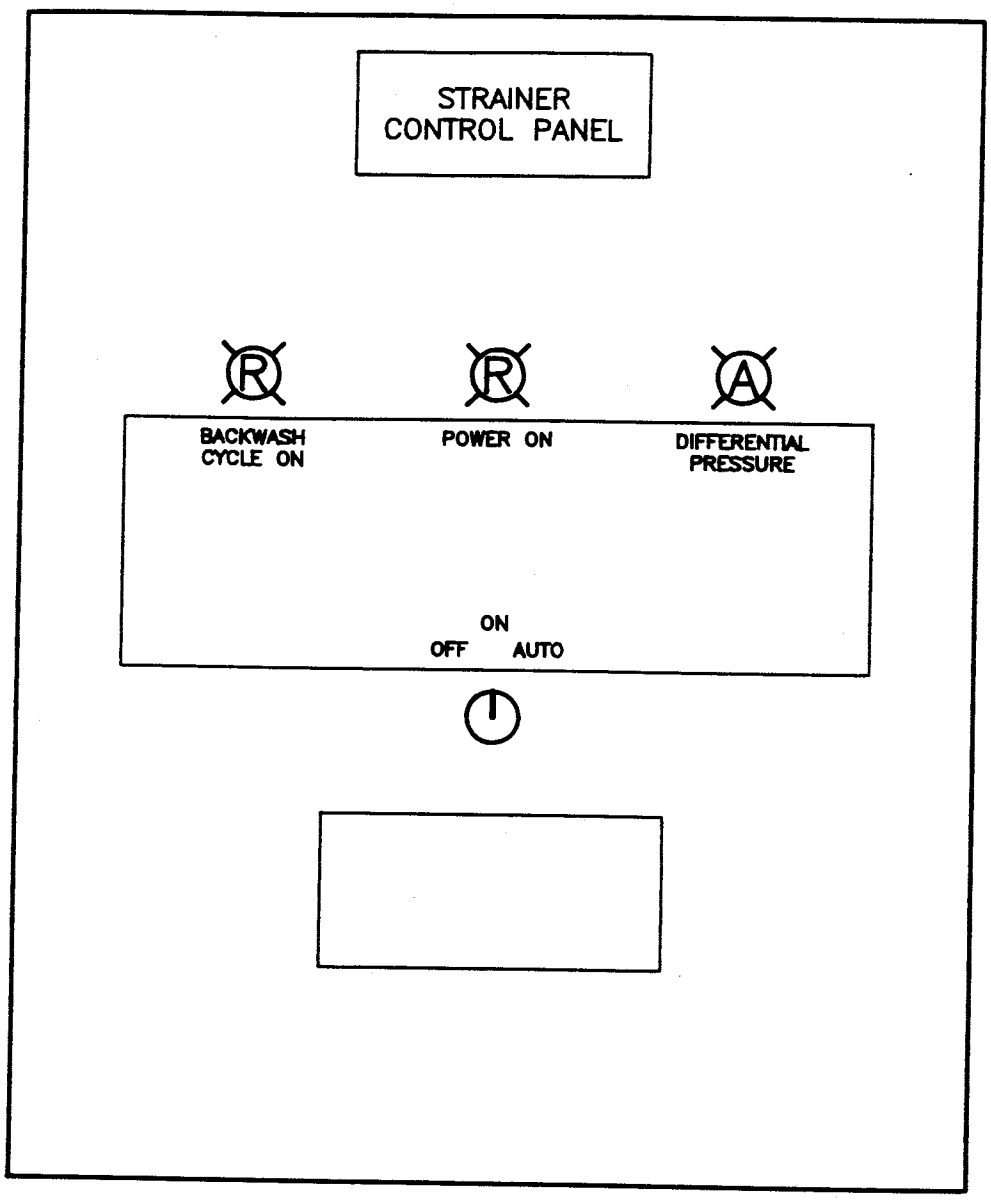
TABLE 10-2 (continued)

FLUSHING WATER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S553-HS1	PUMP CONTROL (LOS)	S				
S553-HS2	PUMP CONTROL (COMP/OFF/HAND)			C	I	
S553-MN	PUMP CONTROL (START)				C	
S553-MM	PUMP STATUS - RUN	I*		I	I	*AT MCC
S553-PAL	LOSS OF SEAL WATER			A		
S553-PG	PUMP DISCHARGE PRESSURE	I				0 to 1100 kPa
S554-HS1	STRAINER CONTROL (LOS)	S				
S554-HS2	STRAINER CONTROL (OFF/ON/HAND)		C			
S554-MM	STRAINER STATUS - RUN	I*	I		I	*AT MCC
S554-VD	BACKWASH STATUS - ON		I			
S554-PAH	PRESS DIFFERENTIAL HIGH		A			
S554-QF	STRAINER FAILURE				Q	
S555-PI	SYSTEM PRESSURE	I			I	0 to 1400 kPa

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 10-6



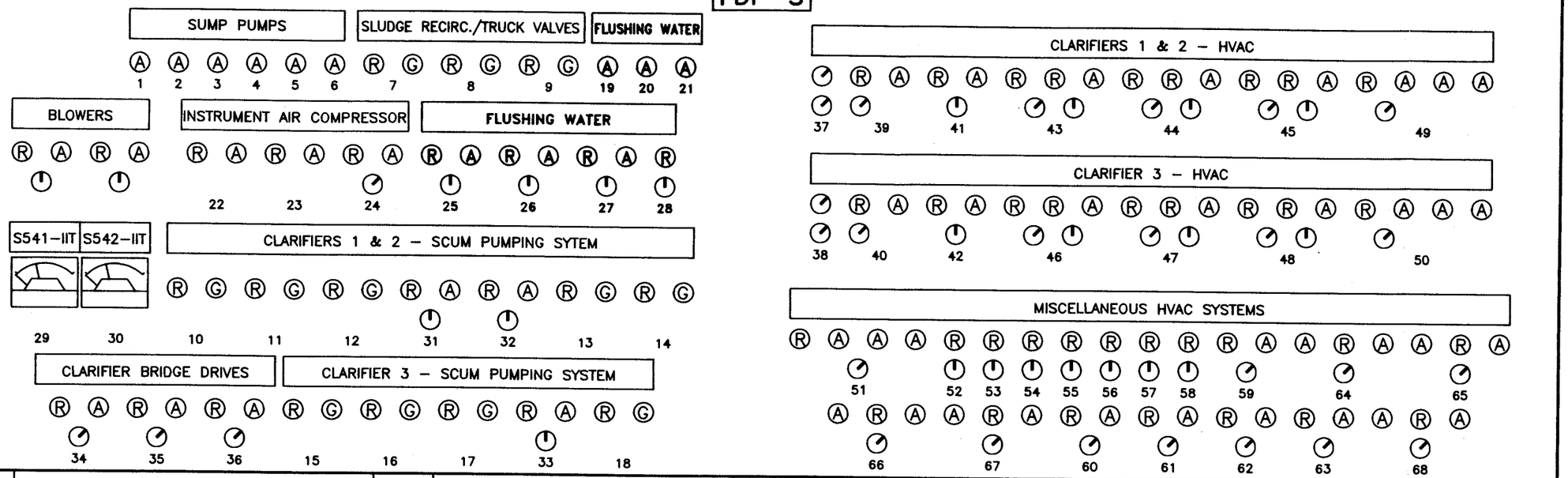
LEGEND

- RED PILOT LIGHT
- AMBER PILOT LIGHT
- 3 POSITION SELECTOR SWITCH

FLUSHING WATER STRAINER LOCAL PANEL LAYOUT

Date : January 1994
Figure 10–5

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No. 1–6

No.	DESCRIPTION
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

A (Ⓐ) – A – HIGH LEVEL

A (Ⓡ) B (Ⓖ) – A – OPEN, B – CLOSED

No. 7–18

No.	DESCRIPTION
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV

A (Ⓐ) – A – LOSS OF SEAL WATER

No. 19–21

No.	DESCRIPTION
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No. 22–23

A (Ⓡ) B (Ⓐ) – A – RUN, B – FAIL

No.	DESCRIPTION
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

A (Ⓡ) B (Ⓐ), C (⊘) – A – RUN, B – LOSS OF FLOW, C – OFF/ON

No.24

No.	DESCRIPTION
24	COMPRESSOR COOLING FAN – S537–FN

A (Ⓡ) B (Ⓐ), C (①) – A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND

No. 25–27

No.	DESCRIPTION
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

A (Ⓡ), B (①) – A – RUN, B – COMP/OFF/HAND

No. 28

No.	DESCRIPTION
28	FLUSHING WATER PUMP – S553–FWP

A (Ⓡ) B (Ⓐ), C (①), D – A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT

No. 29–30

No.	DESCRIPTION
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No. 31–33

A (Ⓡ) B (Ⓐ), C (①) – A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND

No.	DESCRIPTION
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP

A (Ⓡ) B (Ⓐ), C (⊘) – A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON

No. 34–36

No.	DESCRIPTION
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

A (⊘), B (⊘) – A – COMP/HAND, B – SUMMER/WINTER

No. 37–38

No.	DESCRIPTION
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

A (Ⓡ) B (Ⓐ), C (⊘) – A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 39–40

No.	DESCRIPTION
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

A (Ⓡ) B (Ⓐ), C (①) – A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND

No. 41–42

No.	DESCRIPTION
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

A (Ⓡ) B (Ⓡ) C (Ⓐ) D (⊘) E (①) – A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND

No. 43–48

No.	DESCRIPTION
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

A (Ⓡ) B (Ⓐ) C (Ⓐ) D (Ⓐ), E (⊘) – A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON

No. 49–51

No.	DESCRIPTION
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

A (Ⓡ), B (①) – A – RUN, B – COMP/OFF/HAND

No. 52–58

No.	DESCRIPTION
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

A (Ⓡ) B (Ⓐ), C (⊘) – A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 59–63

No.	DESCRIPTION
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

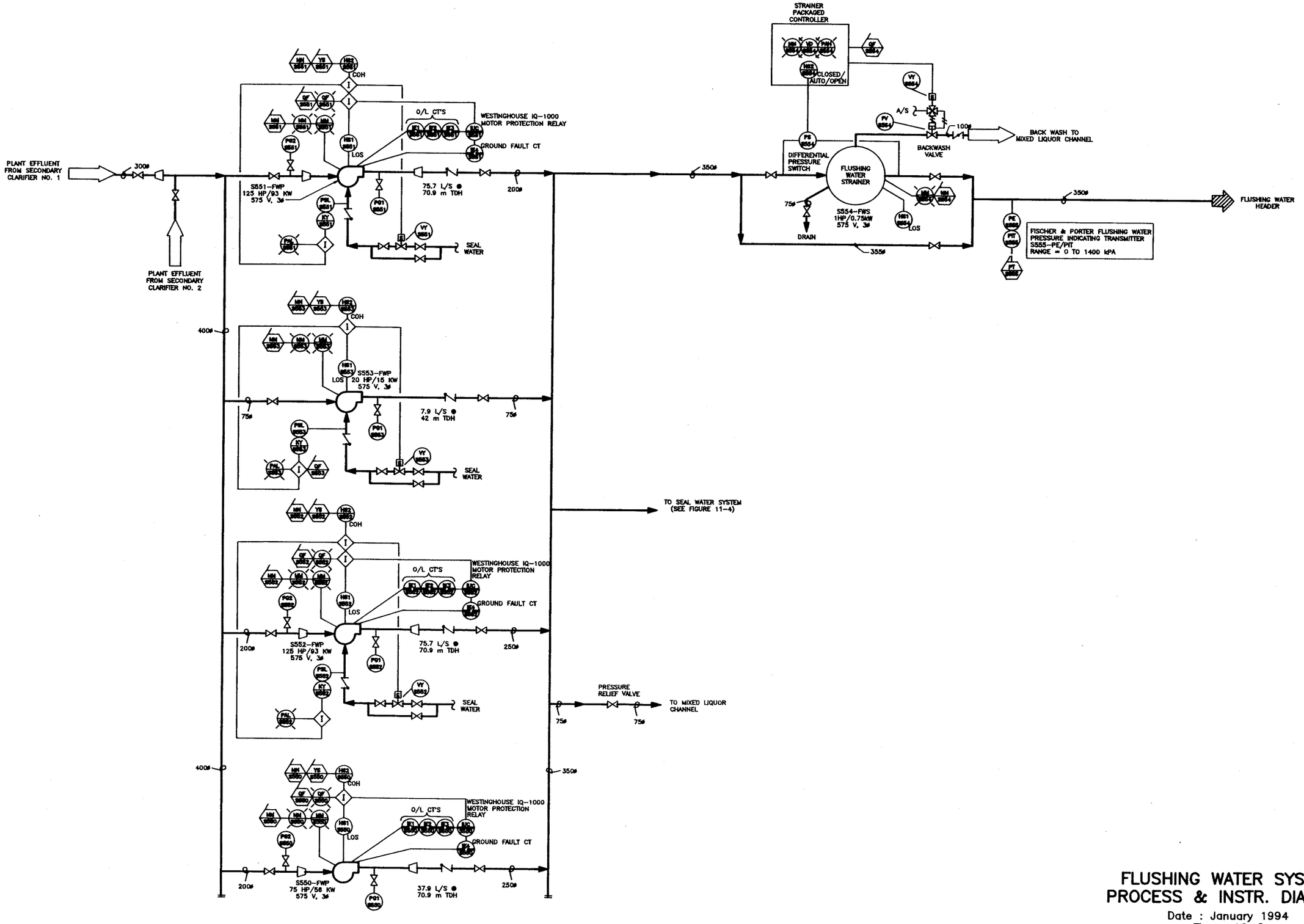
A (Ⓐ) B (Ⓡ) C (Ⓐ) D (⊘) – A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON

No. 64–68

No.	DESCRIPTION
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

FLUSHING WATER SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 10–4



FLUSHING WATER SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 10-6

High demand	39 L/S to 76 L/S Use Operator selected duty pump, S551-FWP or S552-FWP, with the other as a standby

Automatic control of the flushing water pumps is based on flushing water line pressure.

1) When flushing water line pressure falls below a low demand, low setpoint (tuned) - start pump S553-FWP;
2) If after two minutes (tuned) the flushing water line pressure is below intermediate low setpoint (450 kPa) - start pump S550-FWP and confirm run status;
3) Stop pump S553-FWP;
4) If after two minutes (tuned) the flushing water line pressure is below high demand low setpoint (tuned) - start the large duty pump, either S552-FWP or S551-FWP, and confirm run status;
5) Stop pump S550-FWP;
6) If the flushing water line pressure is above the high demand, high setpoint (tuned) for more than two minutes (tuned) - stop the large duty pump and start pump S550-FWP;
7) If the flushing water line pressure is above the intermediate demand, high setpoint (tuned) more than two minutes (tuned) - stop the intermediate pump S550-FWP and start pump S553-FWP;
8) If the flushing water line pressure is above the low demand, high setpoint (550 kPa) (tuned) more than two minutes (tuned) - stop the small pump S553-FWP.

Two 125 Hp pumps, S551-FWP/S552-FWP, are used as duty and standby pumps for high demand flushing water. If the duty pump fails, the standby pump is started automatically.

If the flushing water line pressure exceeds 750 kPa (tuned) for more than 60 seconds, an alarm is initiated and all flushing water pumps are stopped.

If the pressure safety valve opens, all pumps are stopped and an alarm is initiated.

Normally, the strainer is set in "AUTO" at the strainer control panel. It is designed to run continuously while the flushing water system is in operation. Since it removes fine particles from the flushing water, the filter media will eventually clog up and become ineffective. Two timers control the frequency of initiation and the duration of periodic backwash cycles which reverse flow through the strainer at regular intervals. A differential pressure switch across the strainer filter triggers an alarm and automatically initiates a backwash cycle should the filter become too plugged.

10.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific graphic displays noted here and summarized in Bridging Table 10-1.

Manual control consists of Operator-initiated commands to:

1) Start/stop pumps one at a time;
2) Open/close flushing water crossover valve.

Operating Procedures - Graphic 5S:

1) Press 1P "Flushing Water Pump #1 S551" and verify that it is in "auto";
2) Press 2P "Flushing Water Pump #2 S553" and verify that it is in "auto";
3) Press 3P "Flushing Water Pump #3 S552" and verify that it is in "auto";
4) Press 4P "Flushing Water Pump #4 S550" and verify that it is in "auto";
5) Press 5P "Flushing Water Pump Select" and select the duty pump: Pump 1 = S551, Pump 3 = S552;
6) Reset any "Flushing Water High Pressure Alarm" by pressing 1S and selecting "Reset".

Based on the flushing water demand pressures, the sequence will automatically begin.

10.4 ROUTINE CHECKS

1. **Flushing Water Pumps S551-FWP, S552-FWP, & S553-FWP:**
   Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;
   Check seal water flow when pumps are running;
   Lubricate pumps regularly.

2. **Flushing Water Pump S550-FWP:**
   Check that pump is operating normally free of excessive noise, vibration, or high motor temperature;
   Lubricate pump regularly.

3. **Flushing Water Strainer S554-FWS:**
   Check to see if strainer drive is operative by visually checking the rotation of the final drive;
   Periodically disassemble for internal inspection and cleaning.

4. **Pressure Sensor/Transmitter S555-PE/PIT:**
   Periodically check calibration or pressure sensor/transmitter. Recalibrate if necessary.

5. **Flushing water pressure relief line:**
   Routinely flush strainer by opening and closing flushing valve;
   Check valve for premature relief;
   Periodically check calibration of valve.

10.5 EQUIPMENT DATA

1. **<u>Flushing Water Pump:</u> S550-FWP**

Location:	Secondary Pump Room
Purpose:	To pump flushing water to system header

Manufacturer:	Pump -	ITT A-C Pump, Type 8100
		600 USGPM, 230 ft. TDH, 175 psi
	Motor -	GE Canada High Efficiency Induction Motor
		56 kw (75hp), 575V, 3ph, 60Hz
		1780 rpm, 66.4 FLA

2. **Flushing Water Pumps: S551-FWP & S552-FWP**

Location:	Secondary Pump Room	
Purpose:	To pump flushing water to system header	
Manufacturer:	Pump -	Worthington 5LR 19
	Motor -	Canron Ltd. AC Motor
		93.2 kw (125hp), 575V, 3ph, 60Hz
		1774 rpm, 110 FLA

3. **Flushing Water Pump: S553-FWP**

Location:	Secondary Pump Room	
Purpose:	To pump flushing water to system header	
Manufacturer:	Pump -	Gorman - Rupp
	Motor -	Gould Century
		15 kw (20hp), 575V, 3ph, 60Hz
		3520 rpm, 18.0 FLA

4. **Flushing Water Strainer: S554-FWS**

Location:	Secondary Pump Room
Purpose:	To filter out fine particles from the flushing water.
Manufacturer:	Hayward Industrial Products Inc.
	Model # 596 FBB
	Max. Pressure - 150 psi
	Temp - 40 to 150 °F

5. **Pressure Sensor: S555-PE/PIT**

Location:	Secondary Pump Room
Purpose:	Monitor pressure on flushing water system header
Manufacturer:	Fischer & Porter
	Range - 0 to 1400 kPa
	Input - 24 VDC; Output - 4 to 20 mADC

11.0 SEAL WATER SYSTEM

11.1 PURPOSE

The seal water system is designed to provide pressurized seal water to the fifteen RAS, WAS, Scum, Sludge Transfer and Flushing Water Pumps. Seal water keeps the pump packings lubricated and provides a seal between the sewage and the packings.

11.2 SYSTEM DESCRIPTION

Seal water is provided for by potable water from the City of Winnipeg water supply system. The connection to the City water supply is made with backflow preventer to stop any contaminated water from the process entering the City water distribution system.

Seal water is then tapped off this supply at various locations to provide for the aforementioned pumps as required. In addition to serving the Secondary Clarifier Area, this supply provides for all the plant seal water needs via a 50mm diameter header running the length of Gallery No. 3.

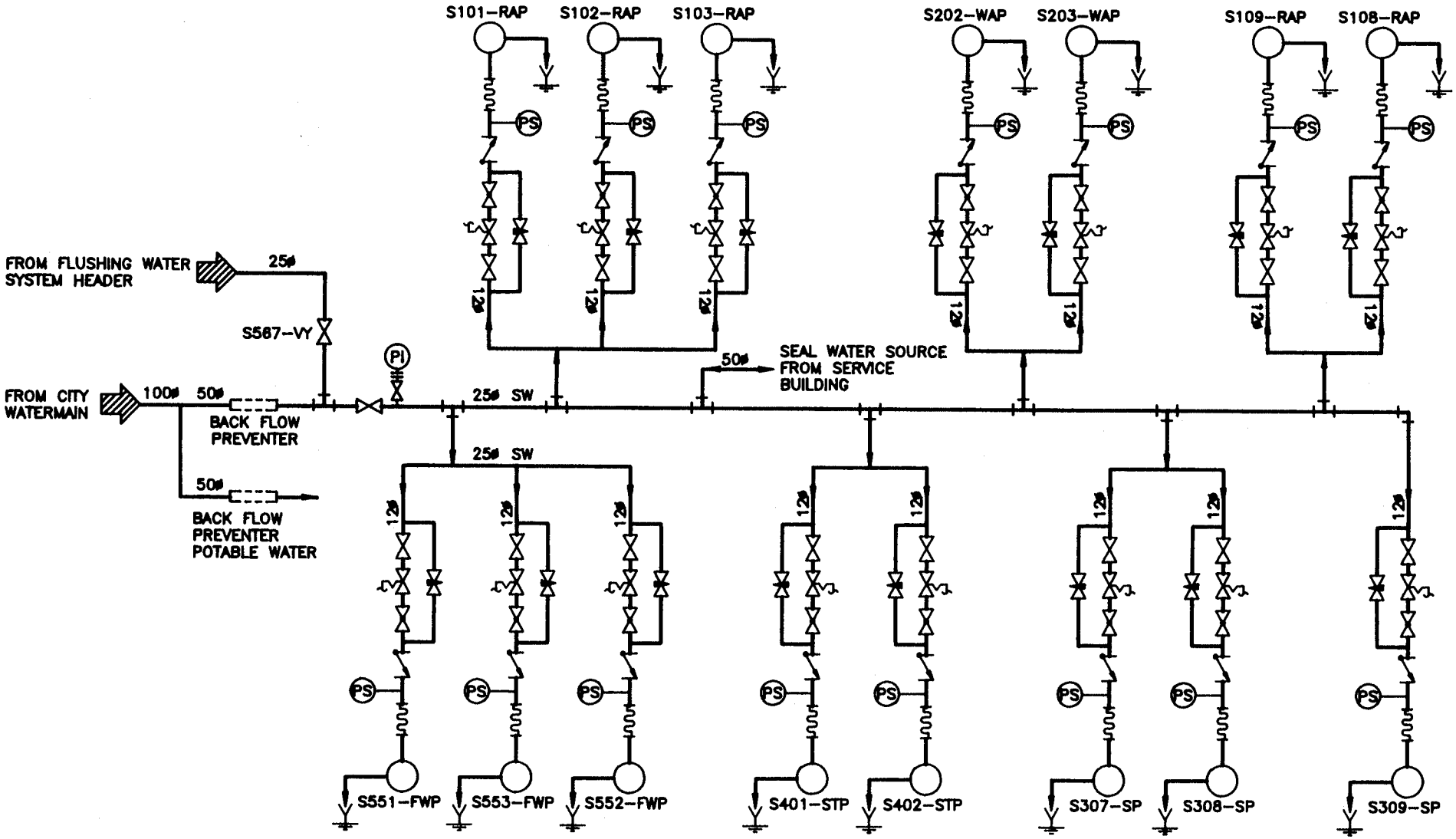
System pressure is monitored by a pressure sensor on the header.

Generally the City water supply has high enough pressure to supply the seal water system. However, should the pressure drop too low, the system can be supplemented by a line off the flushing water header by opening bypass valve S557-VY.

A summary of the equipment described in this section is as follows:

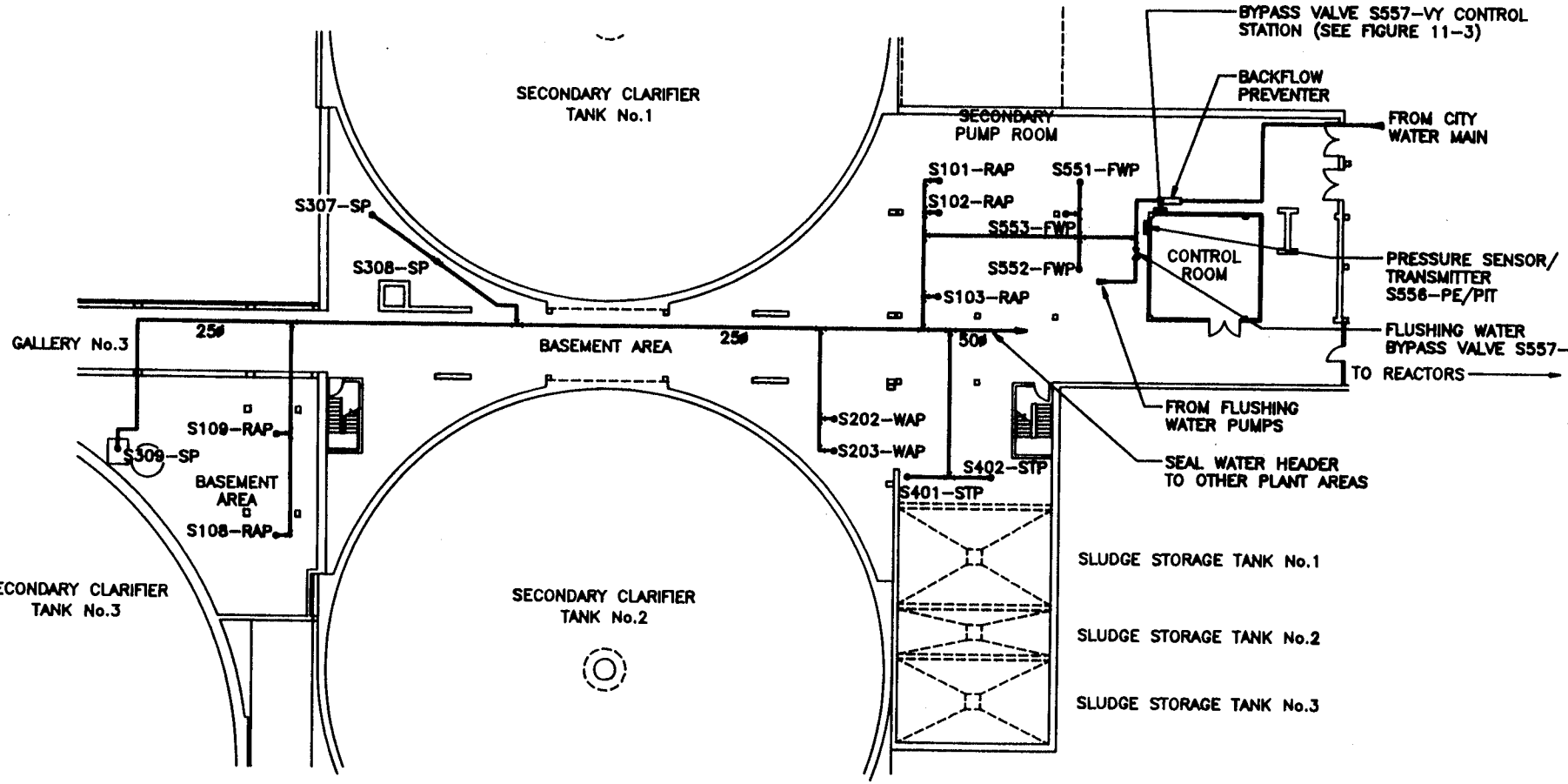
1. System pressure sensor/transmitter: S556-PE/PIT;
2. Flushing water system bypass valve: S557-VY.

A schematic of the system is shown in Figure 11-1 while equipment locations and piping layouts are provided in Figure 11-2.



SEAL WATER SYSTEM SCHEMATIC

Date : January 1994
Figure 11-1



BASEMENT FLOOR PLAN

SEAL WATER SYSTEM LAYOUT

Date : January 1994
Figure 11-2

11.3 MONITORING AND CONTROL

11.3.1 Process Equipment

The flushing water system bypass valve, S557-VY, is controlled from a "COMPUTER/HAND" switch at a local control station. The "HAND" position allows an operator to control the valve manually by using the "OPEN/CLOSE" switch also at the control station while the "COMPUTER" position surrenders valve control to the INFI 90.

The location of the control station is shown in Figure 11-2 while a layout is provided in Figure 11-3.

The INFI 90 monitors the following valve parameters:

1. Valve "COMPUTER/HAND" control switch status.

The seal water system pressure is monitored by pressure sensor/transmitter S556-PE/PIT. The pressure is displayed at the local indicating transmitter and reported to the INFI 90. The location of this sensor/transmitter is also shown in Figure 11-2.

Seal water flow to each pump is controlled by a dedicated solenoid valve tied into the pump operation. A complete description of the monitoring and control of each valve can be found in the sections specific to each pump.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 11-1. Equipment/Instrument Summary Table 11-2 provides a detailed summary of all control and monitoring devices associated with this system. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 11-4.

11.3.2 Automatic Control

Automatic control of the flushing water bypass valve is based on seal water line pressure. If a low seal water line pressure (tuned) is detected by S556-PIT, the flushing water

bypass valve is opened and an alarm (seal water line failure) is initiated. Pumps continue to run.

11.3.3 Workstation Control

Manual control consists of Operator-initiated commands to "OPEN/CLOSE" flushing water bypass valve.

Operating Procedures - Graphic 5S:

1. Reset any "SEAL WATER LOW PRESSURE" alarm by pressing 3S and selecting "RESET";
2. Press 2S "FLUSHING WATER BYPASS VALVE" and verify that it is in "COMPUTER".

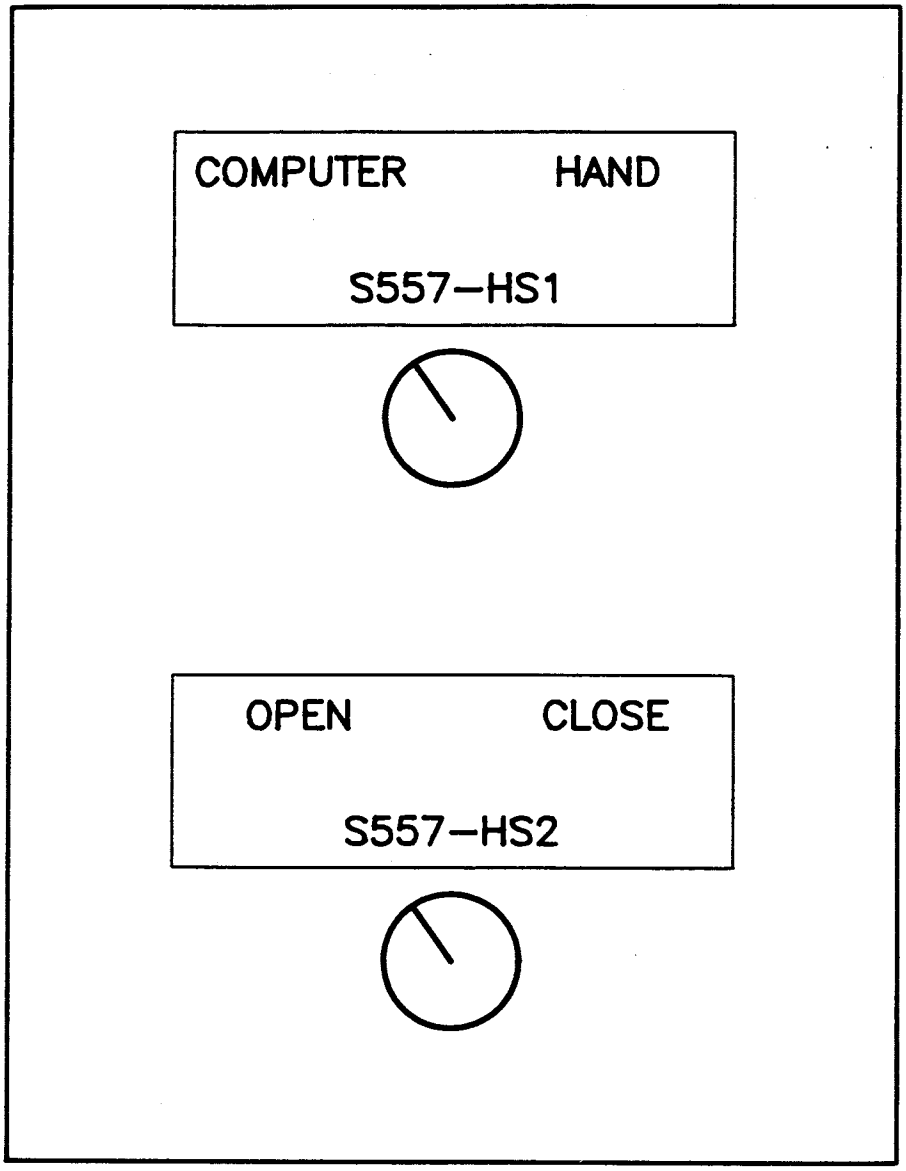
11.4 ROUTINE CHECKS

1. Check the system for leaks;
2. Check that pressure sensor/transmitter is functioning.

11.5 EQUIPMENT DATA

1. **Flushing Water Bypass Valve: S557-VY**
   Location: Secondary Pump Room
   Purpose: To control flow of flushing water to seal water system.
   Manufacturer: Ascoelectric

2. **Pressure Sensor: S556-PE/PIT**
   Location: Secondary Pump Room
   Purpose: Monitor pressure on seal water system header
   Manufacturer: Fischer & Porter
   Range - 0 to 700 kPa
   Input - 24 VDC; Output - 4 to 20mADC



BYPASS VALVE
LOCAL CONTROL STATION LAYOUT

Date : January 1994
Figure 11–3

TABLE 11-1

SEAL WATER SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S556-PI	5-S	3S	5-S			5-S
S557-VY	5-S	2S			5-S	5-S

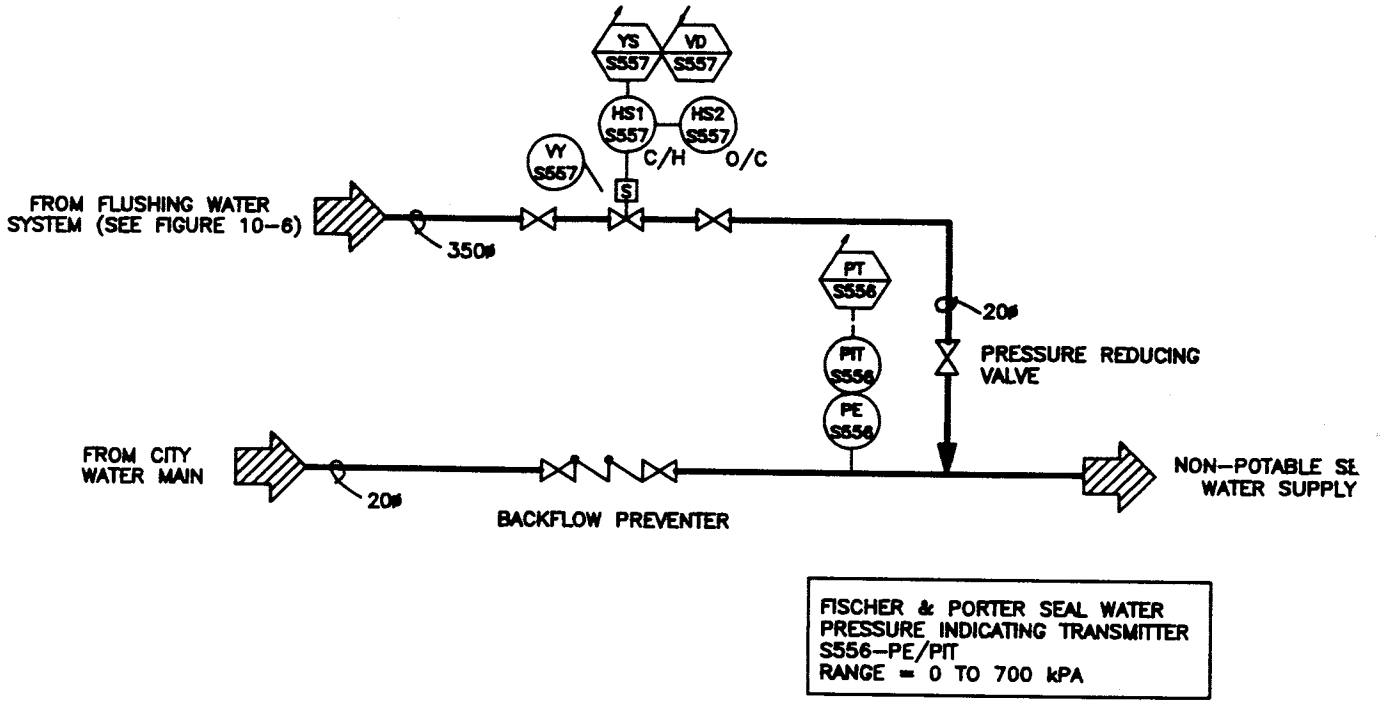
TABLE 11-2

SEAL WATER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S557-HS1	VALVE CONTROL (COMP/HAND)		C		I	
S557-HS2	VALVE CONTROL (OPEN/CLOSE)		C		C	
S556-PI	SW SYSTEM PRESSURE	I			I	0 to 700 kPa

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 11-4



FISCHER & PORTER SEAL WATER
PRESSURE INDICATING TRANSMITTER
S556-PE/PIT
RANGE = 0 TO 700 kPA

SEAL WATER SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 11-4

bypass valve is opened and an alarm (seal water line failure) is initiated. Pumps continue to run.

11.3.3 Workstation Control

Manual control consists of Operator-initiated commands to "OPEN/CLOSE" flushing water bypass valve.

Operating Procedures - Graphic 5S:

1. Reset any "SEAL WATER LOW PRESSURE" alarm by pressing 3S and selecting "RESET";
2. Press 2S "FLUSHING WATER BYPASS VALVE" and verify that it is in "COMPUTER".

11.4 ROUTINE CHECKS

1. Check the system for leaks;
2. Check that pressure sensor/transmitter is functioning.

11.5 EQUIPMENT DATA

1. **Flushing Water Bypass Valve: S557-VY**
   Location: Secondary Pump Room
   Purpose: To control flow of flushing water to seal water system.
   Manufacturer: Ascoelectric

2. **Pressure Sensor: S556-PE/PIT**
   Location: Secondary Pump Room
   Purpose: Monitor pressure on seal water system header
   Manufacturer: Fischer & Porter
   Range - 0 to 700 kPa
   Input - 24 VDC; Output - 4 to 20mADC

12.0 PROCESS AIR SYSTEM

12.1 PURPOSE

The process air system is designed to supply air to the mixed liquor channel to aerate the influent. Aeration prevents solids from settling in the mixed liquor channel.

12.2 SYSTEM DESCRIPTION

The process air system in the Secondary Clarifier Area provides for the process air requirement of the entire plant. Two air blowers, S541-AB and S542-AB, operate in a duty/standby arrangement to draw outside air from a roof plenum via a 600 x 600 air intake duct. The blowers pressurize a system header which splits into a 200mm diameter process air header feeding the other plant areas and a 250mm diameter header running along Gallery No. 3 feeding the mixed liquor channel in the Secondary Clarifier Area. Process air is drawn off at three points through 150mm diameter pipes and injected into the mixed liquor channel through spray nozzles mounted on a diffuser header.

The system is designed to run continuously. Air flow is monitored by a flow sensor on the discharge header.

A summary of the equipment described in this section is as follows:

1. Two constant speed aeration blowers: S541-AB and S542-AB;
2. One air flowmeter: S540-FE/FIT.

A schematic of the system is shown in Figure 12-1 while equipment locations and piping layouts are found on the basement floor plan shown in Figure 12-2. Figure 12-3 shows a layout of the piping, diffusers, aeration piping, etc. in the mixed liquor channel above Gallery No. 3. Section through the channel and a spray nozzle detail are provided in Figure 12-4.

12.3 MONITORING AND CONTROL

12.3.1 Process Equipment

Each of the two air blowers, S541-AB and S542-AB, are controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the blower while the "COMP" position surrenders all control to the INFI 90. Blower "RUN" status indication is available at the MCC and FDP-S. In addition, blower "FAIL" from current overload/surge, ground fault, or high discharge air temperature is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of the blowers is shown in Figure 12-5.

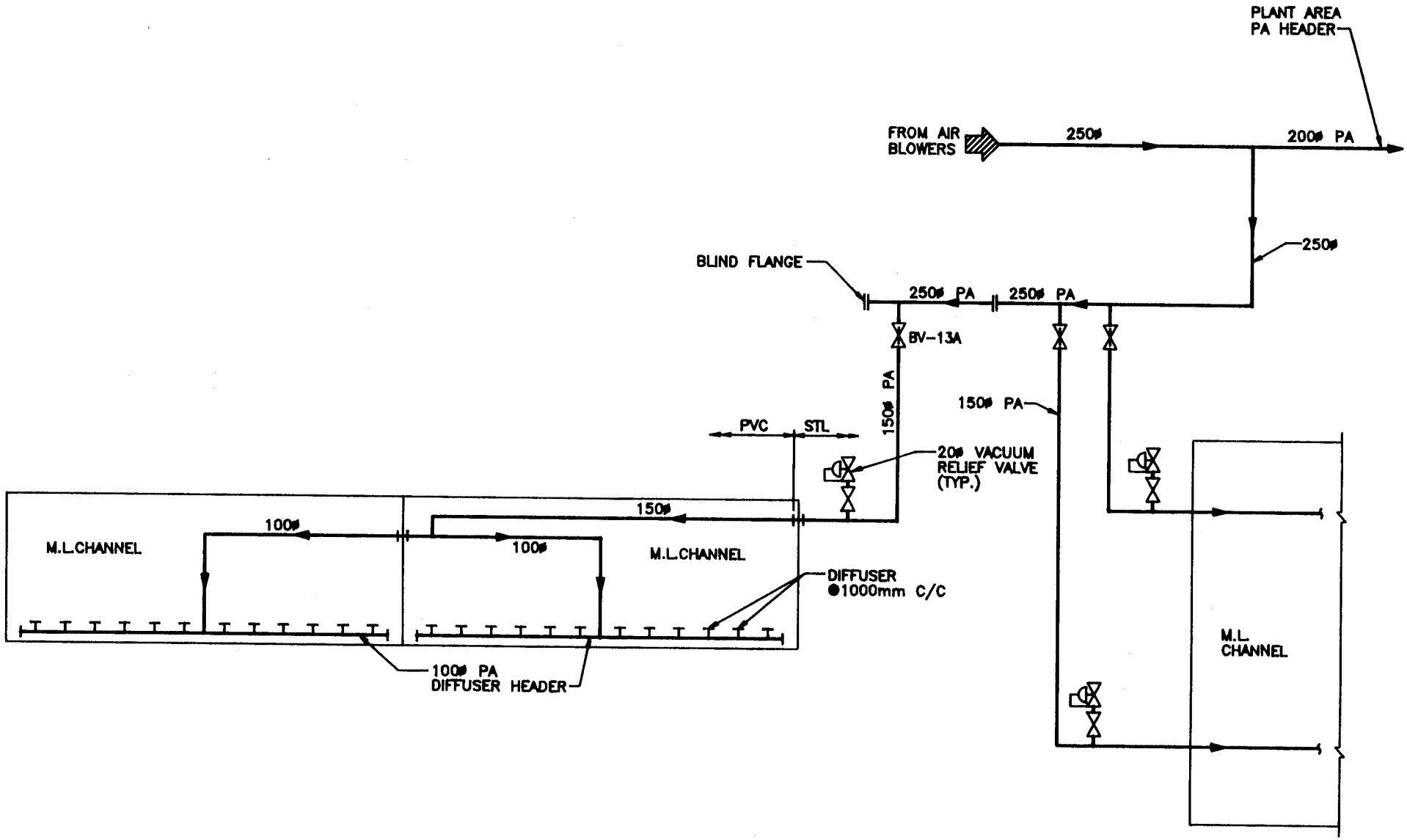
The INFI 90 monitors the following blower parameters:

1. Blower "COMP/OFF/HAND" control switch status;
2. Blower "RUN" status;
3. Blower "FAIL" alarm condition.

Each blower can be shut down and locked out using the "LOS" pushbuttom field located near each unit. These pushbuttons are shown in Figure 12-2.

Air flow in the header is monitored by flowmeter/transmitter S540-FE/FIT. The flow is displayed at the local indicating transmitter and reported to the INFI 90. The location of this device is also shown in Figure 12-2.

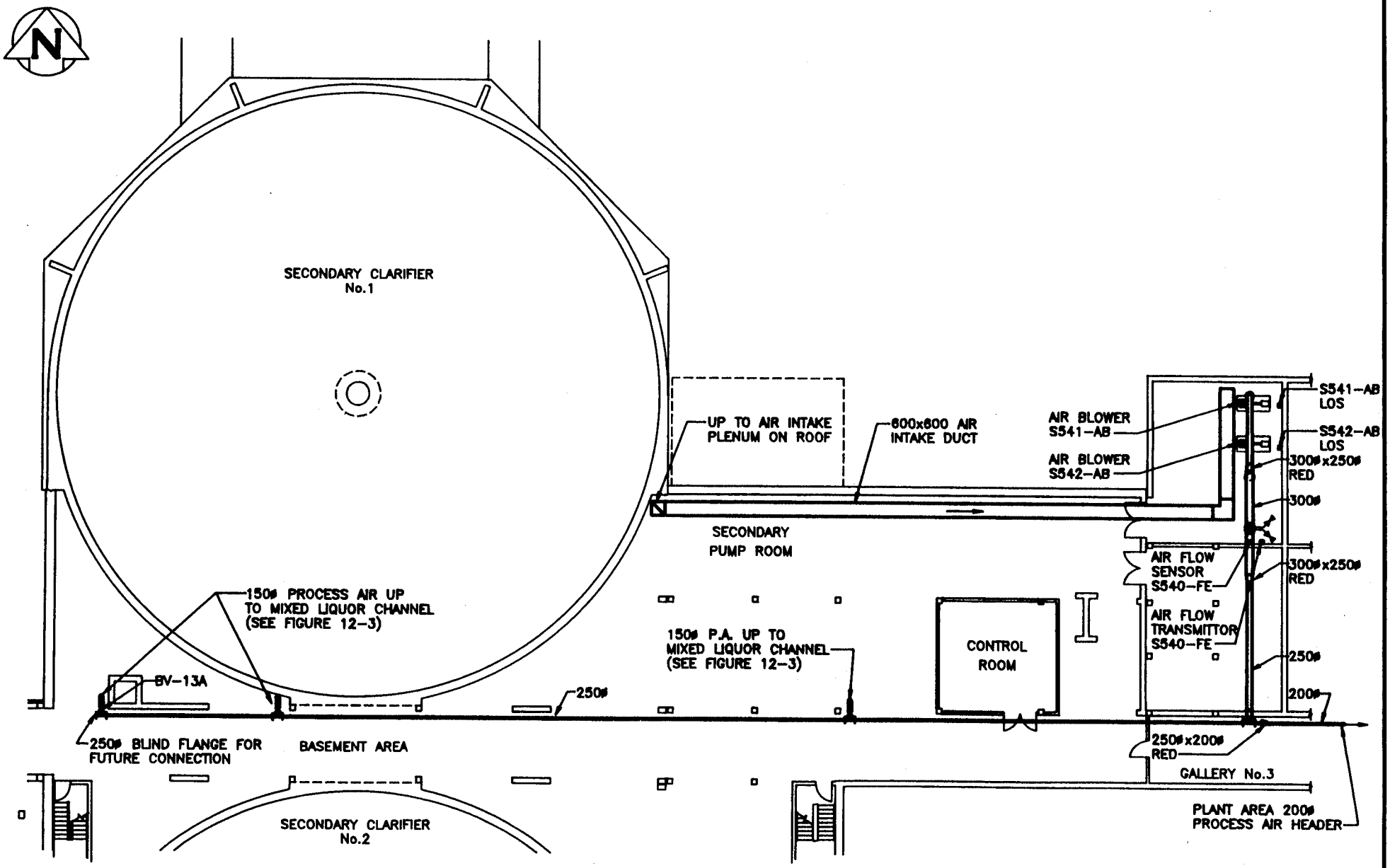
Cross references between this equipment and the INFI 90 may be found in Bridging Table 12-1. Equipment/Instrument Summary Table 12-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 12-6.



PROCES AIR SYSTEM SCHEMATIC

Date : January 1994

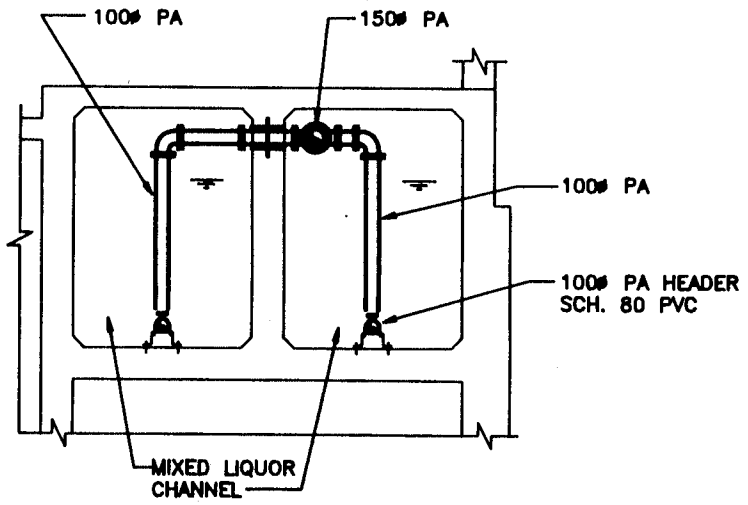
Figure 12-1



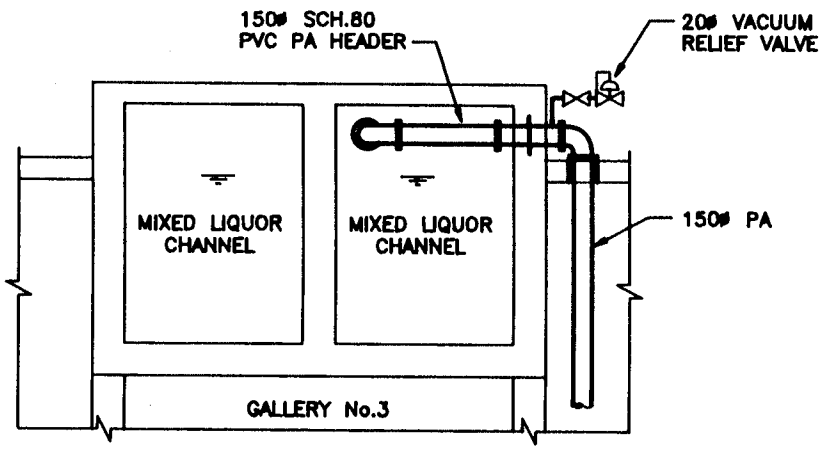
BASEMENT FLOOR PLAN

PROCESS AIR SYSTEM EQUIPMENT LOCATIONS

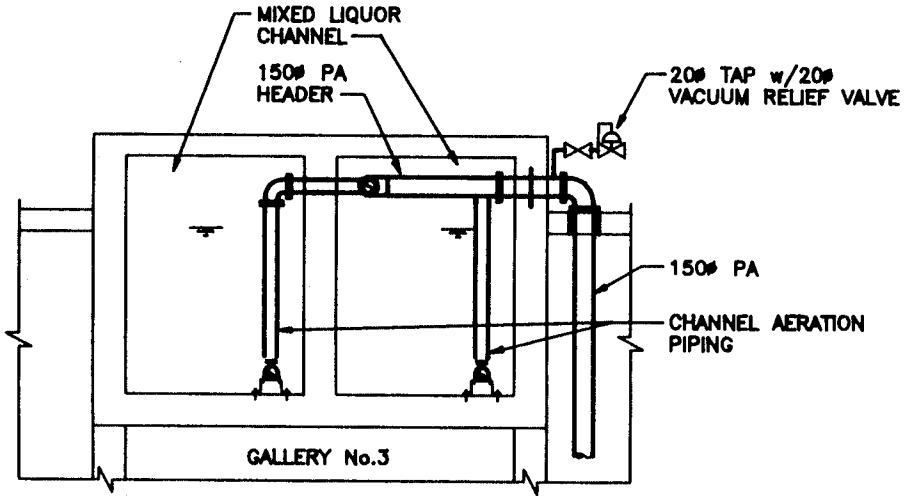
Date : January 1994
Figure 12-2



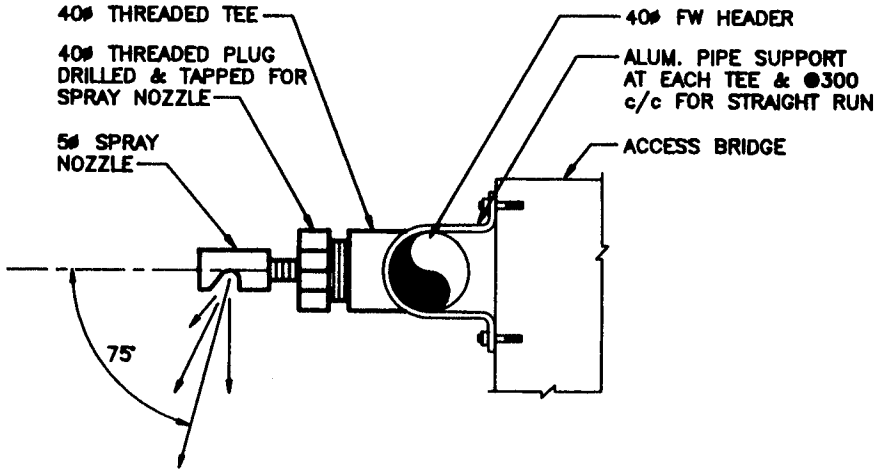
1 SECTION
12-3 | 12-4



2 SECTION
12-3 | 12-4



3 SECTION
12-3 | 12-4



SPRAY NOZZLE DETAIL

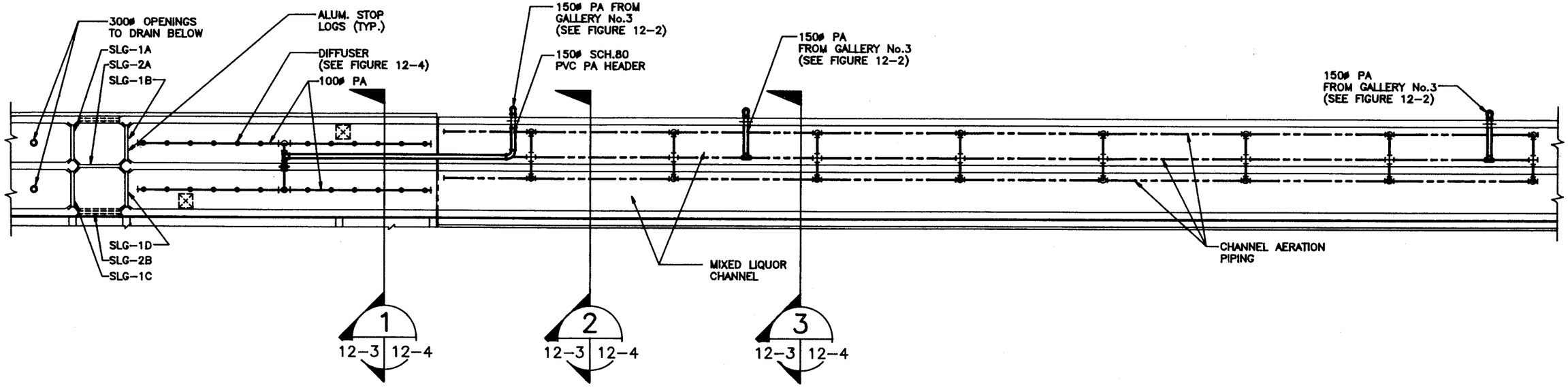
PROCESS AIR EQUIPMENT SECTIONS AND DETAILS

Date : January 1994
Figure 12-4

TABLE 12-1

PROCESS AIR SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S541-AB	5-T	9S, 7S			5-T	5-T
S542-AB	5-T	6S, 7S			5-T	5-T
S540-FI	5-T	5G	5-T	5-T		5-T

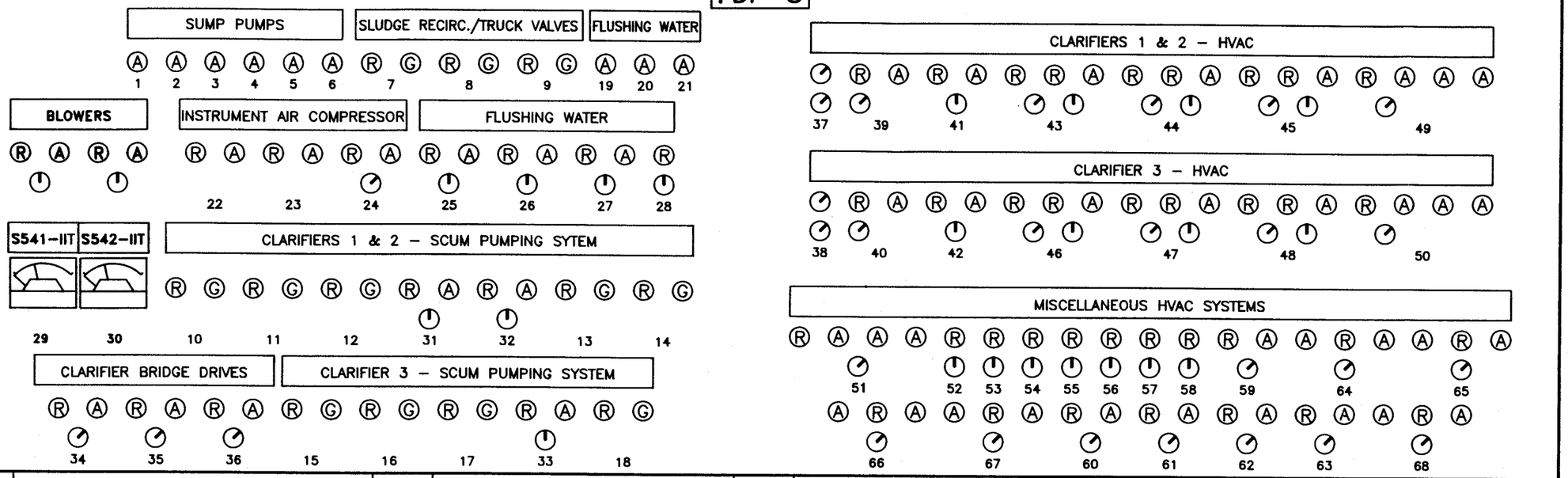


MIXED LIQUOR CHANNEL (AT ELEV. 231.038)

PROCESS AIR SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 12-3

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ⏲ – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

Ⓐ A – HIGH LEVEL

No. 1–6

1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

Ⓡ A, Ⓖ B — A – OPEN, B – CLOSED

No. 7–18

7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV

Ⓐ A – LOSS OF SEAL WATER

No. 19–21

19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

Ⓡ A, Ⓐ B — A – RUN, B – FAIL

No. 22–23

22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

Ⓡ A, Ⓐ B, ⊘C — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No.24

24	COMPRESSOR COOLING FAN – S537–FN

Ⓡ A, Ⓐ B, ⏲C — A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND

No. 25–27

25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

Ⓡ A, ⏲B — A – RUN, B – COMP/OFF/HAND

No. 28

28	FLUSHING WATER PUMP – S553–FWP

Ⓡ A, Ⓐ B, ⏲C, D — A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT

No. 29–30

29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

Ⓡ A, Ⓐ B, ⏲C — A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND

No. 31–33

31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP

Ⓡ A, Ⓐ B, ⊘C — A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON

No. 34–36

34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

⊘A, ⊘B — A – COMP/HAND, B – SUMMER/WINTER

No. 37–38

37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

Ⓡ A, Ⓐ B, ⊘C — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 39–40

39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

Ⓡ A, Ⓐ B, ⏲C — A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND

No. 41–42

41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

Ⓡ A, Ⓡ B, Ⓐ C, ⊘D, ⊘E — A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND

No. 43–48

43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

Ⓡ A, Ⓐ B, Ⓐ C, Ⓐ D, ⊘E — A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON

No. 49–51

49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

Ⓡ A, ⏲B — A – RUN, B – COMP/OFF/HAND

No. 52–58

52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

Ⓡ A, Ⓐ B, ⊘C — A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 59–63

59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

Ⓐ A, Ⓡ B, Ⓐ C, ⏲D — A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON

No. 64–68

64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

PROCESS AIR SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 12–5

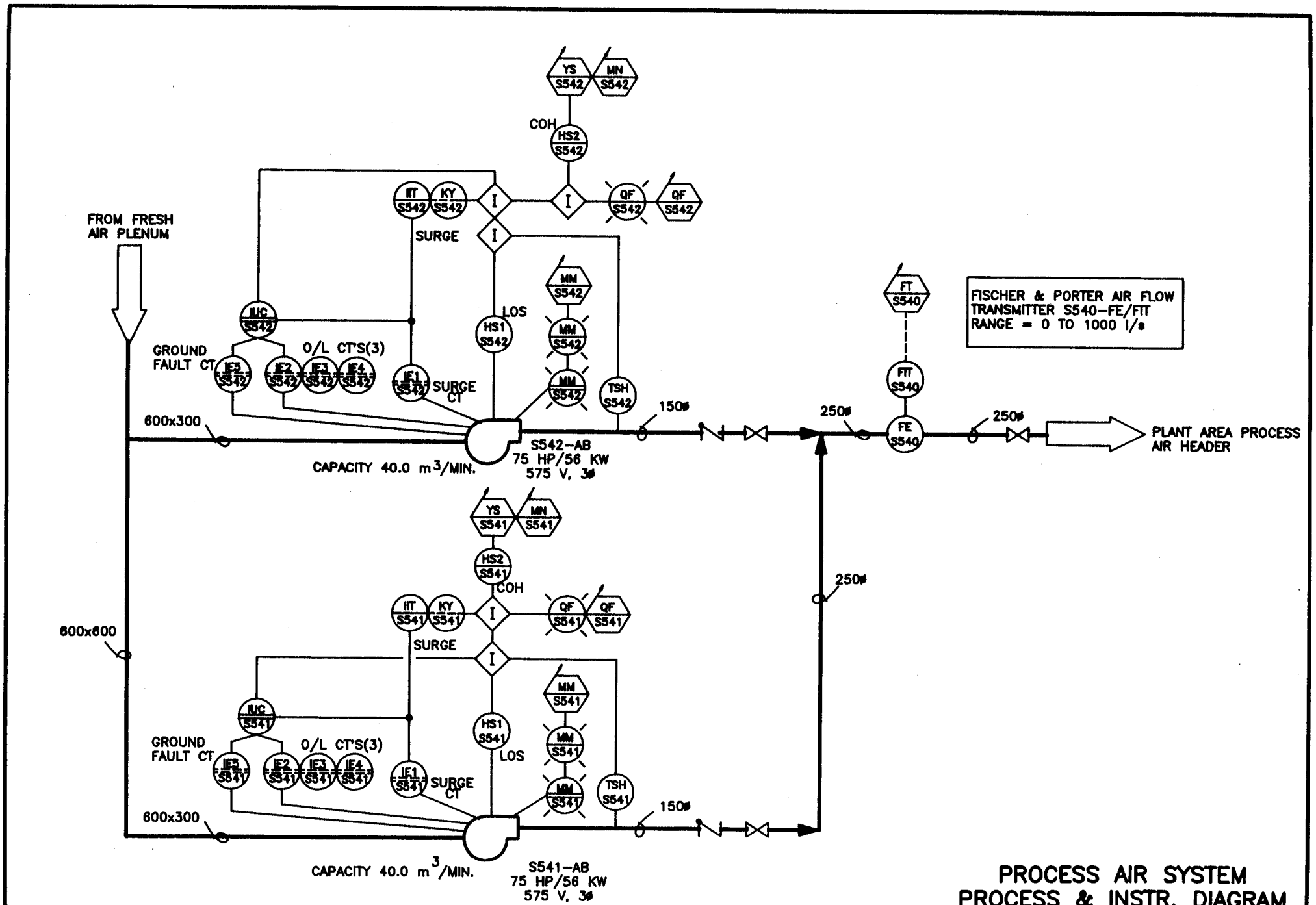
TABLE 12-2

PROCESS AIR SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S541-HS1	BLOWER CONTROL (LOS)	S				
S541-HS2	BLOWER CONTROL (COMP/OFF/HAND)			C	I	
S541-MN	BLOWER CONTROL (START/STOP)				C	
S541-MM	BLOWER STATUS - RUN		I	I	I	
S541-IIT	BLOWER CURRENT			I		0 to 100A
S541-QF	BLOWER FAILURE			Q	Q	
S542-HS1	BLOWER CONTROL (LOS)	S				
S542-HS2	BLOWER CONTROL (COMP/OFF/HAND)			C	I	
S542-MN	BLOWER CONTROL (START/STOP)				C	
S542-MM	BLOWER STATUS - RUN		I	I	I	
S542-IIT	BLOWER CURRENT			I		0 to 100A
S542-QF	BLOWER FAILURE			Q	Q	
S540-FI	PROCESS AIR FLOW	I			I	0 to 1000 L/S

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 12-6



PROCESS AIR SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 12-6

12.3.2 Automatic Control

Automatic Operation:

The duty blower, as selected by the Operator, runs for an Operator-Adjustable time period. Upon time out, the duty and standby blowers automatically switch assignments, with subsequent restart of duty blower and shut down of standby blower,

Note: A blower cannot be restarted for 60 minutes (tunable) after an initiated start.

If the air flow drops below an Operator-entered setpoint for 60 seconds (tunable) or if a blower failure occurs, the standby blower is automatically started.

12.3.3 Workstation Control

To assist in understanding the following control descriptions, refer to the specific graphic displays noted here and summarized in Bridging Table 12-1.

Manual control consists of Operator-initiated command to start/stop a blower.

Operating Procedures - Graphic 5T:

1) Verify that both blowers S542 and S541 are in "COMPUTER";
2) Press 6S "AERATION BLOWER #2 S542" and verify that it is in "AUTO";
3) Press 9S "AERATION BLOWER #1 S541" and verify that it is in "AUTO";
4) Press 7S "AERATION BLOWER DUTY SELECT" and select the duty blower:
   Blower 1 = S541 Blower 2 = S542;
5) Press 7G "AERATION BLOWER RUN TIME SETPOINT" and enter the length of run time in hours.
   Note: The elapse running time for each blower is displayed on the graphic;
6) Press 8G "AERATION BLOWERS OFF TIME SETPOINT" and enter the length of off time in hours.
   Note: The elapse running time for each blower is displayed on the graphic;

7) Press 5G "AERATION BLOWER MINIMUM AIR FLOW SETPOINT" and enter a value;

8) Press 8S "AERATION BLOWER AUTO START" and select "START".

The automatic sequence will begin.

12.4 ROUTINE CHECKS

1. Air Blowers S541-AB and S542-AB

Check the over current relay indicator on FDP-S. It should indicate 50% or less;
Check that blowers are operating normally free of excessive noise, vibration, or surging;
During cold weather take note of the current indicator as it is possible to greatly overload the blower motor when outside air temperature is -18°C or lower.

12.5 EQUIPMENT DATA

1. **Air Blowers: S541-AB and S542-AB**

Location:	Blower Room	
Purpose:	Provide pressurized process air for mixed liquor channel aeration and to supply other plant areas	
Manufacturer:	Blower -	Hoffman Centrifugal Blower
		Model # 38306B1
	Motor -	General Electric Induction Motor
		56 kw (75 hp), 575V, 3ph, 60 Hz
		3560 rpm, 68.0 FLA

2. **Air Flowmeter: S540-FE/FIT**

Location:	Blower Room
Purpose:	Monitor air flow in process air header
Manufacturer:	Fischer & Porter
	Range - 0 to 2000 L/S
	Input - 24 VDC; Output - 4 to 20 mADC

13.0 INSTRUMENT AIR SYSTEM

13.1 PURPOSE

The instrument air system is designed to supply compressed air to all pneumatic instruments and controls in the plant area.

13.2 SYSTEM DESCRIPTION

The instrument air system in the Secondary Clarifier Area provides compressed air for the pneumatic instruments and controls in the entire plant area. Supply air from fan S537-FN draws outside air through a 900 mm intake pipe, passes it through a filter, and supplies it to two compressors, designated S535-AC and S536-AC, which keep the system pressurized. Typically, not all the air is required by the compressors so excess air is either vented to the atmosphere through a 600 mm exhaust pipe or recirculated back to the supply fan.

The compressors feed into a receiver tank which provides temporary storage for the pressurized air. If the compressors should fail, the tank would keep the system pressurized for a short period of time. The air is then passed through one of two packaged desiccant dryers. Each dryer has a pre-filter and after filter unit. The dryers cool the air, which removes most of the moisture. The air then feeds into a 50 mm diameter instrument air header which runs the length of Gallery No. 3.

System pressure is monitored by a pressure sensor/transmitter on the header.

A summary of the equipment described in this section is as follows:

1. Two packaged air compressors: S535-AC and S536-AC;
2. One supply air fan: S537-FN;
3. One pressure sensor/transmitter: S546-PE/PIT.

Equipment locations and piping layouts are found on the basement floor plan shown in Figure 13-1. Figure 13-2 provides a detailed layout of the Blower and Compressor Rooms.

13.3 MONITORING AND CONTROL

A pressure switch mounted on the air discharge line from the compressors will bring a compressor on and off line as the system pressure rises and falls. The compressors are controlled from a "COMP1/COMP2/ALTERNATE" switch located on a local mechanical alternator panel. An operator can designate either compressor to be duty by selecting "COMP1" or "COMP2" or have them alternate coming on line by selecting "ALTERNATE". Compressor "RUN" status indication is available at FDP-S. In addition, a compressor "FAIL" alarm condition is monitored at the panel and at FDP-S.

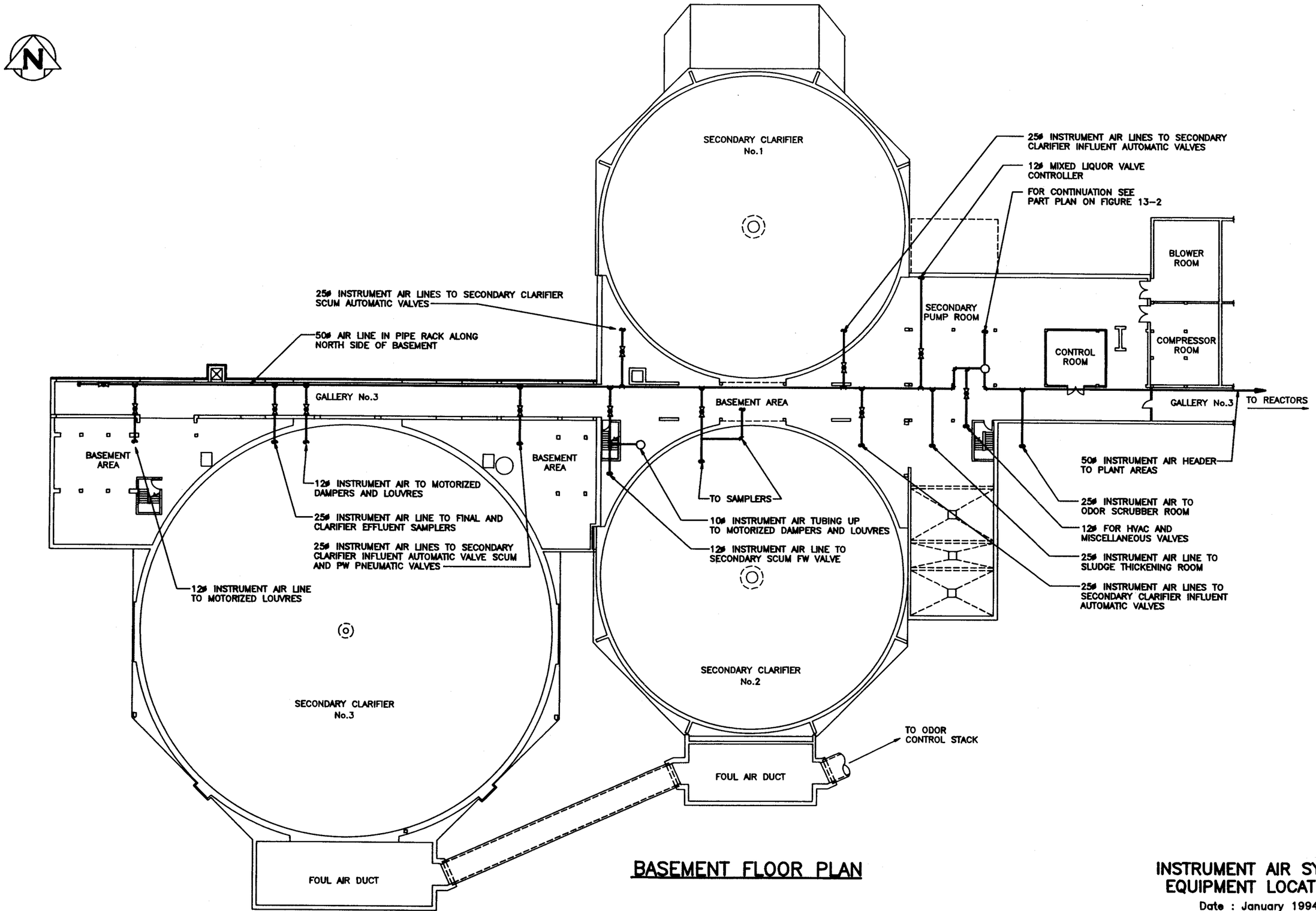
The location of the panel is shown in Figure 13-2 and a detail provided in Figure 13-3. The section of FDP-S dedicated to the monitoring of the compressors is shown in Figure 13-4.

The INFI 90 monitors the following compressor parameters:

1. Compressor "RUN" status;
2. Compressor "FAIL" alarm condition.

Each compressor can be shut down and locked-out using the "LOS" pushbutton field located near each unit. These pushbuttons are shown in Figure 13-2.

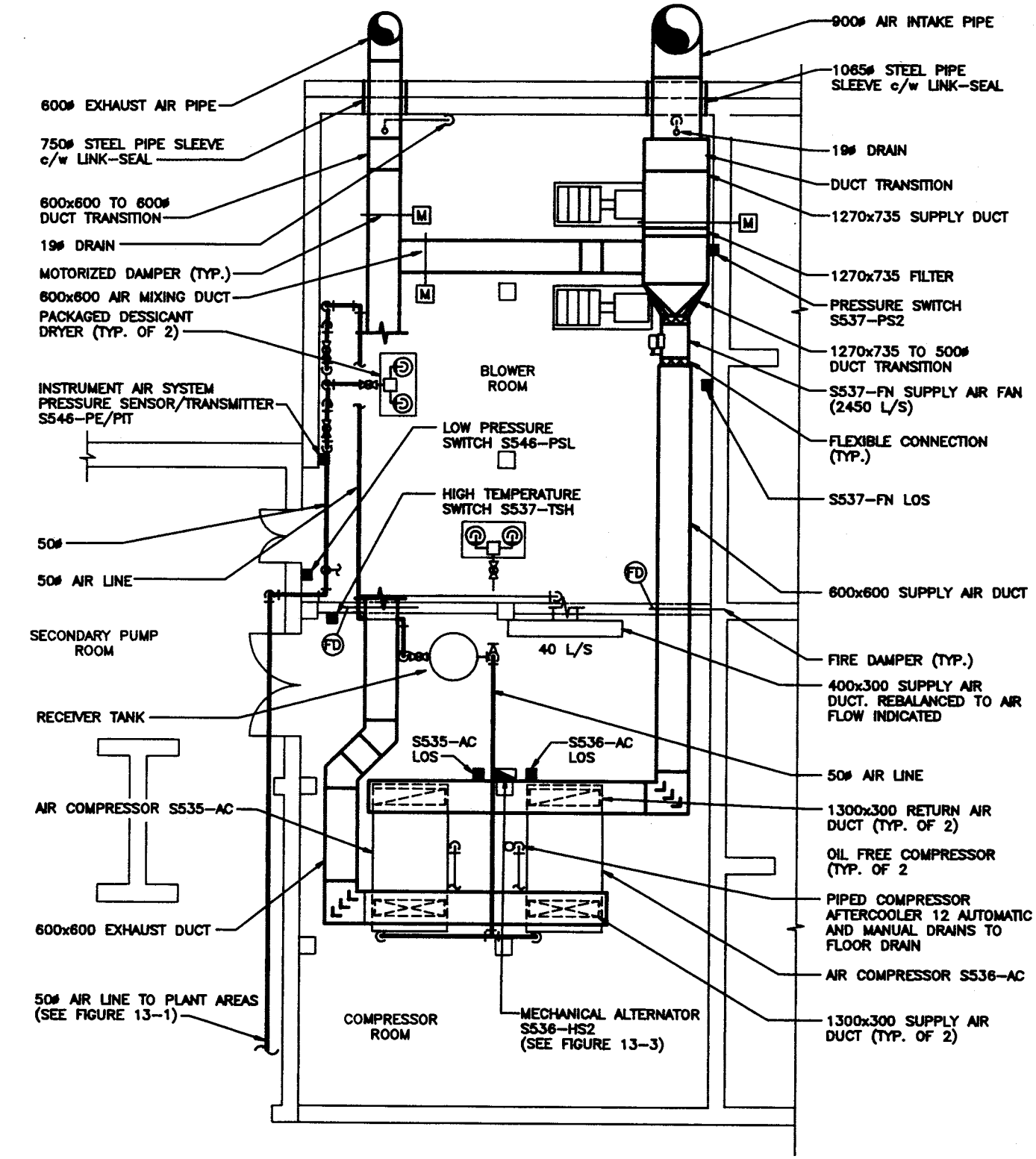
Air pressure in the header is monitored by pressure sensor/transmitter S546-PE/PIT. The pressure is displayed at the local indicating transmitter and reported to the INFI 90. Furthermore, a pressure switch will send a low pressure alarm signal to the INFI 90 if system pressure drops below 550 kPa. Locations of these devices are provided in Figure 13-2.



BASEMENT FLOOR PLAN

INSTRUMENT AIR SYSTEM EQUIPMENT LOCATIONS

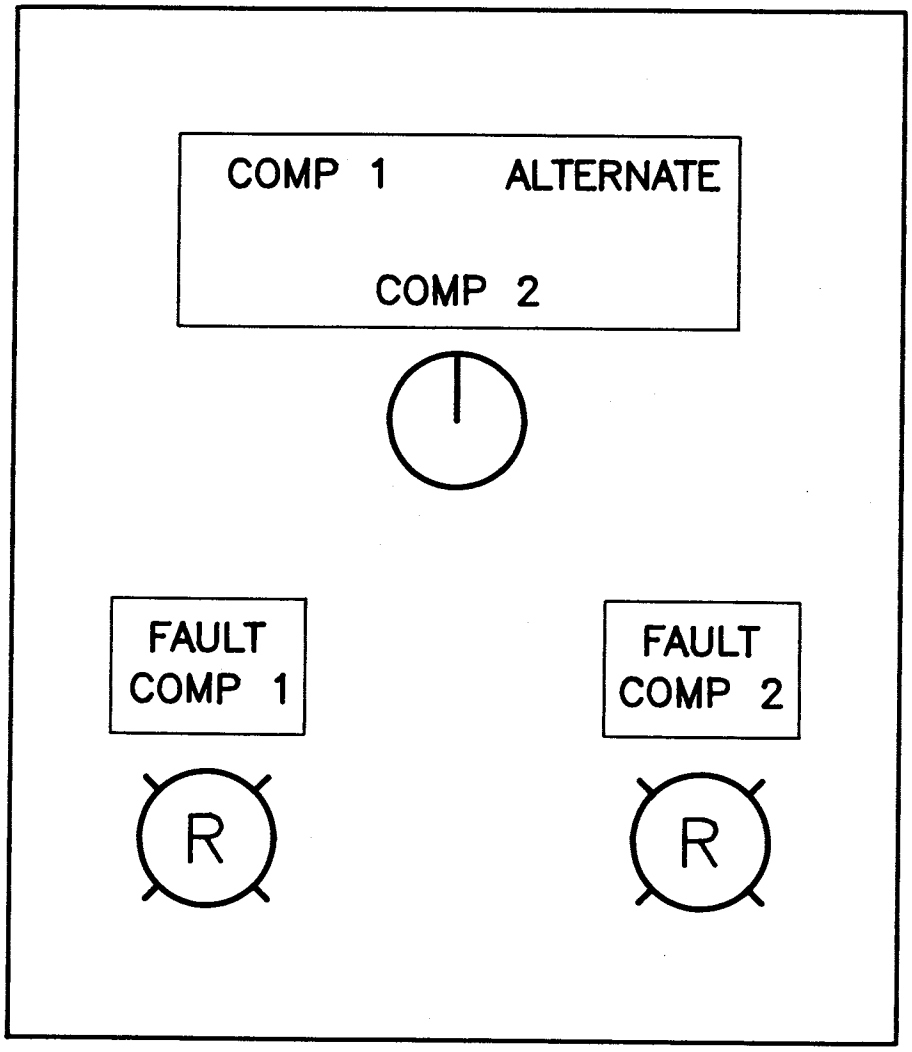
Date : January 1994
Figure 13-1



PARTIAL FLOOR PLAN

INSTRUMENT AIR SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 13-2



LEGEND

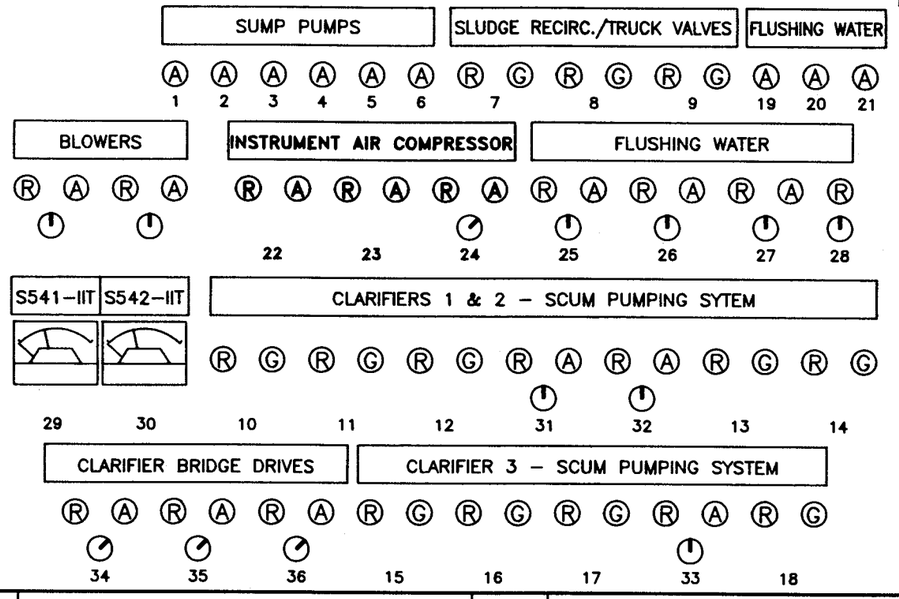
3 POSITION SELECTOR SWITCH

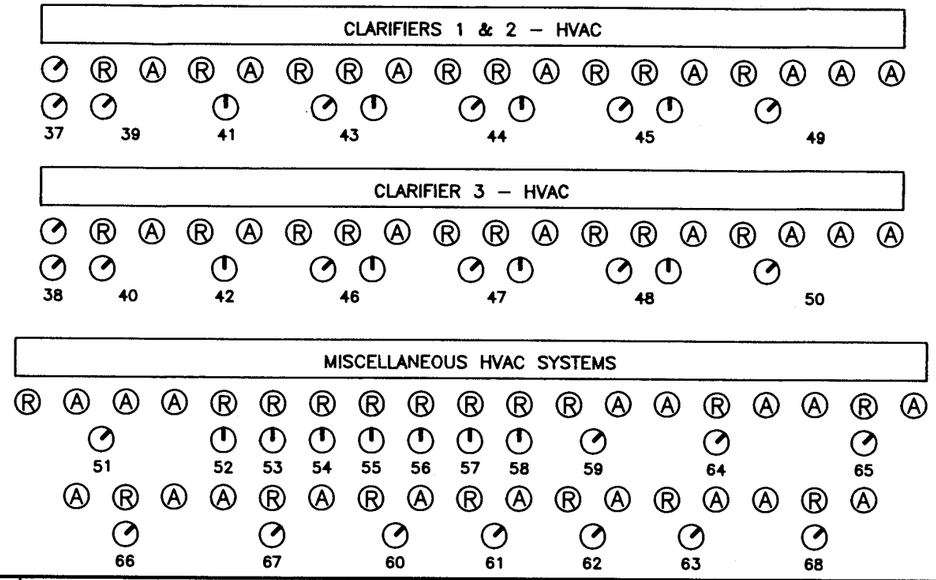
R RED PILOT LIGHT

AIR COMPRESSOR SYSTEM
MECHANICAL ALTERNATOR PANEL

Date : January 1994
Figure 13-3

FDP–S





LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ⏲ – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	A — HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	A — OPEN B — CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	A — LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	A — RUN B — FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	A — RUN B — LOSS OF FLOW C — OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	A — RUN B — PUMP FAIL C — COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A — RUN B — COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	A — RUN B — FAIL C — COMP/OFF/HAND D — CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	A — RUN B — LOSS OF SEAL WATER C — COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	A — RUN B — HIGH TORQUE FAIL C — OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A — COMP/HAND B — SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	A — RUN B — LOSS OF FLOW C — OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	A — RUN B — LOSS OF FLOW C — COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	A — SLOW B — FAST C — LOSS OF FLOW D — SLOW/FAST E — COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	A — RUN B — GLYCOL FLOW FAIL C — FLUSH WATER FLOW FAIL D — LOW TEMP E — OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A — RUN B — COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	A — RUN B — LOSS OF FLOW C — OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	A — LOSS OF FLOW B — RUN C — LOW TEMP D — OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

INSTRUMENT AIR SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 13–4

Air supply fan S537-FN is controlled by an "ON/OFF" switch at FDP-S. The fan is designed to run continuously so this switch should normally be in the "ON" position. Fan "RUN" status indication is available at the MCC and FDP-S. A fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of this fan is shown in Figure 13-4.

The INFI 90 monitors the following fan parameters:

1. Fan "RUN" status;
2. Fan "LOSS OF FLOW" alarm condition.

The fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. The pushbutton is shown in Figure 13-2.

A pressure switch at the incoming air filter and a temperature switch at the air discharge duct will send "HIGH DIFFERENTIAL PRESSURE" and "HIGH DISCHARGE AIR TEMPERATURE" alarm signals to the INFI 90. Locations of these devices are provided in Figure 13-2.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 13-1. Equipment/Instrument Summary Table 13-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 13-5.

13.4 ROUTINE CHECKS

1. Air Compressors

Observe any excessive noise or vibration;

TABLE 13-1

INSTRUMENT AIR SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S535-AC	5-T					5-T
S536-AC	5-T					5-T
S537-FN	5-T					5-T
S546-PI	5-T		5-T			5-T

TABLE 13-2

INSTRUMENT AIR SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S535-HS1	COMP. #1 CONTROL (LOS)	S				
S536-HS2	COMP. CONTROL (MECH. ALTERNATOR)		C			
S535-MM	COMP. #1 STATUS - RUN			I	I	
S535-QF	COMP. #1 FAILURE		Q	Q	Q	
S536-HS1	COMP. #2 CONTROL (LOS)	S				
S536-HS2	COMP. CONTROL (MECH. ALTERNATOR)		C			
S536-MM	COMP. #2 STATUS - RUN			I	I	
S536-QF	COMP. #2 FAILURE		Q	Q	Q	
S537-HS1	FAN CONTROL (LOS)	S				
S537-HS2	FAN CONTROL (ON/OFF)			C		
S537-MM	FAN STATUS - RUN	*I		I	I	*AT MCC
S537-QF	FAN FAILURE			Q	Q	
S537-PAH	SUPPLY AIR PRESS. HIGH				A	
S537-TAH	SUPPLY AIR TEMP. HIGH				A	
S546-PI	INST. AIR PRESS. INDICATION	I			I	0 to 1000 kPa
S546-PAL	INST. AIR LOW PRESSURE				A	< 550 kPa

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 13-5

Check the system to ensure the pressure reducing valves are working correctly; The air receiver blow-out valve should be opened regularly to drain moisture.

2. Air Dryer

Periodically blow any lint and dirt off the condenser section. Failure to keep the condenser clean will result in reduced dryer efficiency and may cause a complete refrigerant compressor breakdown;

Manually blow down the trap mechanism once a month to prevent a build-up of sludge in the drain area.

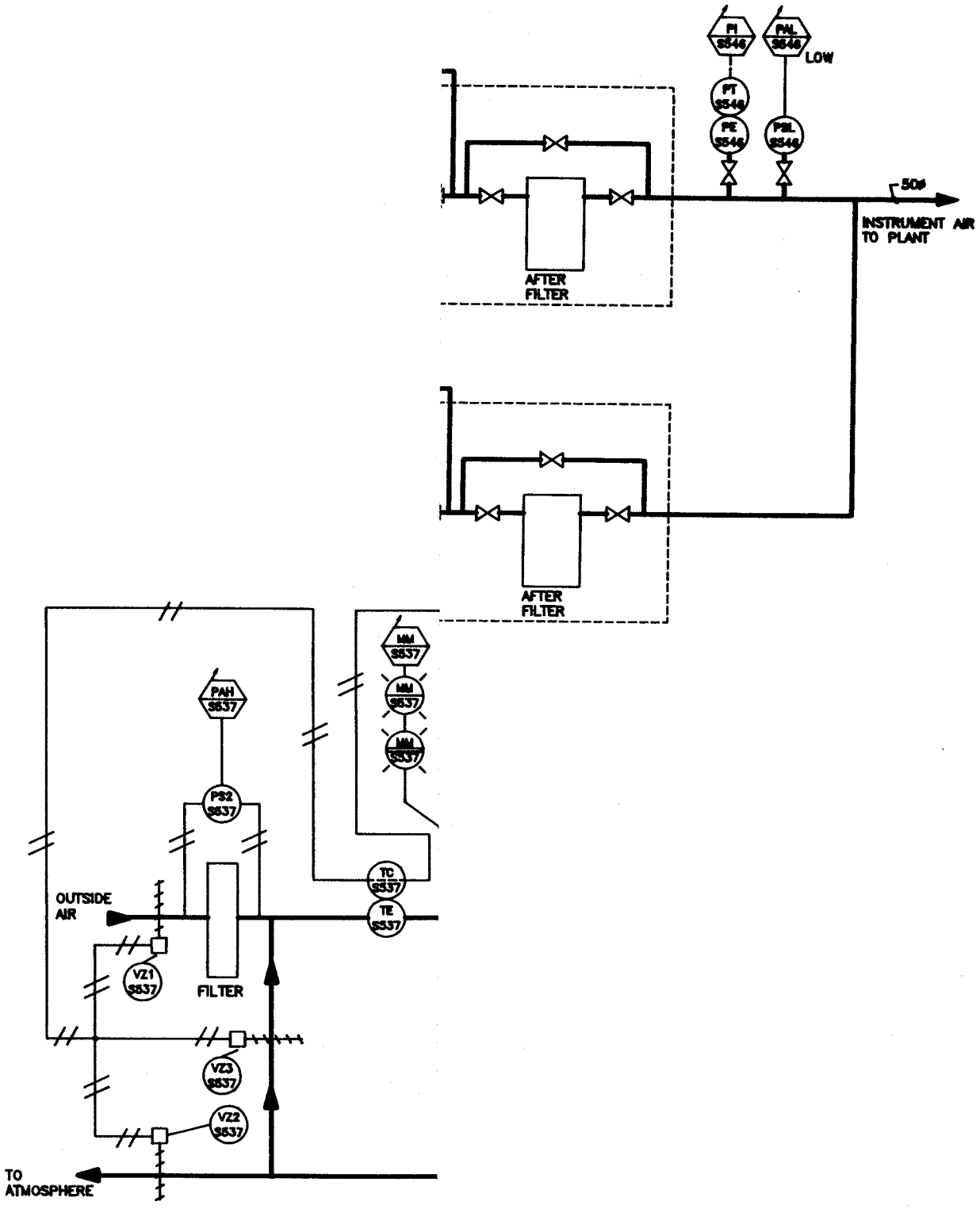
13.5 EQUIPMENT DATA

1. **<u>Air Compressors:</u> S535-AC and S536-AC**

Location:	Compressor Room
Purpose:	Provide pressurized compressed air to instrument air header
Manufacturer:	Atlas Copco ZT 245
	108 L/S @ 8.6 bar
	45 kW (60HP), 575V, 3ph, 60Hz
	3600 rpm, 55.0 FLA

2. **<u>Air Supply Fan:</u> S537-FN**

Location:	Blower Room
Purpose:	Provide outside air to instrument air compressors S535-AC and S536-AC
Manufacturer:	Fan - Northern Blower
	Motor - 2.2 kW (3Hp), 575V, 3ph, 60Hz
	1750 rpm, 2.9 FLA



INSTRUMENT AIR SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 13–5

3. **Pressure Sensor/Transmitter: S546-PE/PIT**

Location:	Blower Room
Purpose:	Monitor pressure of instrument air header
Manufacturer:	Fischer & Porter
	Range - 0 to 1000 kPa
	Input - 24 VDC; Output - 4 to 20 mADC

14.0 SUMP DRAINAGE SYSTEM

14.1 PURPOSE

The sump drainage system is designed to collect and dispose of underslab drainage, rainwater, and all excess floor runoff produced by process equipment, general clean-up, leaks, and all plumbing fixtures.

14.2 SYSTEM DESCRIPTION

A grid of weeping tile located at the bottom slab level of the tanks and galleries collects the underslab drainage water and conveys it to one of six sumps in the basement area. Floor runoff etc. is also conveyed to the sumps via the floor drainage system. One sump contains a single submersible pump while the other five posses a pair of pumps working alternately to pump the discharge into a clarifier tank or back into the mixed liquor channel.

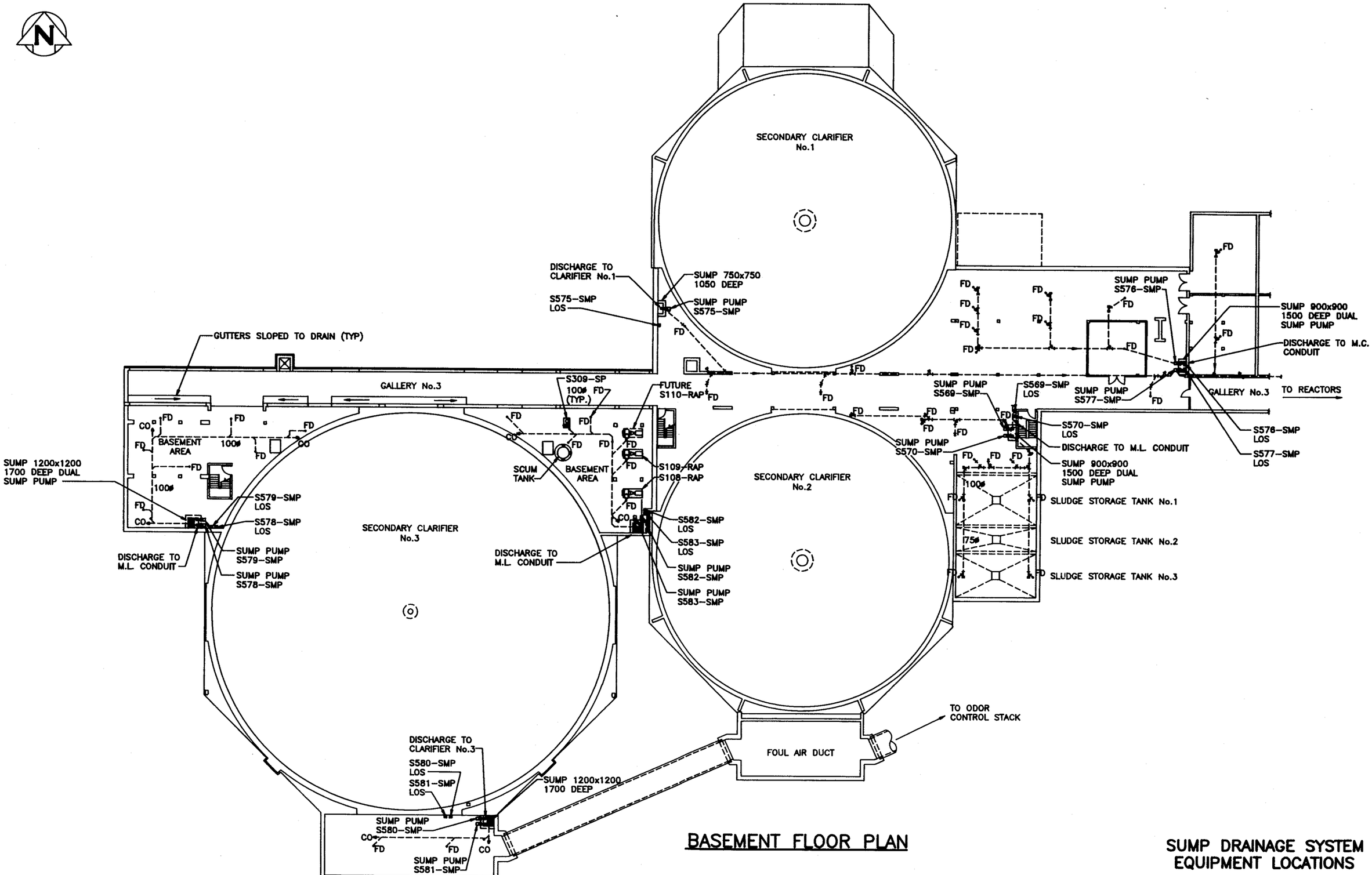
A summary of the equipment described in this section is as follows:

1. Five duplex arrangement sump pump pairs: S569/S570-SMP, S576-S577-SMP, S578/S579-SMP, S580/S581-SMP, & S582/S583-SMP;
2. One single sump pump: S575-SMP.

Equipment locations and drainage layouts are found on the basement floor plan shown on Figure 14-1. Figure 14-2 provides a detailed layout and sectional view of a typical duplex pump arrangement.

14.3 MONITORING AND CONTROL

An operator has no direct control over any of the pumps in this system. The pumps are controlled by a level controller located in each sump. It brings a pump on over a specific level range. In the case of the duplex pump arrangements, each pump is brought on



BASEMENT FLOOR PLAN

SUMP DRAINAGE SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 14-1

TABLE 14-1

SUMP DRAINAGE SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S569-LA	5-U					5-U
S575-LA	5-U					5-U
S576-LA	5-U					5-U
S578-LA	5-U					5-U
S580-LA	5-U					5-U
S582-LA	5-U					5-U

alternately on a call for sump pumping. Pump "RUN" status indication is available at the MCC. Should the sump level exceed a setpoint, a high level alarm condition is displayed at FDP-S and reported to the INFI 90.

The section of FDP-S showing the six high sump level alarms is provided in Figure 14-3.

Each of the eleven pumps can be shut down and locked-out using the "LOS" pushbutton field located near each unit. These pushbuttons are shown in Figure 14-1.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 14-1. Equipment/Instrument Summary Table 14-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 14-4.

14.4 ROUTINE CHECKS

Check that pumps are operating normally free of excessive noise, vibration, or high motor temperature;

On a regulator basis, manually raise the level floats in the sumps to attempt an automatic start of the pumps.

14.5 EQUIPMENT DATA

1. **Sump Pump: S575-SMP**

Location:	Basement Area near clarifier No. 1
Purpose:	Discharge sump drainage into clarifier No. 1
Manufacturer:	Baldor
	0.56 kW (0.75hp), 575V, 3ph, 60Hz
	1725 rpm, 1.2 FLA

TABLE 14-2

SUMP DRAINAGE SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S569-HS	PUMP CONTROL (LOS)	S				
S570-HS	PUMP CONTROL (LOS)	S				
S569-LC	PUMP MECH. ALTERNATOR	C				
S569-MM	PUMP STATUS - RUN		I			
S570-MM	PUMP STATUS - RUN		I			
S569-LA	SUMP HIGH LEVEL			A	A	
S575-HS	PUMP CONTROL (LOS)	S				
S575-LC	PUMP CONTROL (START)	C				
S575-MM	PUMP STATUS - RUN		I			
S575-LA	SUMP HIGH LEVEL			A	A	
)76-HS	PUMP CONTROL (LOS)	S				
S577-HS	PUMP CONTROL (LOS)	S				
S576-LC	PUMP MECH. ALTERNATOR	C				
S576-MM	PUMP STATUS - RUN		I			
S577-MM	PUMP STATUS - RUN		I			
S576-LA	SUMP HIGH LEVEL			A	A	
S578-HS	PUMP CONTROL (LOS)	S				
S579-HS	PUMP CONTROL (LOS)	S				
S578-LC	PUMP MECH. ALTERNATOR	C				
S578-MM	PUMP STATUS - RUN		I			
S579-MM	PUMP STATUS - RUN		I			
S578-LA	SUMP HIGH LEVEL			A	A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 14-4

(Continued)

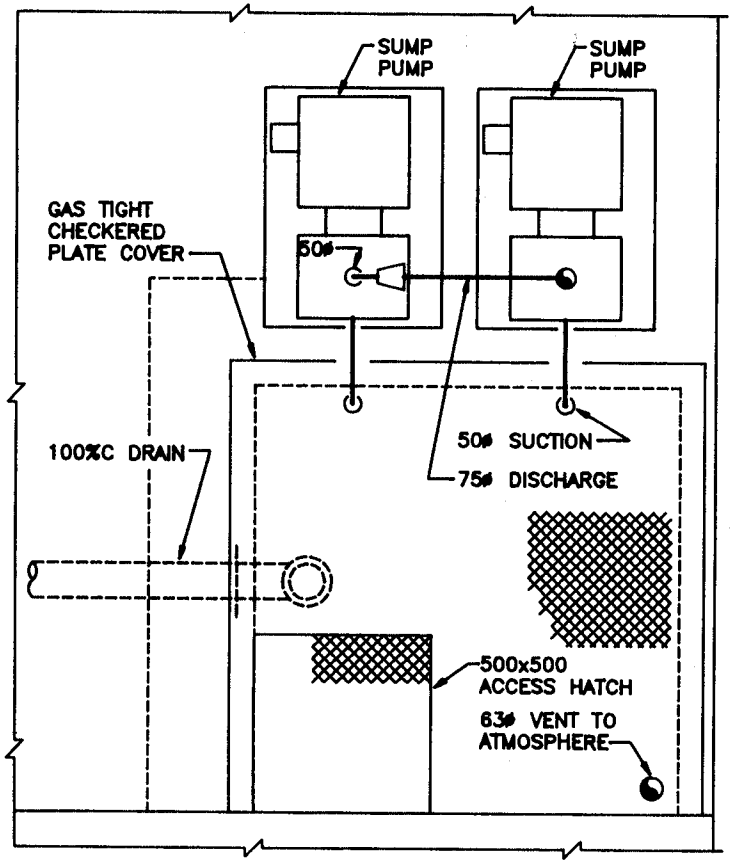
TABLE 14-2 (Continued)

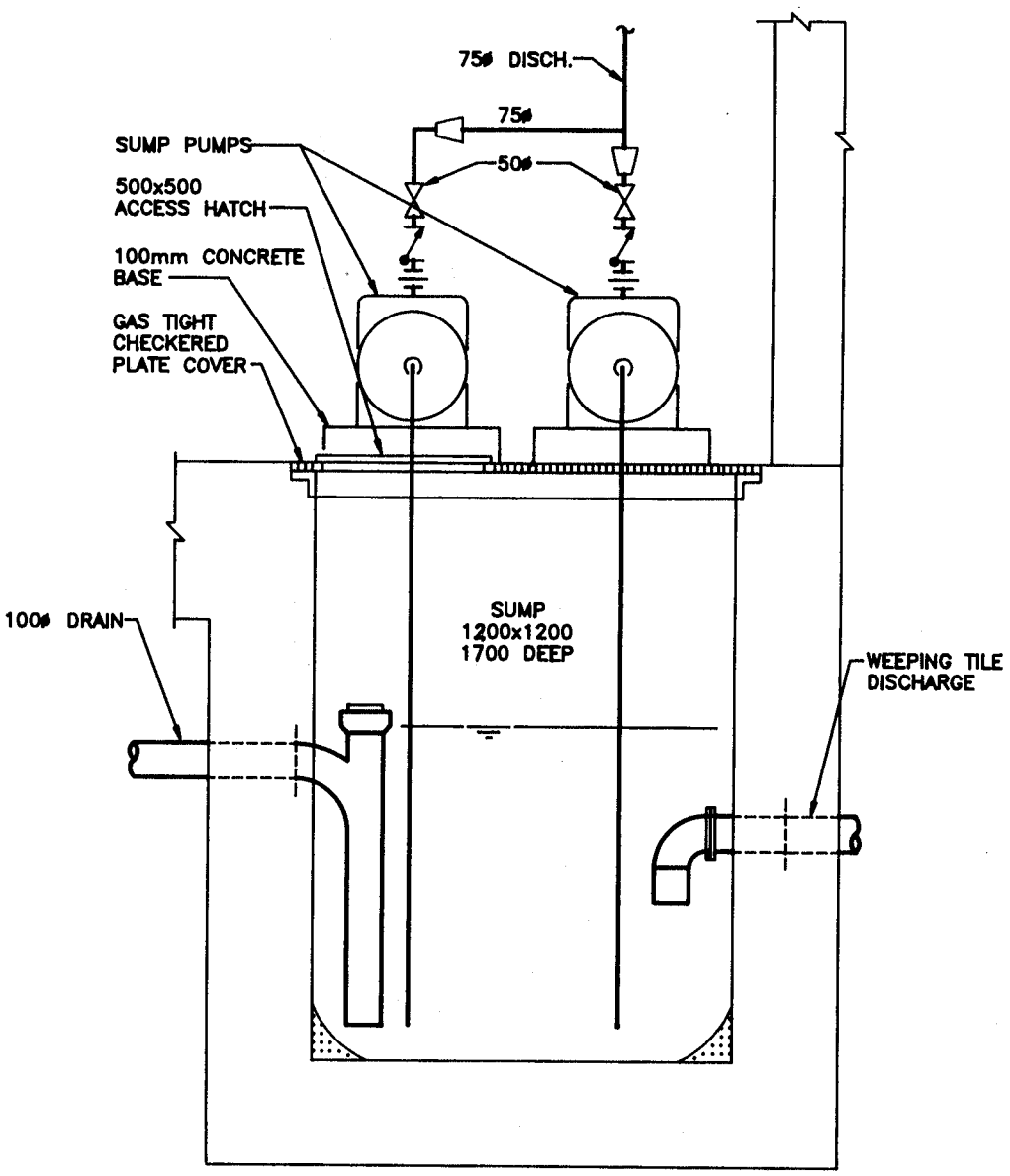
SUMP DRAINAGE SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S580-HS	PUMP CONTROL (LOS)	S				
S581-HS	PUMP CONTROL (LOS)	S				
S580-LC	PUMP MECH. ALTERNATOR	C				
S580-MM	PUMP STATUS - RUN		I			
S581-MM	PUMP STATUS - RUN		I			
S580-LA	SUMP HIGH LEVEL			A	A	
S582-HS	PUMP CONTROL (LOS)	S				
S583-HS	PUMP CONTROL (LOS)	S				
S582-LC	PUMP MECH. ALTERNATOR	C				
S582-MM	PUMP STATUS - RUN		I			
S583-MM	PUMP STATUS - RUN		I			
S582-LA	SUMP HIGH LEVEL			A	A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 14-4

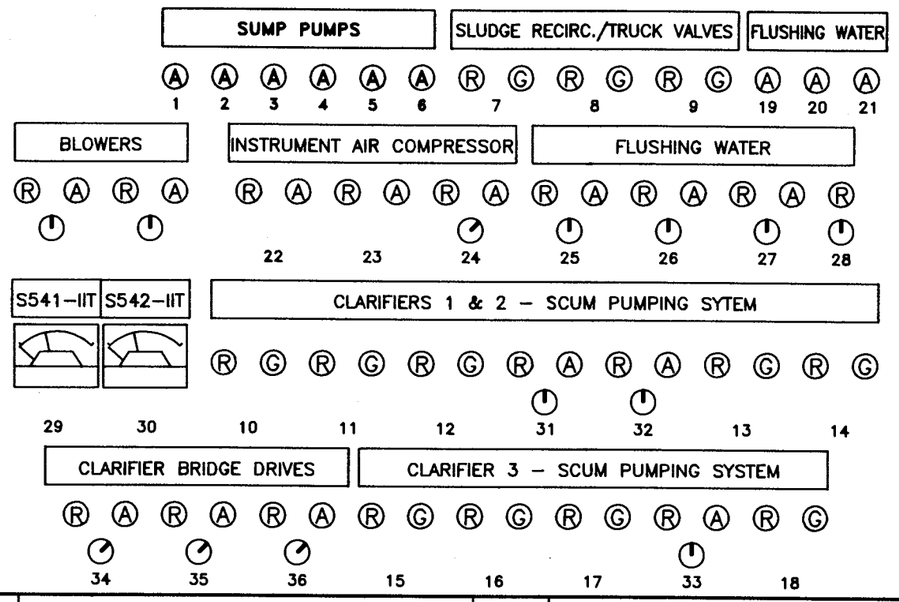


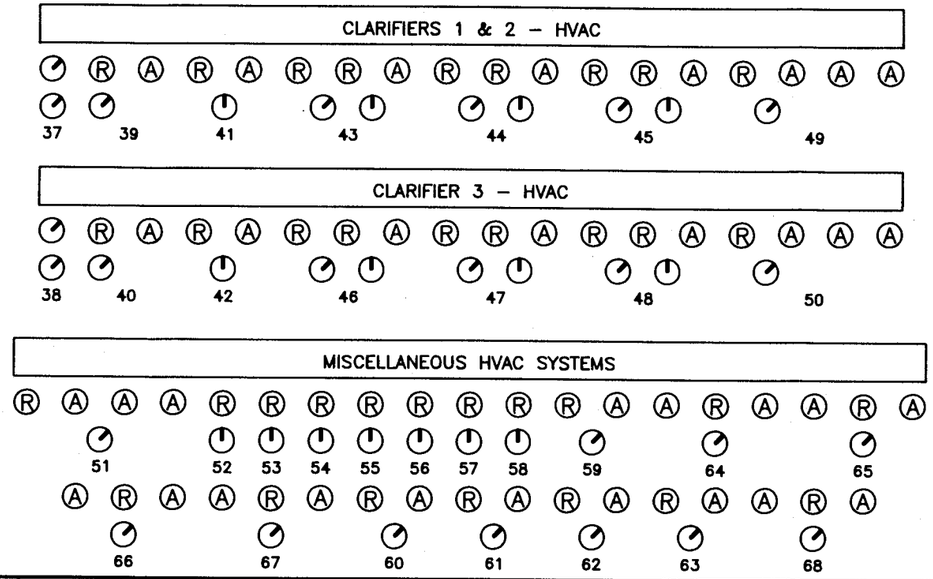


TYPICAL DUAL PUMP ARRANGEMENT

Date : January 1994
Figure 14-2

FDP–S





LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	Ⓡ Ⓖ A – OPEN, B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C ⊘ – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	Ⓡ Ⓐ A – RUN, B – PUMP FAIL, C ① – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	Ⓡ – A RUN, B ① – B COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	Ⓡ Ⓐ A – RUN, B – FAIL, C ① – COMP/OFF/HAND, D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

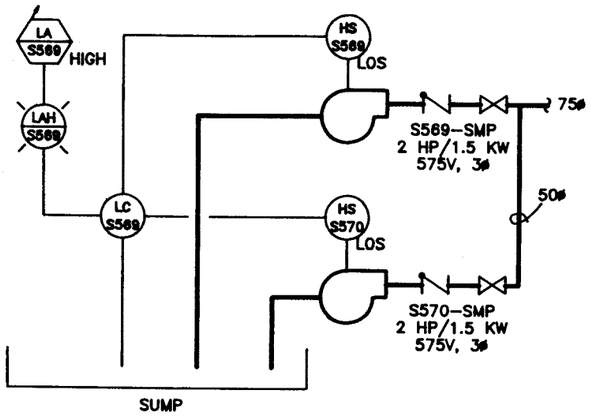
No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – LOSS OF SEAL WATER, C ① – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	Ⓡ Ⓐ A – RUN, B – HIGH TORQUE FAIL, C ⊘ – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A ⊘ – A COMP/HAND, B ⊘ – B SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C ⊘ – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C ① – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW, D ⊘ Ⓔ E – SLOW/FAST, E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	Ⓡ Ⓐ Ⓐ Ⓐ E ⊘ – A RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A Ⓡ – A RUN, B ① – B COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C ⊘ – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

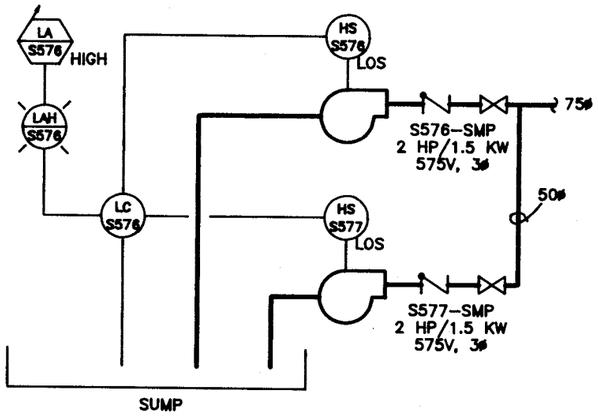
No.	DESCRIPTION
	Ⓐ Ⓡ Ⓐ D ⊘ – A LOSS OF FLOW, B RUN, C LOW TEMP, D OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

SUMP DRAINAGE SYSTEM
FIELD DEVICE PANEL FDP–S

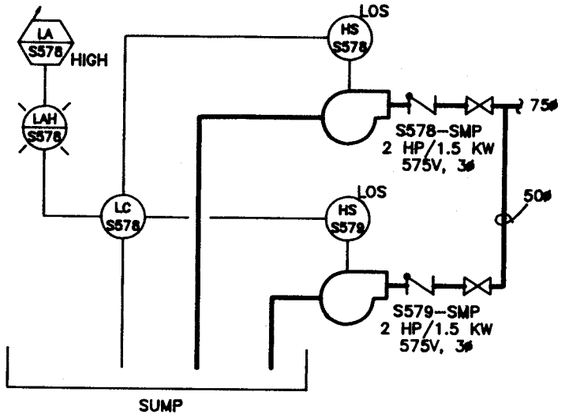
Date : January 1994
Figure 14–3



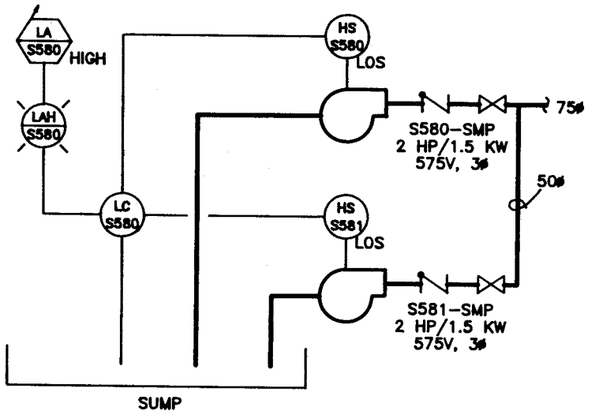
SUMP PUMPS S569-SMP & S570-SMP



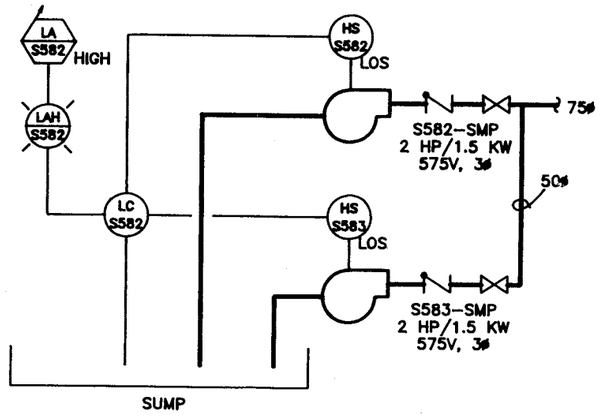
SUMP PUMPS S576-SMP & S577-SMP



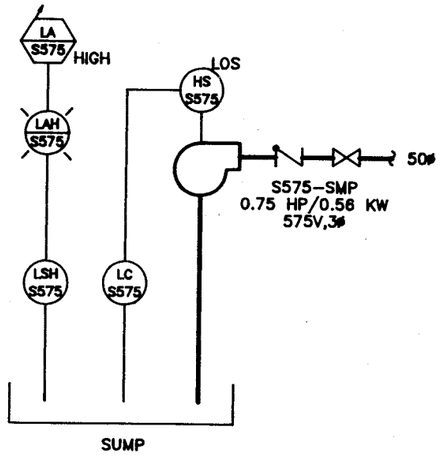
SUMP PUMPS S578-SMP & S579-SMP



SUMP PUMPS S580-SMP & S581-SMP



SUMP PUMPS S582-SMP & S583-SMP



SUMP PUMP S575-SMP

SUMP DRAINAGE SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 14-4

2. **Sump Pumps: S569/S570/S578/S579/S582/S583-SMP**

Location:	Basement Area, various locations
Purpose:	Discharge sump drainage into mixed liquor channel
Manufacturer:	Brook Crompton Canada Inc.
	1.5 kW (2.0hp), 575V, 3ph, 60Hz
	1710 rpm, 2.6 FLA

3. **Sump Pumps: S576/S577-SMP**

Location:	Secondary Pump Room
Purpose:	Discharge sump drainage into mixed liquor channel
Manufacturer:	Brook Electric Motors of Canada Ltd.
	1.5 kW (2.0hp), 575V, 3ph, 60Hz
	1720 rpm, 2.37 FLA

15.0 SAMPLING SYSTEM

15.1 PURPOSE

The sampling system is designed to draw effluent samples from the clarifier tank's effluent discharge and the effluent channel to be processed and analyzed by laboratory personnel.

15.2 SYSTEM DESCRIPTION

Four sampling stations are located at each of the three clarifier effluent conduits and the effluent channel. A small pump circulates effluent through a separate line from which a sample is drawn. The sampler isolates a sample from the stream and stores it in a refrigerated container until it is retrieved by laboratory personnel.

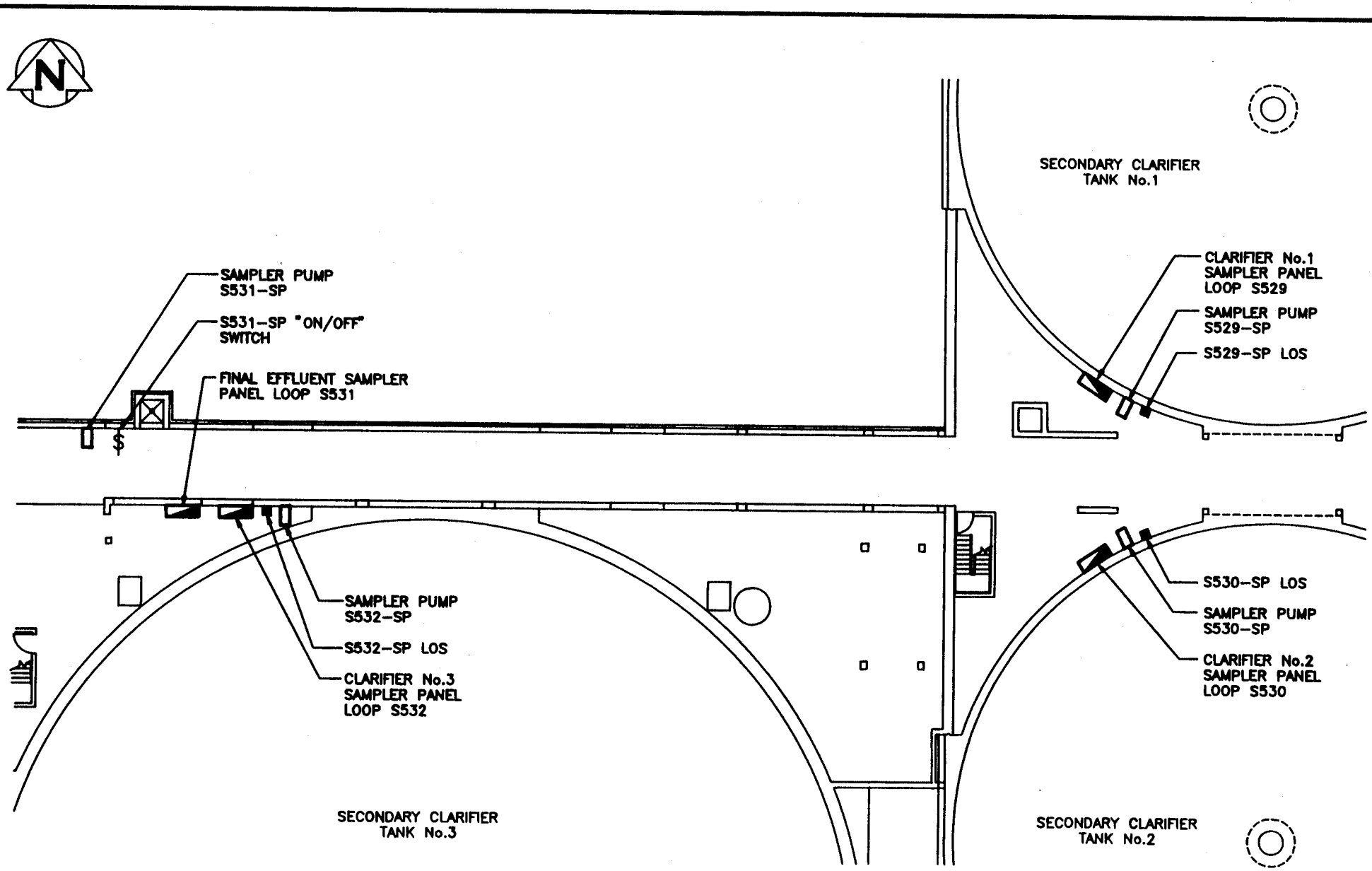
Each of the sampling stations consists of the following items:

1. Sampler controller;
2. "Bristol" plunger type sampler;
3. Refrigerator;
4. Sample container;
5. Automatic moisture drain air line to duckbill sampler;
6. Sample line from the "Bristol" sampler.

A summary of the equipment described in this section is as follows:

1. Clarifier No. 1 Sampling station and pump: S529-SAM & S529-SP;
2. Clarifier No. 2 Sampling station and pump: S530-SAM & S530-SP;
3. Clarifier No. 3 Sampling station and pump: S532-SAM & S532-SP;
4. Final Effluent Sampling station and pump: S531-SAM & S531-SP.

Equipment locations are found on the basement floor plan shown in Figure 15-1.



NOTE

FOR TYPICAL SAMPLER PANEL
LAYOUT SEE FIGURE 15-2

BASEMENT FLOOR PLAN

SAMPLING SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 15-1

15.3 MONITORING AND CONTROL

15.3.1 Process Equipment

Each of the samplers is controlled from a "HAND/OFF/AUTO" switch located at a control panel near the sampler. The "HAND" and "OFF" positions allow for manual control at the panel while the "AUTO" position puts the sampler under automatic control. A second control switch, "INT/EXT", and an "EJECT" pushbutton are used for manual control. Sampler "OPERATING" status indication is available at the panel.

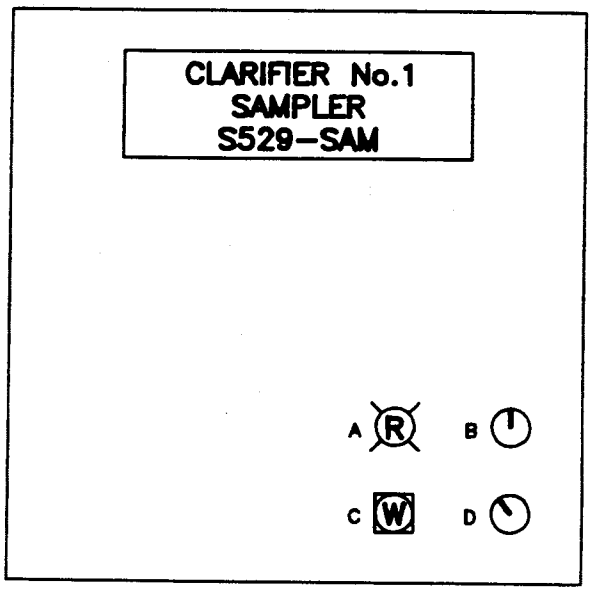
The locations of the four panels are shown in Figure 15-1 while a typical layout is provided in Figure 15-2.

The INFI 90 monitors the following sampler parameters:

1. Sampler "HAND/OFF/AUTO" control switch status;
2. Sampler "OPERATING" status;
3. Sampler "FAILURE" alarm condition.

Each of the circulating pumps is designed to run continuously. However, each clarifier sampler pump can be shut down and locked-out using the "LOS" pushbutton field located near each unit. "RUN" status indication for these three pumps is available at the MCC. The final effluent sampler pump, S531-SP, is controlled from an "ON/OFF" switch field located near the unit. The four pumps and their respective pushbutton/switch are located on Figure 15-1.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 15-1. Equipment/Instrument Summary Table 15-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 15-3.



A – SAMPLER OPERATING
B – HAND/OFF/AUTO
C – EJECT
D – INT/COMPUTER

TYPICAL FOR SAMPLERS S530, S531 & S532

LEGEND

- (R) – RED PILOT LIGHT
- [W] – WHITE PUSHBUTTON
- ⏲ – 3 POSITION SEL. SWITCH
- ⏲ – 2 POSITION SEL. SWITCH

SAMPLER PANEL TYPICAL LAYOUT

Date : January 1994
Figure 15–2

TABLE 15-1

SAMPLING SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S529-SAM	5-L	2S, 6S			5-L	5-L
S530-SAM	5-L	3S, 7S			5-L	5-L
S531-SAM	5-L	4S, 5S			5-L	5-L
S532-SAM	5-L	1S, 8S			5-L	5-L

TABLE 15-2

SAMPLING SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S529-HS1	SAMPLER CONTROL (HAND/OFF/AUTO)		C		I	
S529-HS2	SAMPLER CONTROL (INT/COMP)		C			
S529-HS3	SAMPLER CONTROL (EJECT)		C			
S529-AN	SAMPLER CONTROL (INITIATE)				C	
S529-AM	SAMPLER STATUS - OPERATING		I		I	
S529-AF	SAMPLER FAILURE				A	
S529-HS4	SAMPLE PUMP CONTROL (LOS)	S				
S530-HS1	SAMPLER CONTROL (HAND/OFF/AUTO)		C		I	
S530-HS2	SAMPLER CONTROL (INT/COMP)		C			
S530-HS3	SAMPLER CONTROL (EJECT)		C			
30-AN	SAMPLER CONTROL (INITIATE)				C	
S530-AM	SAMPLER STATUS - OPERATING		I		I	
S530-AF	SAMPLER FAILURE				A	
S530-HS4	SAMPLE PUMP CONTROL (LOS)	S				
S531-HS1	SAMPLER CONTROL (HAND/OFF/AUTO)		C		I	
S531-HS2	SAMPLER CONTROL (INT/COMP)		C			
S531-HS3	SAMPLER CONTROL (EJECT)		C			
S531-AN	SAMPLER CONTROL (INITIATE)				C	
S531-AM	SAMPLER STATUS - OPERATING		I		I	
S531-AF	SAMPLER FAILURE				A	
S531-HS4	SAMPLE PUMP CONTROL (ON/OFF)	S				
S532-HS1	SAMPLER CONTROL (HAND/OFF/AUTO)		C		I	
S532-HS2	SAMPLER CONTROL (INT/COMP)		C			
S532-HS3	SAMPLER CONTROL (EJECT)		C			
S532-AN	SAMPLER CONTROL (INITIATE)				C	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 15-3

(continued)

TABLE 15-2 (continued)

SAMPLING SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S532-AM	SAMPLER STATUS - OPERATING		I		I	
S532-AF	SAMPLER FAILURE				A	
S532-HS4	SAMPLE PUMP CONTROL (LOS)	S				

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 15-3

15.3.2 Local Panel Control

In this mode, an operator has total control of the sampling operation from the local panel as per the following sequence of operation:

1. Set the "HAND/OFF/AUTO" switch to "HAND";
2. Sampler plunger extends;
3. Automatic spring returns switch to "OFF" position;
4. Sampler plunger retracts;
5. "EJECT" pushbutton is pressed and held. Eject air is now on;
6. "EJECT" pushbutton is released and eject air is off.

The "HAND" switch position functions in the internal and external modes whereas the "EJECT" pushbutton is disabled in the "AUTO" mode.

At the completion of this cycle a sample has been withdrawn from the line and deposited in a refrigerated two litre container.

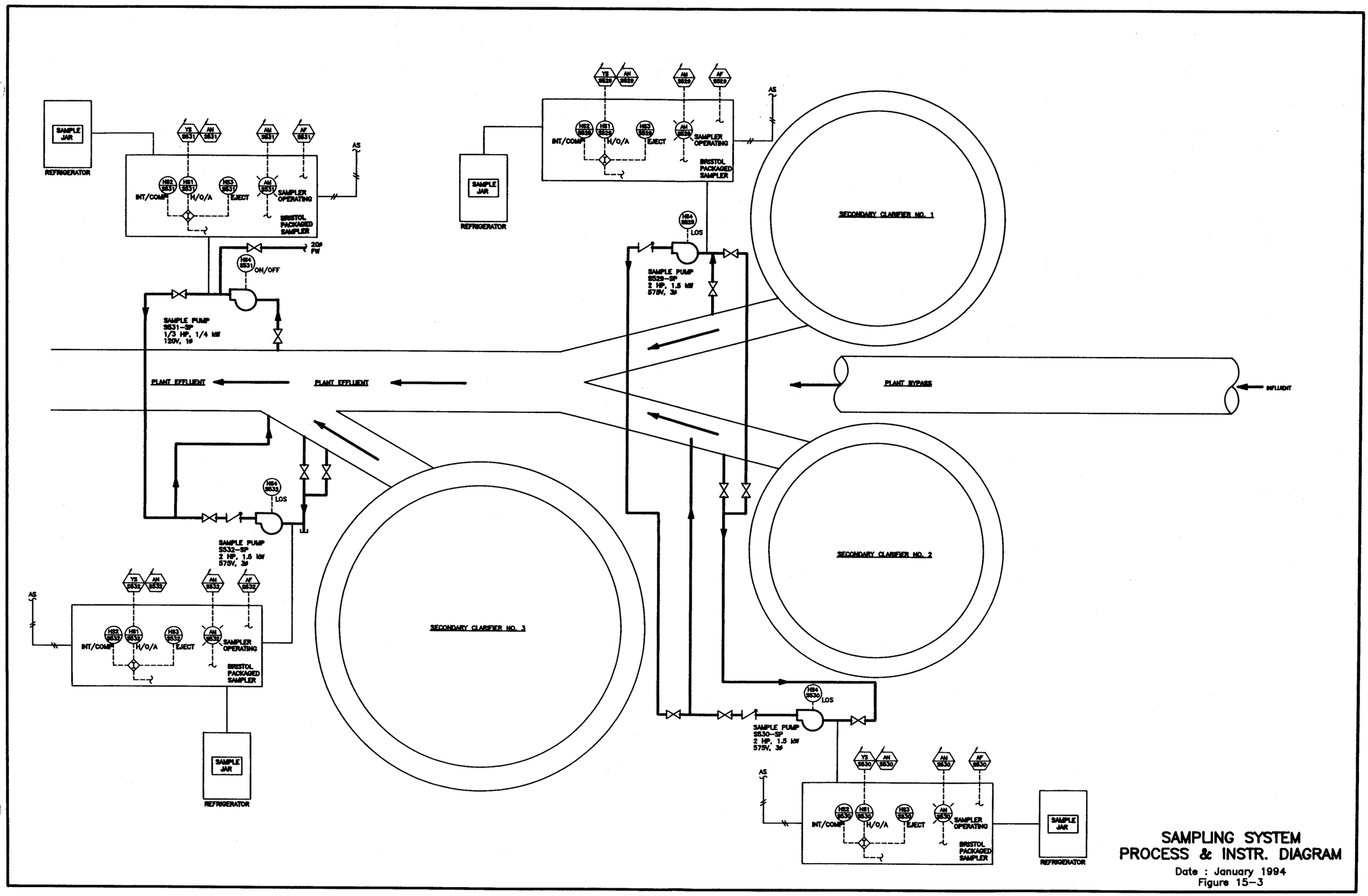
15.3.3 Automatic Control

15.3.3.1 Internal

In this mode, the local panel controls all the sampling operations internally as per the following sequence of operation:

1. Set "HAND/OFF/AUTO" switch to the "AUTO" position;
2. Set "INT/EXT" switch to the "INT" position;
3. Sampler plunger extends, times out internally, and then retracts;
4. Eject air starts, times out internally, and then stops.

At the completion of this cycle a sample has been withdrawn from the line and deposited in a refrigerated two litre container.



SAMPLING SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 15–3

15.3.3.2 External

In this mode, a remote signal from the INFI 90 initiates a sampling operation. The subsequent steps are similar to those for the automatic internal mode as per the following sequence of operation:

1. Set "HAND/OFF/AUTO" switch to the "AUTO" position;
2. Set "INT/EXT" switch to the "EXT" position;
3. Remote contact closes to start sampling operation;
4. Sampler plunger extends, times out internally, and then retracts;
5. Eject air starts, times out internally, and then stops.

At the completion of this cycle a sample has been withdrawn from the line and deposited in a refrigerated two litre container.

15.3.4 Workstation Control

To assist in understanding the following control descriptions, refer to the specific graphic displays noted here and summarized in Bridging Table 15-1.

Automatic sampling will start based on totalized secondary effluent flow. Effluent flow for individual clarifiers is calculated as follows:

SE flow = Mixed Liquor Flow (see Section 2.0) - RAS flow (see Section 5.0).

Operating Procedures - Graphic 5L:

1. Verify that all samplers are in "AUTO";
2. Press 1S "SE Flow Sampler S532" and verify that it is in "auto";
3. Press 2S "SE Flow Sampler Clarifier #1, S529" and verify that it is in "auto";
4. Press 3S "SE Flow Sampler Clarifier #2, S530" and verify that it is in "auto";
5. Press 4S "SE Flow Sampler Clarifier #3, S531" and verify that it is in "auto";
6. Press 5S "Sampler S531 Flow Setpoint" and enter a value;

7. Press 6S "Sampler S529 Flow Setpoint" and enter a value;
8. Press 7S "Sampler S530 Flow Setpoint" and enter a value;
9. Press 8S "Sampler S532 Flow Setpoint" and enter a value;
10. Press 1M "Sampler Mode" and select "all". "all" = all samplers or "single" = individual samplers.

Automatic sampling will start based on totalized secondary effluent flow.

15.4 ROUTINE CHECKS

Periodically check samplers to ensure that "POWER ON" indication is showing and that no fault lights are on.

15.5 EQUIPMENT DATA

1. **Samplers: S529-SAM, S530-SAM, S531-SAM, & S532-SAM**

Location:	Basement Area near effluent conduits
Purpose:	Provide sampling of all clarifier effluent
Manufacturer:	BEC ISOLOK Sampler
	Model # 5AA-99-08-44

2. **Circulating Pumps: S529-SP & S530-SP**

Location:	Basement Area near respective samplers	
Purpose:	Circulate effluent through samplers	
Manufacturer:	Pump -	Monarch Pump
		Model B/E 33
	Motor -	Toshiba World Energy Series
		1.1 kW (1.5hp), 575V, 3ph, 60Hz
		3500 rpm, 1.9 FLA

3. **Circulating Pump: S531-SP**

Location:	Adjacent to sampler S531-SAM	
Purpose:	Circulate effluent to the sampler	
Manufacturer:	Pump -	Monarch Pump
		Model B/E 33
	Motor -	CGE AC Motor
		1/4 kW (1/3hp), 115V, 1ph, 60Hz
		3450 rpm, 7.7 FLA

4. **Circulating Pump: S532-SP**

Location:	Adjacent to sampler S532-SAM	
Purpose:	Circulate effluent to the sampler	
Manufacturer:	Pump -	Monarch Pump
		Model B/E 33
	Motor -	WEG Induction Motor
		.75 kW (1hp), 575V, 3ph, 60Hz
		3470 rpm, 1.3 FLA

16.0 HYDROGEN SULFIDE DETECTION SYSTEM

16.1 PURPOSE

The hydrogen sulfide (H_2S) detection system is designed to detect and produce an alarm should dangerous H_2S levels occur.

16.2 SYSTEM DESCRIPTION

Two H_2S detectors,one in the Truck Bay and the other in the Scrubber Room, monitor the H_2s levels in these specific areas.

A summary of the equipment described in this section is as follows:

1. Truck Bay Area H_2S sensor/analyzer: S535-AE/AIT;
2. Scrubber Room H_2S sensor/analyzer: No equipment number.

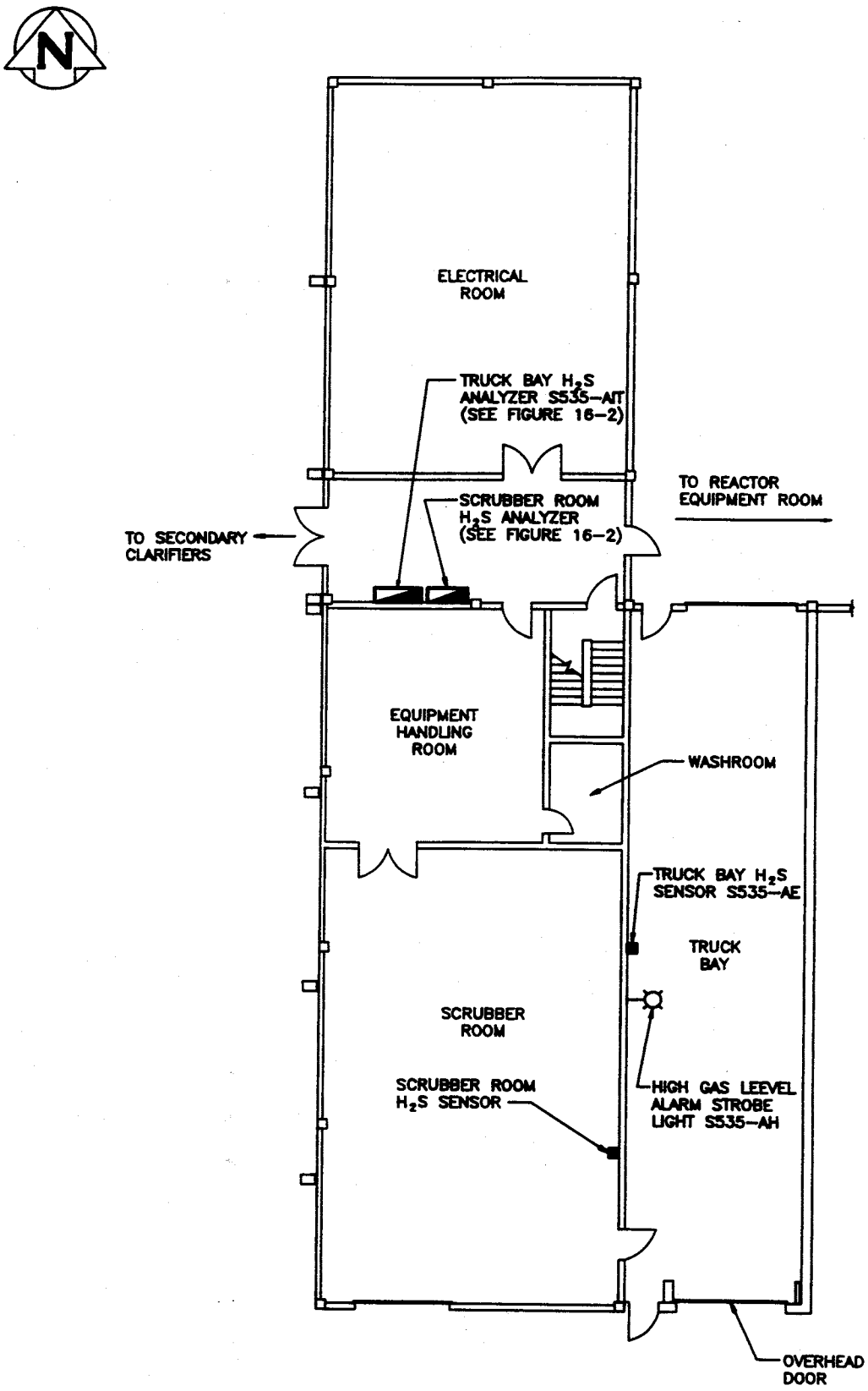
Equipment locations are found on the ground floor plan shown in Figure 16-1.

16.3 MONITORING AND CONTROL

Each of the sensors transmits a signal to an analyzer mounted on the wall in the corridor outside the Equipment Handling Room. At this panel an operator can monitor H_2S gas levels in parts per million (ppm), a "HIGH H_2S LEVEL" alarm condition, and an "ANALYZER FAILURE" alarm condition. All alarms are cleared using the "RESET" pushbutton.

The locations of the two panels are shown in Figure 16-1 and a typical detail provided in Figure 16-2.

The high level alarm is set at 10 ppm for both analyzers. This is the "Threshold Limit Value" for eight working hours. In addition to alarm indication at the analyzer and to the INFI 90 the Truck Bay analyzer will initiate a wall-mounted strobe light alarm in the Truck Bay. This alarm has automatic reset when the H_2S level drops below 10 ppm.



GROUND FLOOR PLAN

HYDROGEN SULFIDE DETECTION SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 16-1

Cross references between this equipment and the INFI 90 may be found in Bridging Table 16-1. Equipment/Instrument Summary Table 16-2 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 16-3.

16.4 SAFETY PROCEDURES

16.4.1 Hydrogen Sulfide

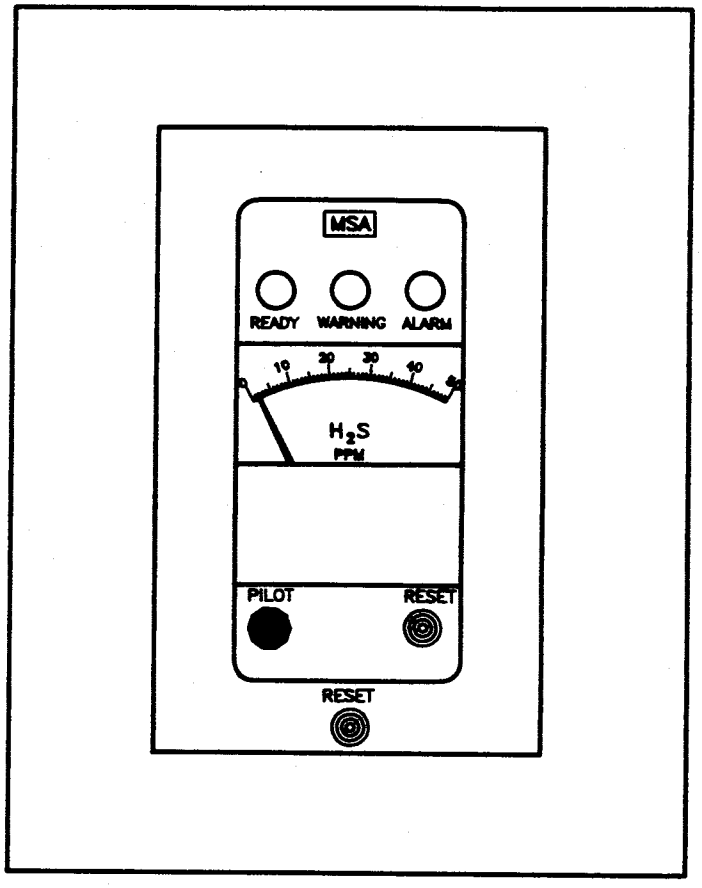
Hydrogen sulfide is a colorless gas having the odor of rotten eggs. It is commonly produced by the decomposition of sulphur-bearing organic material and is often found in sewers or sewage disposal plants. Even in low quantities the odor of hydrogen sulfide is easily detected, but this is only true when it is first encountered. It is not a reliable warning signal because sensitivity to this odor disappears rapidly with the breathing of a small quantity of the gas.

16.4.2 Toxicity

The toxic action resulting from exposure to hydrogen sulfide is usually acute. The usual symptom is unconsciousness within a few seconds coming on without pain or warning. As a rule, unconsciousness is followed immediately by cessation of breathing. The gas is readily absorbed into the blood stream resulting in systemic poisoning along with paralysis of the respiratory centre of the brain. Death results from asphyxiation. A worker, upon inhaling a large dose of the gas, falls as if struck by a blow and dies almost instantaneously.

16.4.3 Fire and Explosive Hazards

Hydrogen sulfide burns very readily with a blue flame and produces sulfur dioxide, a very irritating gas. It forms explosive mixtures with air.



TYPICAL H_2S ANALYZER
PANEL LAYOUT

Date : January 1994
Figure 16–2

TABLE 16-1

HYDROGEN SULFIDE DETECTION SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S535-AE	5-O		5-O			5-O

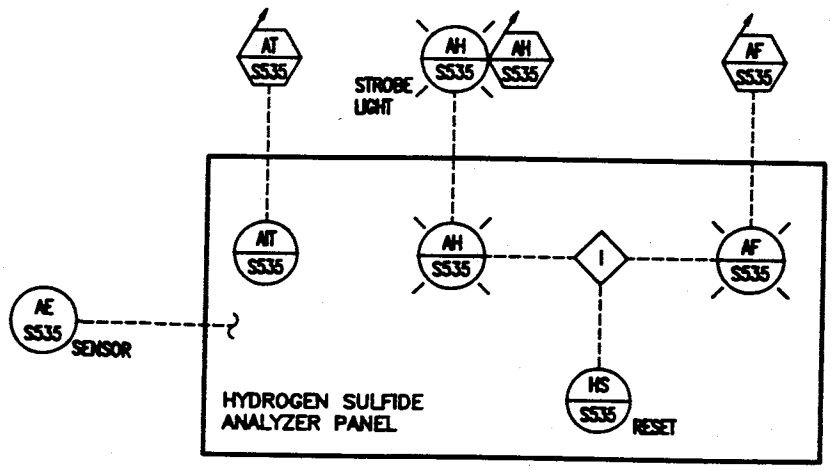
TABLE 16-2

HYDROGEN SULFIDE DETECTION SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

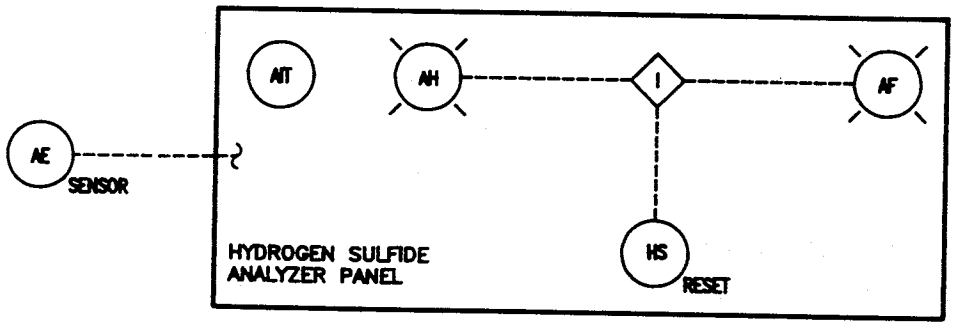
INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S535-AI	TRUCK BAY H_2S LEVEL		I		I	0 to 50 ppm
S535-AH	TRUCK BAY H_2S LEVEL HIGH	A	A		A	> 10 ppm
S535-AF	TRUCK BAY ANALYZER FAILURE		A		A	
S535-HS	FAILURE RESET		R			
AI	SCRUBBER ROOM H_2S LEVEL		I			0 to 50 ppm
AH	SCRUBBER ROOM H_2S LEVEL HIGH		A			> 10 ppm
AF	SCRUBBER ROOM ANALYZER FAILURE		A			
HS	FAILURE RESET		R			

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 16-3



TRUCK BAY ANALYZER



SCRUBBER ROOM ANALYZER

HYDROGEN SULFIDE DETECTION SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 16-3

16.4.4 Symptoms of Poisoning

The distinct odor in gas concentrations from about 0.025 to 200 ppm will signify beyond any doubt that the area is poisoned and personnel should immediately leave the area. Other levels of exposure may cause the following symptoms - headache, dizziness, excitement, nausea, dryness and sensation of pain in nose, throat and chest.

16.4.5 First Air

Hydrogen sulfide acts so quickly on the lungs when breathing that there is no time to call a doctor before beginning to revive the victim. The following steps should be done:

1) Move the victim into fresh air;
2) If victim is unconscious, apply artificial respiration;
3) Keep patient warm;
4) Call doctor and ambulance.

16.4.6 Threshold Limit Value (TLV)

The generally accepted threshold value for an eight hour working period is 10 ppm. This is the setting of the alarm on the Hydrogen Sulfide Analyzer and Alarm.

16.5 EQUIPMENT DATA

1. **H_2S Analyzers:**

Location:	Corridor Area, Ground Floor
Purpose:	Monitor H_2S gas level in Truck Bay and Scrubber Room
Manufacturer:	Mine Safety Appliances Company
	MSA Model 5000 Gas Alarm
	Range: 0 to 50 ppm
	Input - 120VAC; Output - 4 to 20 mADC

17.0 SECURITY SYSTEM

17.1 PURPOSE

The security system is designed to monitor all outside doors (including the Control Room door) and all motion in the basement areas and galleries.

17.2 SYSTEM DESCRIPTION

There are ten door switches that monitor the seven outside doors to the Secondary Clarifier Area and three of the interior doors. In addition, there are five motion detectors located in the basement gallery areas, one of which monitors the operator workstation.

A summary of the equipment described in this section is as follows:

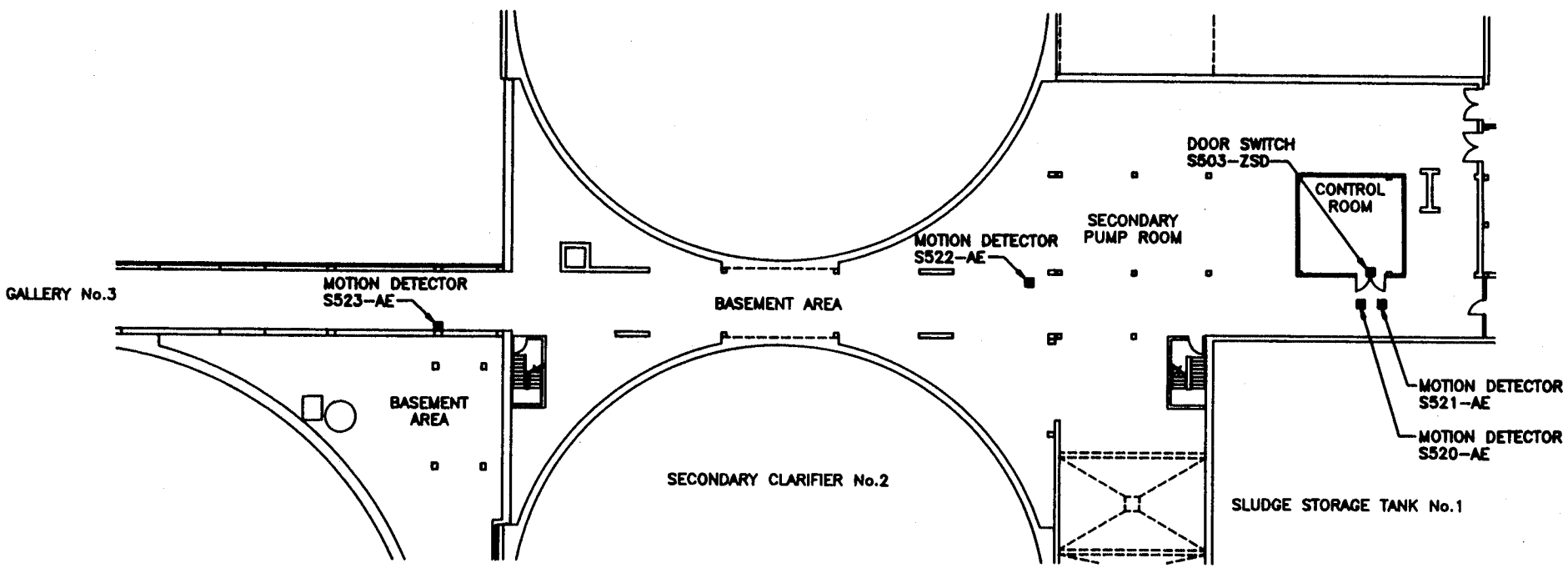
1.	Ten door switches:	S503/S504/S505/S506/S507/S508/S509/S510/S516/S517-ZSD;
2.	Five motion detectors:	S515/S520/S521/S522/S523-AE.

The locations of all these devices are found on the ground floor and basement floor plans shown in Figures 17-1 and 17-2.

17.3 MONITORING AND CONTROL

The INFI 90 monitors the status of all fifteen devices and initiates a security alarm when any of them are triggered while the system is enabled.

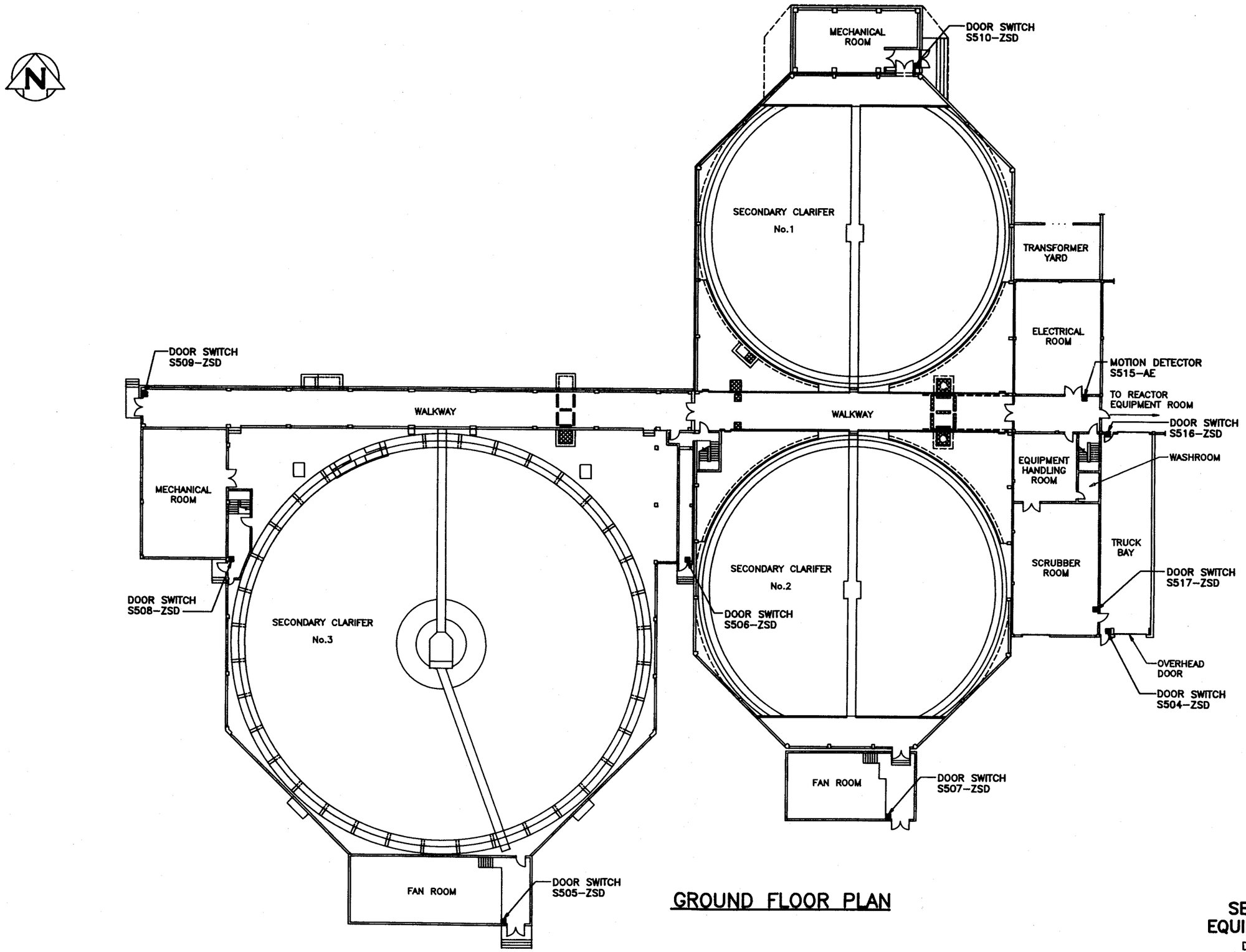
Cross references between the INFI 90 and this system may be found in Bridging Table 17-1. Equipment/Instrument Summary Table 17-2 provides a detailed summary of all alarm devices associated with this system. A listing of these alarms may be found in Utility Alarms Summary Table 1-4. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 17-3.



BASEMENT FLOOR PLAN

SECURITY SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 17-2



GROUND FLOOR PLAN

SECURITY SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 17–1

TABLE 17-1

SECURITY SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S503-XA	5-P, U					5-P, U
S504-XA	5-U					5-U
S505-XA	5-U					5-U
S506-XA	5-U					5-U
S507-XA	5-U					5-U
S508-XA	5-U					5-U
S509-XA	5-U					5-U
S510-XA	5-U					5-U
S516-XA	5-U					5-U
S517-XA	5-U					5-U
S515-XA	5-U					5-U
S520-XA	5-U					5-U
S521-XA	5-U					5-U
S522-XA	5-U					5-U
S523-XA	5-U					5-U

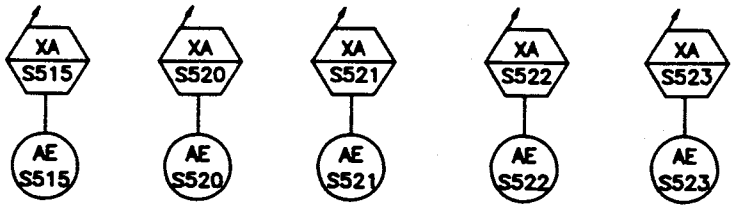
TABLE 17-2

SECURITY SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

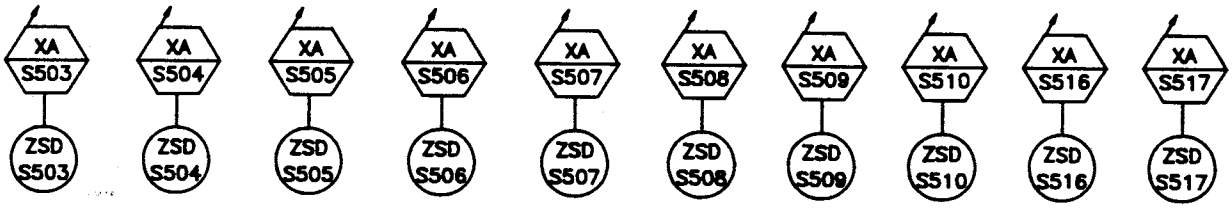
INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S503-ZSD	CONTROL ROOM DOOR OPEN				A	
S504-ZSD	SOUTH TRUCK BAY DOOR OPEN				A	
S505-ZSD	CLARIFIER NO. 3 SOUTH DOOR OPEN				A	
S506-ZSD	CLARIFIER NO. 2 WEST DOOR OPEN				A	
S507-ZSD	CLARIFIER NO. 2 SOUTH DOOR OPEN				A	
S508-ZSD	CLARIFIER NO. 3 SOUTHWEST DOOR OPEN				A	
S509-ZSD	CLARIFIER NO. 3 WEST DOOR OPEN				A	
S510-ZSD	CLARIFIER NO. 1 NORTHWEST DOOR OPEN				A	
S516-ZSD	NORTH TRUCK BAY DOOR OPEN				A	
S517-ZSD	TRUCK BAY/SCRUBBER ROOM DOOR OPEN				A	
S515-AE	LABORATORY AREA MOTION DETECTION				A	
S520-AE	SEC. PUMP RM WEST MOTION DETECTION				A	
S521-AE	SEC. PUMP RM EAST MOTION DETECTION				A	
S522-AE	CLAR. #1 & 2 BASEMENT MOTION DET.				A	
S523-AE	CLAR #3 BASEMENT MOTION DET.				A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 17-3



GALLERY MOTION DETECTORS



OUTSIDE DOOR MONITORING

SECURITY SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 17-3

Overview of Control - Graphic 5U:

Gallery motion detectors and outside door monitors are monitored during an Operator selected time period only (typically non-manned hours and weekends). During these periods, alarms will be transmitted to the McPhillips station.

17.4 EQUIPMENT DATA

1. **Door Switches: S503/S504/S505/S506/S507/S508/S509/S510/S516/S517-ZSD**

Location:	Frames of respective doors
Purpose:	Monitor door open/close status
Manufacturer:	Pass & Seymour
	Model 1200

2. **Motion Detectors: S515/S520/S521/S522/S523-AE**

Location:	Basement Area/Gallery No. 3
Purpose:	Monitor all motion in basement area
Manufacturer:	C & K Systems
	IR204/DT450TC

18.0 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM

18.1 PURPOSE

The heating, ventilating, and air conditioning (HVAC) system is designed to provide heating, ventilating, cooling, and/or odor control of the air in the Secondary Clarifier Area. The system prevents the build-up of noxious gases and provides controlled discharge of exhaust gases to the atmosphere.

18.2 SYSTEM DESCRIPTION

The complete HVAC system for the Secondary Clarifier Area is made up of four independent subsystems that satisfy specific heating, ventilating, cooling, and/or odor control needs for a certain area. These four areas are as follows:

1. Secondary Clarifiers No. 1 & 2 Building;
2. Secondary Clarifier No. 3 Building;
3. Miscellaneous Area "S":
   - i) Secondary Pump Room;
   - ii) Electrical Room;
   - iii) Scrubber Room;
   - iv) Truck Bay Area.
4. Control Room.

Three additional subsystems operate to supply hot and chilled water to and extract excess heat from the heating and cooling coils contained in the systems listed above.

Thirty one fans, air handling units, condensors, and pumps are utilized in the seven subsystems that make up the HVAC system. A summarized listing of the equipment number, capacity, and purpose of each device can be found in HVAC System Fan and Pump Summary Table 18-1.

TABLE 18-1

HVAC SYSTEM FAN AND PUMP SUMMARY

UNIT	CAPACITY (L/S)	PURPOSE
S601-AHU	10,430/15,785	Provide heating and venting to Secondary Clarifiers No. 1 & 2 Building Area
S689-AHU	5,275	Provide heating and venting to Gallery No. 3 and Basement Area
S604-EF	2,000	Provide for exhausting of Gallery No. 3 and Basement Area
S605-EF	17,000	Provide for exhausting of Secondary Clarifiers No. 1 & 2 Building Area
S606-EF S607-EF S608-EF	10,070/15,235	
S614-AHU	14,550/21,700	Provide Heating and venting to Secondary Clarifier No. 3 Building Area
S617-EF	2,530	Provide for exhausting of Gallery No. 3 and Basement Area
S618-EF	17,000	Provide for exhausting of Secondary Clarifier No. 3 Building Area
S619-EF S620-EF S621-EF	12,275/18,575	
S683-AHU	760	Provide heating, cooling, and venting to Electrical Room
S684-AHU	1,100	Provide heating and venting to Scrubber Room and Truck Bay Area
S685-AHU	4,325	Provide heating, cooling, and venting to Secondary Pump Room
S686-EF	2,020	Provide for exhausting of Secondary Pump Room

(Continued)

TABLE 18-1 (Continued)

HVAC SYSTEM FAN AND PUMP SUMMARY

UNIT	CAPACITY (L/S)	PURPOSE
S687-EF	1100	Provide for exhausting of Truck Bay Area
S691-EF	1200	Provide for exhausting of Scrubber Room
S690-AHU	950	Provide pressurized and recirculated air for heating, cooling and venting to Control Room
S690-CU	-	Provide cooling freon to cooling coil S690-CC
S671-HWP S672-HWP	9.0 9.0	Provide hot circulating water to heating coils of air handling units S684-AHU, S685-AHU, and S689-AHU in addition to Unit Heaters S694-UH, S695-UH, S696-UH, S697-UH, S698-UH and S699-UH.
S667-CWP S668-CWP	4.9 4.9	Provide chilled water from chiller unit S648-CH to cooling coils of air handling units S683-AHU and S685-AHU.
S679-CWP S680-CWP	-	Circulate cooling water through chiller unit S648-CH cooling tower and sump.
S649-FN	-	Circulate cooling air through chiller cooling tower.
S609-GP	16.7	Provide hot circulating glycol to pre-heating coil of air handling unit S601-AHU.
S622-GP	20.3	Provide hot circulating glycol to pre-heating coil of air handling unit S614-AHU.
S662-GP	3.8	Provide hot circulating glycol to pre-heating coil of air handling units S684-AHU, S685-AHU, and S689-AHU.

18.3 SUBSYSTEMS

18.3.1 Clarifiers No. 1 and 2 Building HVAC System

18.3.1.1 System Description

Ambient air is replaced with fresh air to provide a more reasonable operating environment. Heating and ventilating of the Secondary Clarifiers No. 1 and 2 Building Area is provided by Air Handling Units S601-AHU and S689-AHU which draw in fresh air through inlet plenums. Each unit has heating coils to warm the air if necessary before it is discharged to the building area through ducts. Additional outside air can be drawn in during emergency ventilating conditions through air damper S603-VZ.

Air is exhausted from Gallery No. 3 into the main floor building area by Exhaust Fan S604-EF. The entire building air is exhausted into the foul air duct by three fans, S606-EF, S607-EF, and S608-EF. This duct connects to an outdoor odor control stack which vents the foul air at an elevation sufficiently high to allow for the dispersion of foul odors. Supplemental exhausting of air to the atmosphere can be provided during emergencies by Exhaust Fan S605-EF.

The space temperature in the building area and the outside air temperature are monitored by temperature sensors/transmitters.

A summary of the equipment described in this section is as follows:

1. Two air handling units: S601-AHU & S689-AHU;
2. One outside air damper: S603-VZ;
3. One basement exhaust fan: S604-EF;
4. Three foul air exhaust fans: S606-EF, S607-EF, and S608-EF;
5. One emergency exhaust fan: S605-EF;
6. Two temperature sensor/transmitters: S602-TE/TT & S610-TE/TT.

Equipment locations are found on the floor plans shown in Figures 18-1, 18-2, 18-3, and 18-4.

18.3.1.2 Monitoring and Control

Air handling unit S601-AHU is controlled from a Supervisory Control Panel located in the Control Room. From here an operator can manipulate a Main Switch ("ON/OFF"), Heat Switch ("WINTER/SUMMER") and a Dual Air Switch ("HIGH/LOW"). Status indication for all these settings is available at the panel in addition to "SAFETY RELAY" and "FILTER LIGHT" warning indications. The INFI 90 can select "HIGH" or "LOW" for the dual air setting.

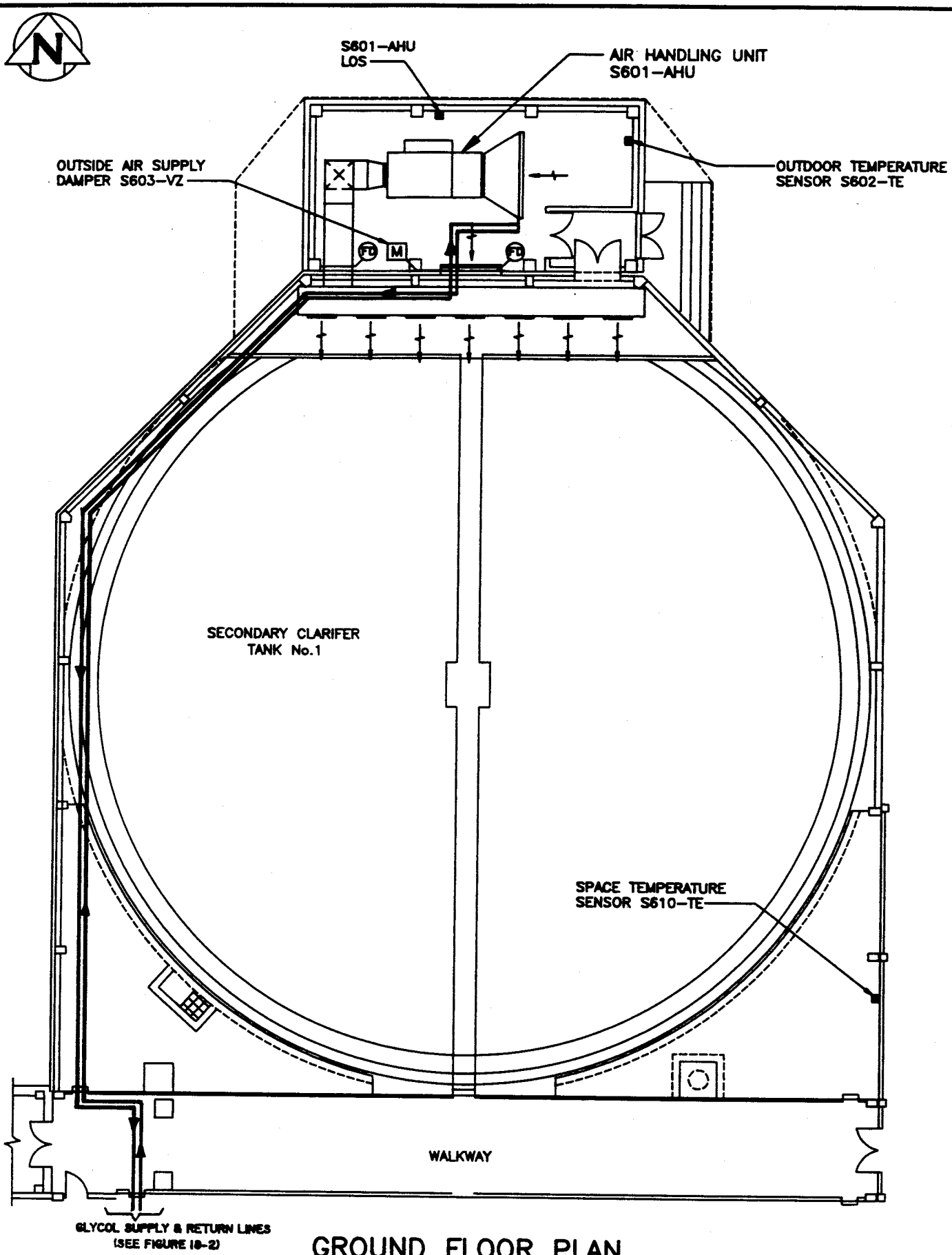
The location of this panel is found in Figure 18-4 while a layout is provided in Figure 18-5.

The INFI 90 monitors the following unit parameters:

1. "BURNER ON" status;
2. "HIGH AIR FLOW" status;
3. "LOW AIR FLOW" status;
4. "FLAME FAILURE" alarm condition.

The unit may be shut down and locked-out using the "LOS" pushbutton field located near the unit. The pushbutton is shown in Figure 18-1.

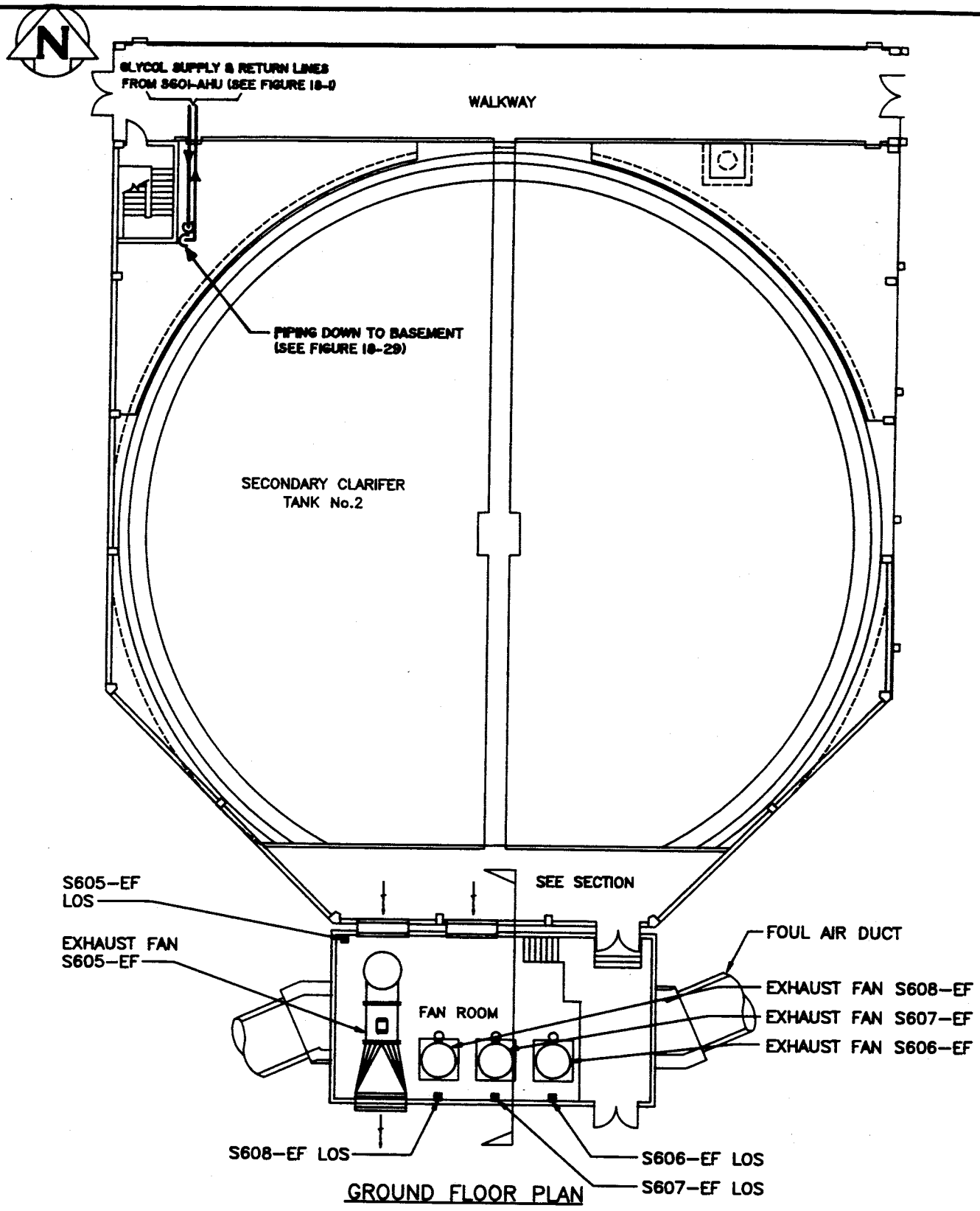
Air handling unit S689-AHU is controlled from an "ON/OFF" switch at FDP-S. The unit is designed to run continuously so this switch should normally be in the "ON" position. Unit "RUN" status indication is available at the MCC and FDP-S. "LOW TEMP FREEZE" and "LOSS OF FLOW" alarm conditions are also monitored at FDP-S. The setpoint at which the unit will maintain space temperature is set from the INFI 90. The INFI 90 has no other control over the unit. The unit supply air temperature is displayed on a gauge at ventilation panel SCP-1 located in the Ventilation Room.



GROUND FLOOR PLAN

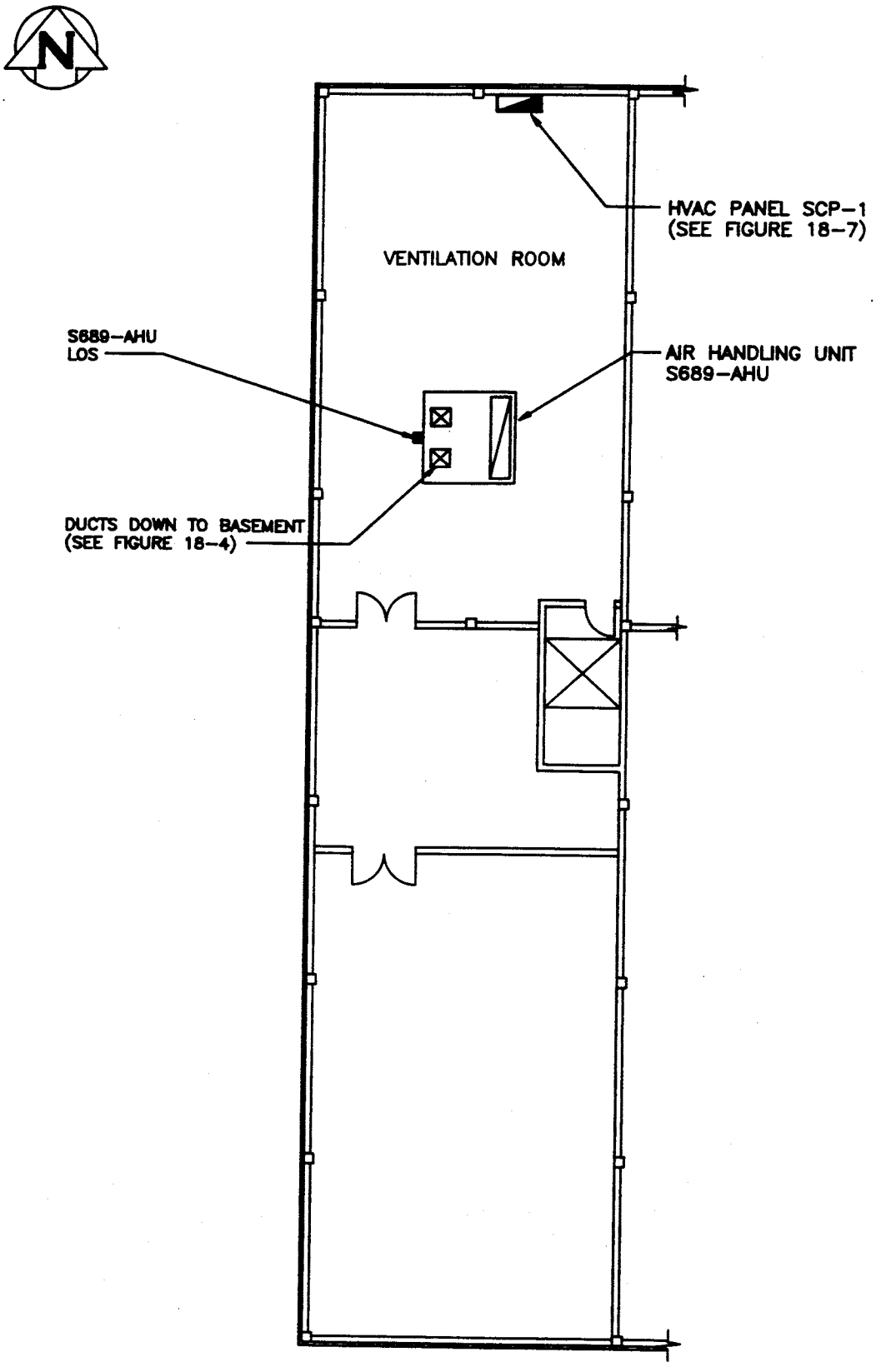
CLARIFIERS No.1 & 2 HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-1



CLARIFIERS No.1 & 2 HVAC SYSTEM EQUIPMENT LOCATIONS

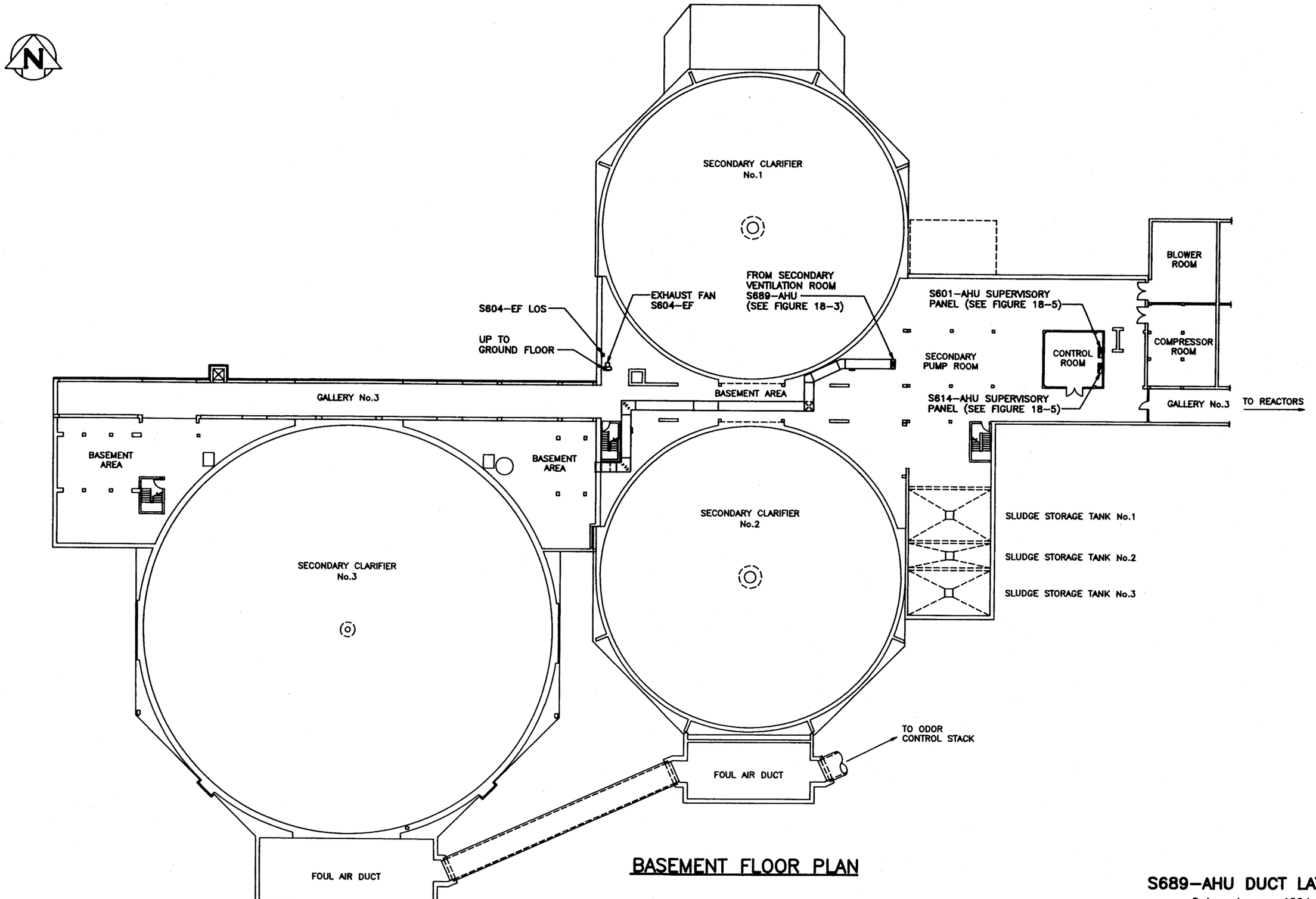
Date : January 1994
Figure 18-2



PLAN EL 237.592

S689-AHU & SCP-1 EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-3



BASEMENT FLOOR PLAN

S689-AHU DUCT LAYOUT

Date : January 1994
Figure 18-4

The section of FDP-S dedicated to the monitoring and control of this unit is shown in Figure 18-6. The location of panel SCP-1 is shown in Figure 18-3 while a layout is provided in Figure 18-7.

The INFI 90 monitors the following unit parameters:

1. Unit "RUN" status;
2. Unit "COMMON FAILURE" alarm condition due to low temperature freeze or loss of flow.

The unit may be shut down and locked-out using the "LOS" pushbutton field located near the unit. The pushbutton is shown in Figure 18-3.

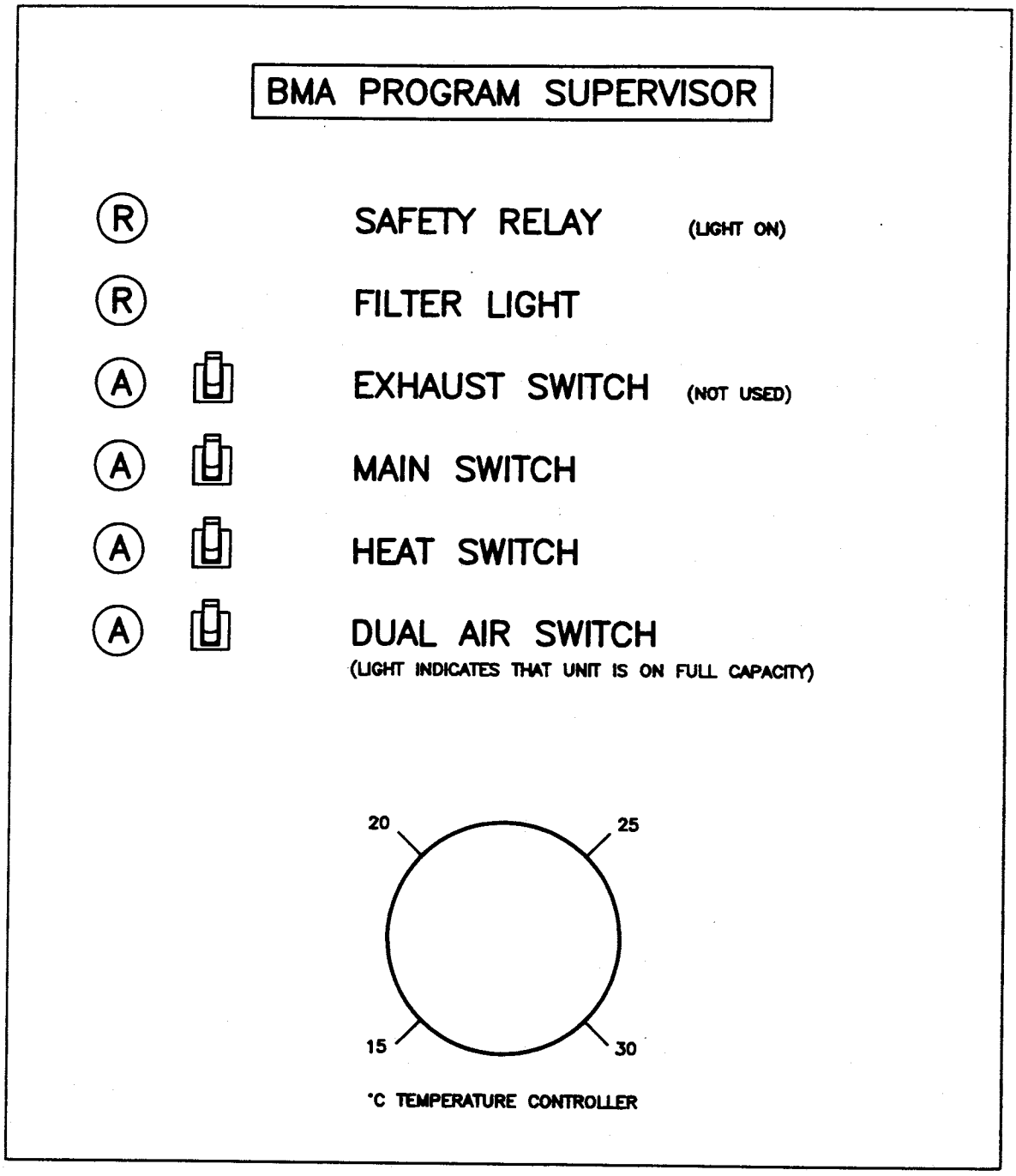
Outside air damper S603-VZ is controlled from a "COMP/HAND" switch at FDP-S. The "HAND" position allows an operator to manually control the damper using a "SUMMER/WINTER" position switch also at FDP-S. The "COMP" position surrenders damper control to the INFI 90.

The section of FDP-S dedicated to the control of this damper is shown in Figure 18-6.

The INFI 90 monitors the following damper parameters:

1. Damper "COMP/HAND" control switch status;
2. Damper "OPEN" status.

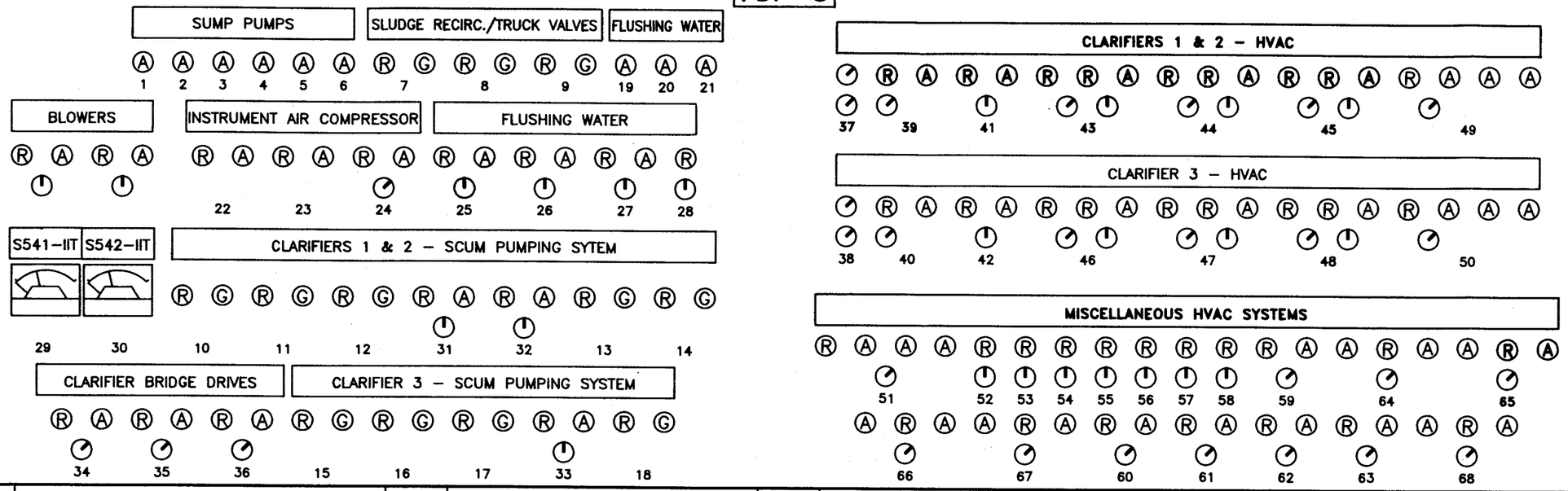
Gallery exhaust fan S604-EF is controlled from an "ON/OFF" switch at FDP-S. The fan is designed to run continuously so this switch should normally be in the "ON" position. Fan "RUN" status indication is available at the MCC and FDP-S. In addition, a fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S. The INFI 90 has no control over this fan.



TYPICAL SUPERVISORY CONTROL PANEL LAYOUT

Date : January 1994
Figure 18–5

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ◔ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	Ⓐ A – HIGH LEVEL
	No. 1–6
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	Ⓡ Ⓖ A – OPEN, B – CLOSED
	No. 7–18
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	Ⓐ A – LOSS OF SEAL WATER
	No. 19–21
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – FAIL
	No. 22–23
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C ◔ – OFF/ON
	No.24
24	COMPRESSOR COOLING FAN – S537–FN
	Ⓡ Ⓐ A – RUN, B – PUMP FAIL, C ① – COMP/OFF/HAND
	No. 25–27
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	Ⓡ A – RUN, ① B – COMP/OFF/HAND
	No. 28
28	FLUSHING WATER PUMP – S553–FWP
	Ⓡ Ⓐ A – RUN, B – FAIL, ① C – COMP/OFF/HAND, D – CURRENT
	No. 29–30
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – LOSS OF SEAL WATER, ① C – COMP/OFF/HAND
	No. 31–33
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	Ⓡ Ⓐ A – RUN, B – HIGH TORQUE FAIL, ◔ C – OFF/ON
	No. 34–36
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	◔ A – COMP/HAND, ◔ B – SUMMER/WINTER
	No. 37–38
37	**OUTDOOR AIR DAMPER – S603–VZ**
38	OUTDOOR AIR DAMPER – S616–VZ
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, ◔ C – OFF/ON
	No. 39–40
39	**GALLERY EXHAUST FAN – S604–EF**
40	GALLERY EXHAUST FAN – S617–EF
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, ① C – COMP/OFF/HAND
	No. 41–42
41	**EXHAUST FAN – S605–EF**
42	EXHAUST FAN – S618–EF

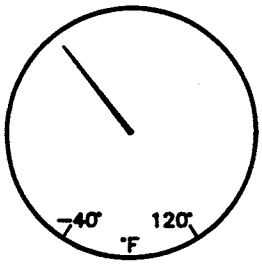
No.	DESCRIPTION
	Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW, ◔ D – SLOW/FAST, ① E – COMP/OFF/HAND
	No. 43–48
43	**EXHAUST FAN – S606–EF**
44	**EXHAUST FAN – S607–EF**
45	**EXHAUST FAN – S608–EF**
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	Ⓐ Ⓐ Ⓐ A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, ◔ E – OFF/ON
	No. 49–51
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	Ⓡ A – RUN, ① B – COMP/OFF/HAND
	No. 52–58
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, ◔ C – OFF/ON
	No. 59–63
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	Ⓐ Ⓡ Ⓐ A – LOSS OF FLOW, B – RUN, C – LOW TEMP, ① D – OFF/ON
	No. 64–68
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	**GALLERY AIR HANDLING UNIT – S689–AHU**
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

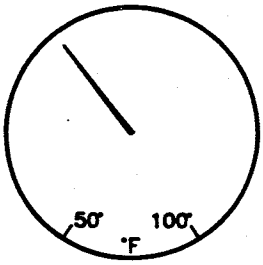
CLARIFIERS No.1 & 2 HVAC SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–6

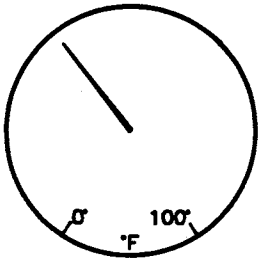
CONTROL PANEL SCP-1



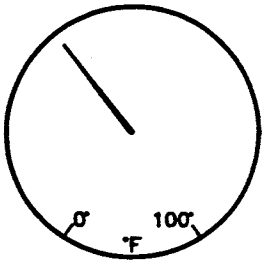
OUTSIDE AIR TEMPERATURE



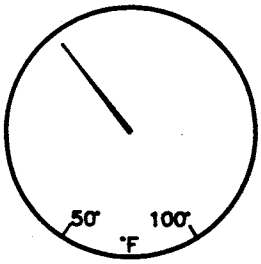
R682 SPACE TEMP.



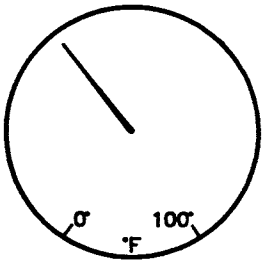
S683 SUPPLY AIR TEMP.



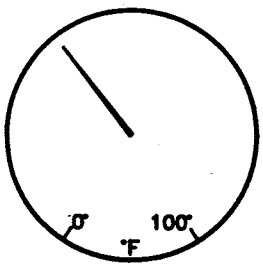
S684 SUPPLY AIR TEMP.



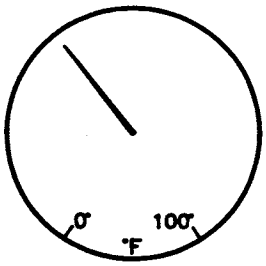
S685 SPACE TEMP.



S689 SUPPLY AIR TEMP.



S685-PG4 MIXED AIR



S683-PG5 MIXED AIR

VENTILATION PANEL SCP-1 LAYOUT

Date : January 1994
Figure 18-7

The section of FDP-S dedicated to the monitoring and control of this fan is shown in Figure 18-6.

The INFI 90 monitors the following fan parameters:

1. Fan "RUN" status;
2. Fan "FAILURE" alarm condition.

The fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. This pushbutton is shown in Figure 18-4.

Each of the building area exhaust fans, S606-EF, S607-EF, and S608-EF, is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "OFF" position disables the unit while the "HAND" position allows an operator to manually select fan speed using the "SLOW/FAST" switch also at FDP-S. The "COMP" position surrenders all fan control to the INFI 90 which can select fast or slow speed operation. Fan "SLOW SPEED" and "FAST SPEED" status indications are available at the MCC and FDP-S. In addition, a fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of these fans is shown in Figure 18-6.

The INFI 90 monitors the following fan parameters:

1. Fan "COMP/OFF/HAND" control switch status;
2. Fan "SLOW SPEED" and "FAST SPEED" statuses;
3. Fan "FAILURE" alarm condition.

Each fan can be shut down and locked-out using the "LOS" pushbuttons field located near the unit. These pushbuttons are shown in Figure 18-2.

High speed exhaust fan S605-EF is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the fan while the "COMP" position surrenders all control to the INFI 90. Fan "RUN" status indication is available at the MCC and FDP-S. In addition, a "LOSS OF FLOW" alarm condition is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of this fan is shown in Figure 18-6.

The INFI 90 monitors the following fan parameters:

1. Fan "COMP/OFF/HAND" control switch status;
2. Fan "RUN" status;
3. Fan "FAILURE" alarm condition.

The fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. This pushbutton is shown in Figure 18-2.

Outside air temperature and building area temperature are monitored by temperature sensor/transmitters S602-TE/TT and S610-TE/TT respectively. The temperatures are displayed locally and reported to the INFI 90. Locations of the devices are shown in Figure 18-1.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-2. Equipment/Instrument Summary Table 18-3 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-8.

TABLE 18-2

SECONDARY CLARIFIERS NO. 1 & 2 HVAC SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S601-AHU	5-M	2F			5-M	5-M
S603-VZ	5-M	1F			5-M	5-M
S689-AHU	5-M			5-M		5-M
S604-EF	5-M					5-M
S605-EF	5-M, OVERVIEW	6F			5-M	5-M
S606-EF	5-M, OVERVIEW	3F			5-M	5-M
S607-EF	5-M, OVERVIEW	4F			5-M	5-M
S608-EF	5-M, OVERVIEW	5F			5-M	5-M
S602-TI	5-M		5-M			5-M
S610-TI	5-M		5-M			5-M

TABLE 18-3

SECONDARY CLARIFIERS NO.1 & 2 HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-1	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S601-HS1	S601-AHU CONTROL (LOS)	S				
S601-UN	S601-AHU CONTROL (DUAL AIR)				C	
S601-BM	S601-AHU STATUS - BURNER ON				I	
S601-FH	S601-AHU STATUS - HIGH FLOW				I	
S601-FL	S601-AHU STATUS - LOW FLOW				I	
S601-QF	S601-AHU FLAME FAILURE				Q	
S603-HS1	S603-VZ CONTROL (COMP/HAND)			C	I	
S603-HS2	S603-VZ CONTROL (SUMMER/WINTER)			C		
S603-VD	S603-VZ CONTROL (OPEN)				C	
S603-ZD	S603-VZ STATUS - OPEN				I	
S689-HS1	S689-AHU CONTROL (LOS)	S				
S689-HS2	S689-AHU CONTROL (ON/OFF)			C		
S689-MM	S689-AHU STATUS - RUN	I*		I	I	* AT MCC
S689-FF	S689-AHU LOSS OF FLOW			A		
S689-TAL	S689-AHU LOW TEMP FREEZE			A		<2°C
S689-QF	S689-AHU COMMON FAILURE				Q	
S689-TC	S689-AHU TEMP. SETPOINT				C	
S689-TG	S689-AHU SUPPLY AIR TEMP		I			0 to 100°F
S604-HS1	S604-EF CONTROL (LOS)	S				
S604-HS2	S604-EF CONTROL (ON/OFF)			C		
S604-MM	S604-EF STATUS - RUN	I*		I	I	* AT MCC
S604-QF	S604-EF FAN FAILURE			Q	Q	
S605-HS1	S605-EF CONTROL (LOS)	S				
S605-HS2	S605-EF CONTROL (COMP/OFF/HAND)			C	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-8

(continued)

TABLE 18-3 (continued)

SECONDARY CLARIFIERS NO.1 & 2 HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-1	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S605-MN	S605-EF CONTROL (START/STOP)				C	
S605-MM	S605-EF STATUS - RUN	I*		I	I	* AT MCC
S605-QF	S605-EF FAN FAILURE			Q	Q	
S606-HS1	S606-EF CONTROL (LOS)	S				
S606-HS2	S606-EF CONTROL (COMP/OFF/HAND)			C	I	
S606-HS3	S606-EF CONTROL (SLOW/FAST)			C		
S606-SB	S606-EF CONTROL (SLOW)				C	
S606-SD	S606-EF CONTROL (FAST)				C	
S606-SL	S606-EF STATUS - SLOW	I*		I	I	* AT MCC
S606-SH	S606-EF STATUS - FAST	I*		I	I	* AT MCC
S606-QF	S606-EF FAN FAILURE			Q	Q	
S607-HS1	S607-EF CONTROL (LOS)	S				
S607-HS2	S607-EF CONTROL (COMP/OFF/HAND)			C	I	
S607-HS3	S607-EF CONTROL (SLOW/FAST)			C		
S607-SB	S607-EF CONTROL (SLOW)				C	
S607-SD	S607-EF CONTROL (FAST)				C	
S607-SL	S607-EF STATUS - SLOW	I*		I	I	* AT MCC
S607-SH	S607-EF STATUS - FAST	I*		I	I	* AT MCC
S607-QF	S607-EF FAN FAILURE			Q	Q	
S608-HS1	S608-EF CONTROL (LOS)	S				
S608-HS2	S608-EF CONTROL (COMP/OFF/HAND)			C	I	
S608-HS3	S608-EF CONTROL (SLOW/FAST)			C		
S608-SB	S608-EF CONTROL (SLOW)				C	
S608-SD	S608-EF CONTROL (FAST)				C	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-8

(contin...)

TABLE 18-3 (continued)

SECONDARY CLARIFIERS NO.1 & 2 HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-1	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S608-SL	S608-EF STATUS - SLOW	I*		I	I	* AT MCC
S608-SH	S608-EF STATUS - FAST	I*		I	I	* AT MCC
S608-QF	S608-EF FAN FAILURE			Q	Q	
S602-TT	OUTDOOR AIR TEMP	I			I	-50 to 50°C
S610-TT	CLARIFIER NO. 1 & 2 BLDG. TEMP	I			I	0 to 30°C

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-8

Fan operation shall be monitored by differential pressure switch S684-PS which on loss of flow shall shut down the fan, and close the outdoor air damper.

On a low limit temperature (below 2°C) as sensed by the low temperature controller S684-TSL the fan shall be stopped and the outside damper S684-VZ1 will fully close.

The exhaust fan S687-EF shall run as selected through the "ON/OFF" switch. With the switch in the "ON" position the fan will run and the damper S687-VZ will move to full open position through E/P relay S687-VY. Fan operation shall be monitored by differential pressure switch S687-PS which on loss of flow shall shut down the fan and close the exhaust air damper.

The exhaust fan S691-EF shall run as selected through the "ON/OFF" switch. With the switch in the "ON" position the fan will run and the damper S691-VZ will move to full open position through E/P relay S691-VY. Fan operation shall be monitored by differential pressure switch S691-PS which on loss of flow shall shut down the fan and close the exhaust air damper.

The secondary pump room is heated and cooled by an air handling unit S685-AHU which utilizes the plant heat recovery system, hot water heating system and cooling water system. It runs continuously with the control switch at FDP-S in the "ON" position. E/P relay S685-VY1 is switched to enable mixed air temperature modulation, as sensed by the mixed air transmitter S685-TE1, through outside damper S685-VZ1, return air damper S685-VZ4, and relief air damper S685-VZ3 and as controlled by pneumatic temperature controller S685-TC1. Damper S685-VZ1 minimum position is set at multi-purpose relay S685-VY3.

With outdoor air temperature above 4°C as sensed by outdoor air temperature sensor S683-TE1, and a demand for heat the positioning relay S685-VY3 shall allow the temperature controller S685-TC to modulate the face and bypass dampers S685-VZ2, and the three way hot water heating valve S685-TV1, the three way cooling valve S685-TV2 will remain closed. On demand for cooling the three way hot water heating valve will close, the face and bypass dampers will move to full bypass and the three way cooling

control valve will modulate to maintain the space temperature as sensed by wall thermostat S685-TS. The supply duct thermostat S685-TE2 shall override the space temperature control and maintain a minimum discharge air temperature of 12.8°C. The space temperature set point can be reset from the INFI 90.

With outdoor air temperature below 4°C the positioning relay S685-VY2 shall drive the three way heating control valve S685-TV1 to its full heating position and the three way cooling control valve S685-TV2 to its full closed position and the temperature controller S685-TC shall modulate the face and bypass dampers S685-VZ2 to maintain the desired temperature as sensed by wall thermostat S685-TS.

Fan operation shall be monitored by differential pressure switch S685-PS which on loss of flow shall shut down the fan and close the outdoor air damper, return air damper and the relief air damper.

On a low limit indication (below 2°C) by the low limit switch S685-TSL, the fan shall be stopped, outside air, return air, and relief dampers S685-VZ1/VZ3/VZ4 and the control valves shall all move to their fail safe positions.

The exhaust fan S686-EF shall run as selected through the "ON/OFF" switch. With the switch in the "ON" position the fan will run continuously.

Area "S" HVAC System Temperature Setpoints - Graphic 5O:

1. S683-AHU temperature setpoint: Press 1T to select temperature - enter value and press enter;

2. S684-AHU temperature setpoint: Press 2T to select temperature - enter value and press enter;

3. S685-AHU temperature setpoint: Press 3T to select temperature - enter value and press enter.

18.3.4 Control Room HVAC System

18.3.4.1 System Description

Due to the critical nature of the equipment located in the Control Room supplying fresh ventilation air is not sufficient. The room must be kept pressurized to prevent stray corrosive gases escaping into the Secondary Clarifier Area from entering the Control Room. Return air from the Control Room is mixed with supply air from air handling unit S689-AHU and drawn into pressurization unit S690-AHU. The air is drawn through a series of filters for purification purposes. The air handling unit then supplies the air under pressure to the Control Room. Prior to entering the room, the air may be heated by a 4kW electric duct heater or cooled by a cooling coil operating in conjunction with Rooftop Package Condensing Unit S690-CU. This system not only maintains the space temperature but also keeps the air pressurized and as free from dust particles as possible.

High temperature and smoke alarm conditions in the Control Room are monitored.

A summary of the equipment described in this section is as follows:

1. One air handling unit/pressurization unit: S690-AHU;
2. One rooftop condensing unit: S690-CU;
3. One high temperature switch: S502-TSH;
4. One smoke alarm: S501-AE.

Equipment locations are found on the floor plans shown in Figure 18-18.

18.3.4.2 Monitoring and Control

Air handling unit S690-AHU is controlled from an "ON/OFF" switch at FDP-S. The unit is designed to run continuously so this switch should normally be in the "ON" position. Unit "RUN" status indication is available at the MCC and FDP-S. A "LOSS OF FLOW" alarm

condition is monitored at FDP-S. The setpoint at which the unit will maintain space temperature is set from a thermostat. The INFI 90 has no control over this unit. Filter system pressure differential indication is available at a pressure gauge panel mounted directly on the unit.

The section of FDP-S dedicated to the monitoring and control of this unit is shown in Figure 18-19. The location of the pressure gauge panel is shown in Figure 18-18 while a layout is provided in Figure 18-20.

The INFI 90 monitors the following unit parameters:

1. Unit "RUN" status;
2. Unit "LOSS OF FLOW" alarm condition.

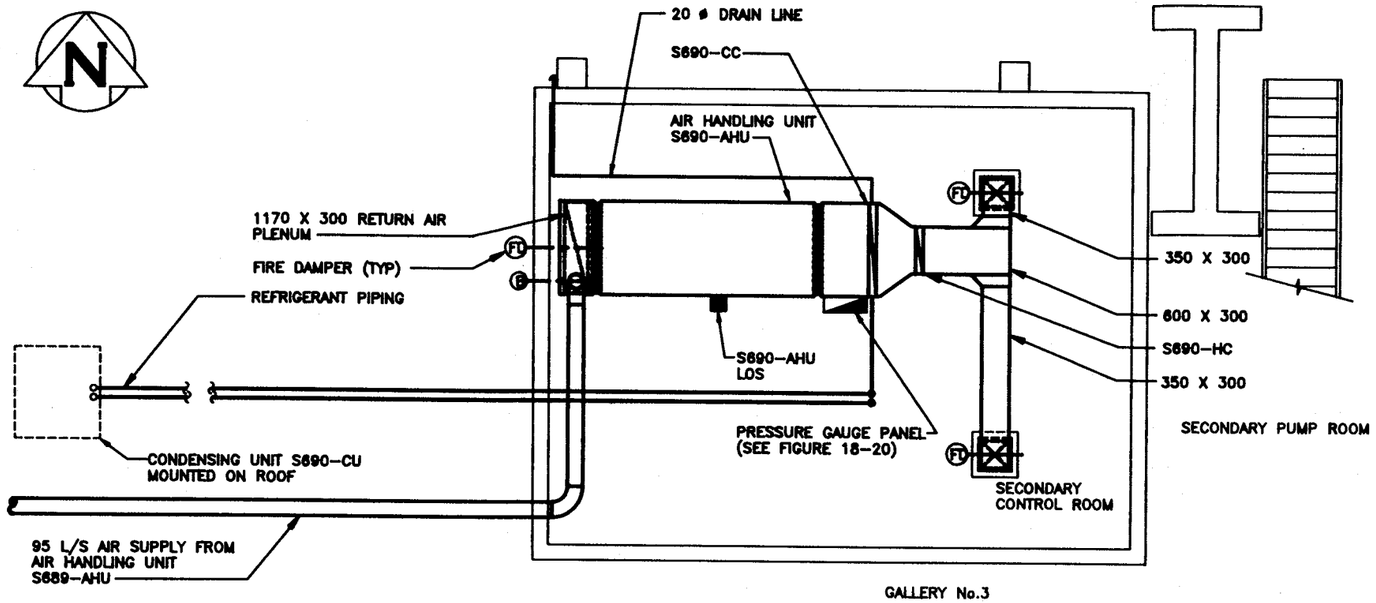
The unit may be shut down and locked-out using the "LOS" pushbutton field located near the unit. This pushbutton is shown in Figure 18-18.

In addition, the INFI 90 also monitors the following parameters:

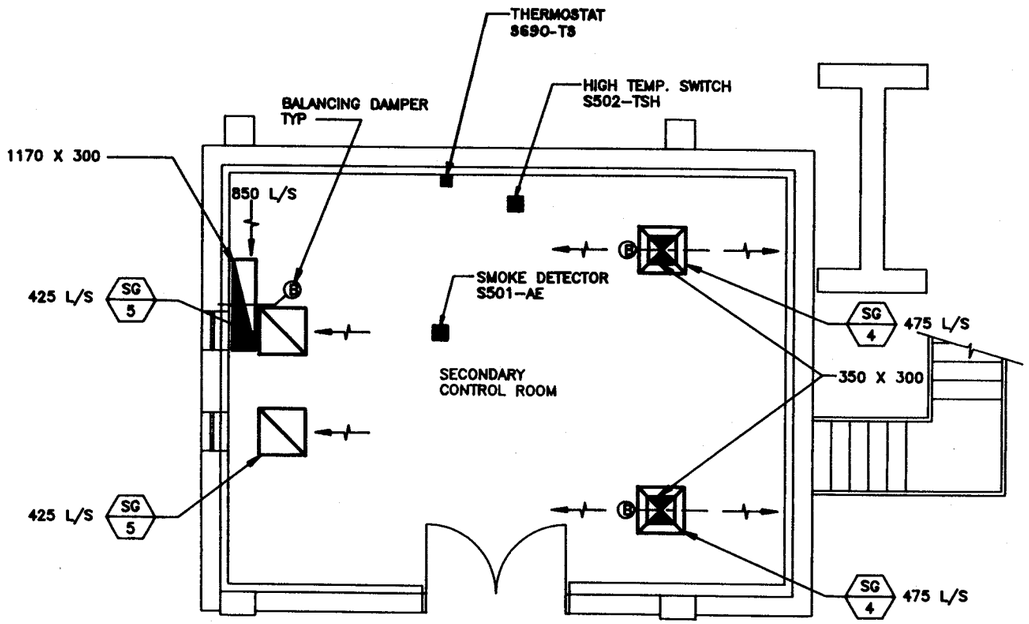
1. Control Room smoke alarm condition;
2. Control Room high temperature alarm condition.

The locations of these devices are shown in Figure 18-18.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-8. Equipment/Instrument Summary Table 18-9 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-21.



PLAN AT ELEV. 230.666



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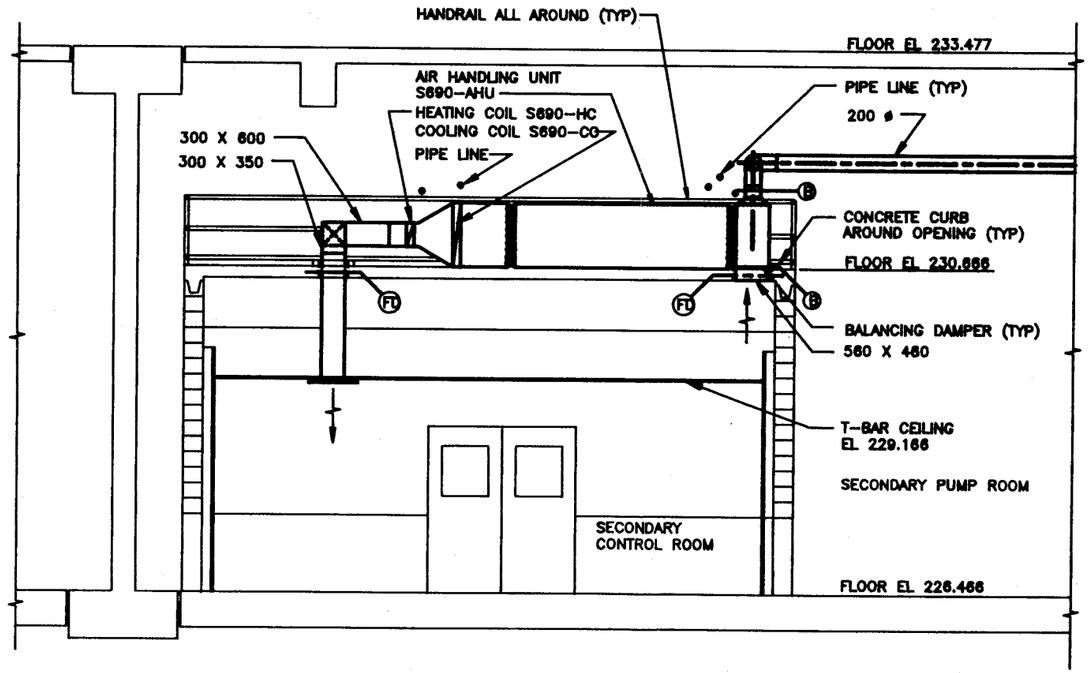
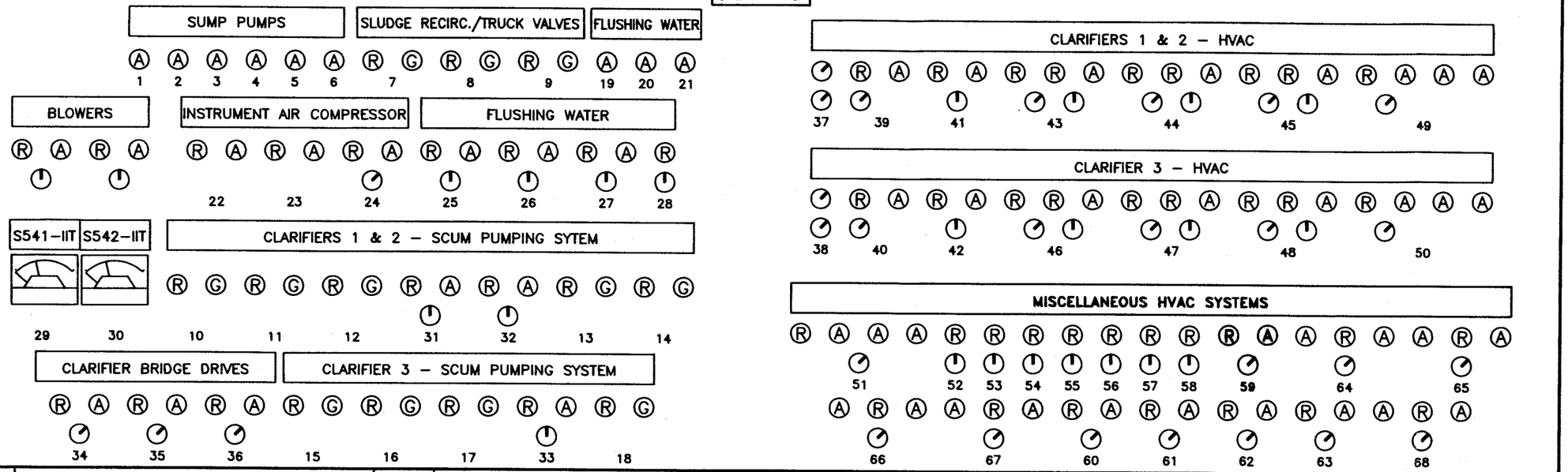


SECTION

CONTROL ROOM HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18–18

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ⏲ – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	A Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	A B Ⓡ Ⓒ A – OPEN B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	A Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	A B Ⓡ Ⓐ A – RUN B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	A B Ⓡ Ⓐ A – RUN B – LOSS OF FLOW C ⊘ C – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	A B Ⓡ Ⓐ A – RUN B – PUMP FAIL C ⏲ C – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A Ⓡ A – RUN B ⏲ B – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	A B Ⓡ Ⓐ A – RUN C ⏲ B – FAIL C – COMP/OFF/HAND D D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

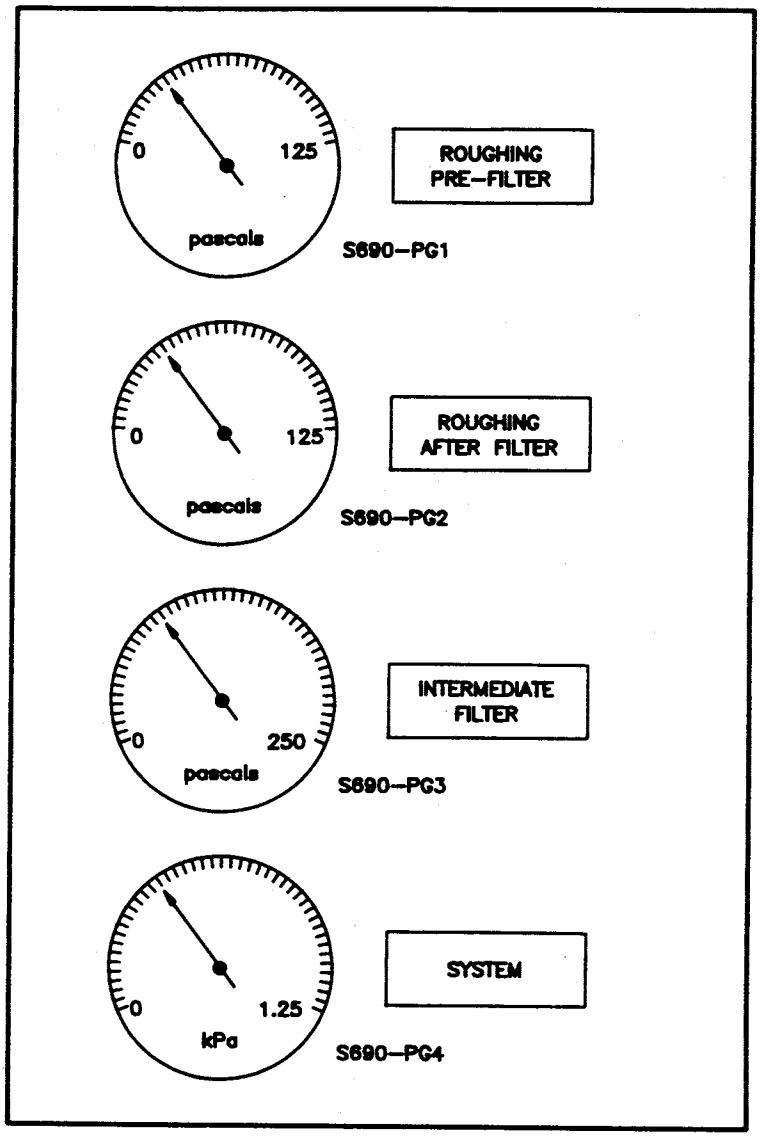
No.	DESCRIPTION
	A B Ⓡ Ⓐ A – RUN B – LOSS OF SEAL WATER C ⏲ C – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	A B Ⓡ Ⓐ A – RUN C ⊘ B – HIGH TORQUE FAIL C – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A ⊘ A – COMP/HAND B ⊘ B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	A B Ⓡ Ⓐ A – RUN C ⊘ B – LOSS OF FLOW C – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	A B Ⓡ Ⓐ A – RUN C ⏲ B – LOSS OF FLOW C – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	A B C A – SLOW Ⓡ Ⓡ Ⓐ B – FAST D ⊘ ⏲ E C – LOSS OF FLOW D – SLOW/FAST E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	A B C D Ⓡ Ⓐ Ⓐ Ⓐ A – RUN E ⊘ B – GLYCOL FLOW FAIL C – FLUSH WATER FLOW FAIL D – LOW TEMP E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A Ⓡ A – RUN B ⏲ B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	A B Ⓡ Ⓐ A – RUN C ⊘ B – LOSS OF FLOW C – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	A B C A – LOSS OF FLOW Ⓐ Ⓡ Ⓐ B – RUN D ⊘ C – LOW TEMP D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

CONTROL ROOM HVAC SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–19



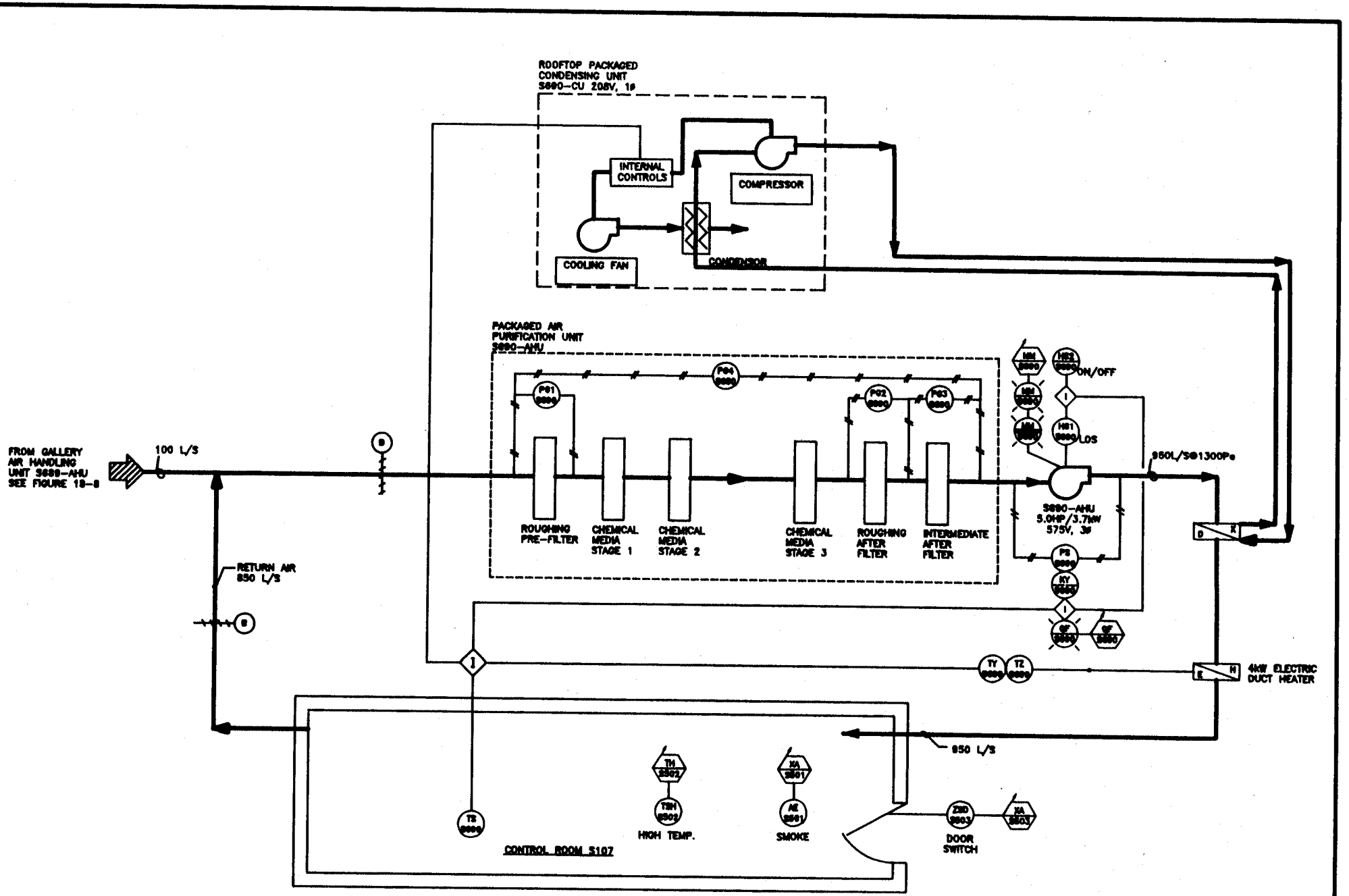
CONTROL ROOL HVAC SYSTEM
PRESSURE GAUGE LAYOUT

Date : January 1994
Figure 18–20

TABLE 18-8

CONTROL ROOM HVAC SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S690-AHU	5-P					5-P
S501-XA	5-P					5-P
S502-TH	5-P					5-P



CONTROL ROOM S107– AIR PURIFICATION SYSTEM

CONTROL ROOM HVAC SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18–21

TABLE 18-9

CONTROL ROOM HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S690-HS1	S690-AHU CONTROL (LOS)	S				
S690-HS2	S690-AHU CONTROL (ON/OFF)			C		
S690-MM	S690-AHU STATUS - RUN	I*		I	I	* AT MCC
S690-QF	S690-AHU UNIT FAILURE			Q	Q	
S690-PG1	ROUGHING PRE-FILTER DIFF. PRESS.		I			0 to 125 Pa
S690-PG2	ROUGHING AFTER FILTER DIFF. PRESS.		I			0 to 125 Pa
S690-PG3	INTERMEDIATE AFTER FILTER DIFF. PRESS.		I			0 to 250 Pa
S690-PG4	SYSTEM DIFF. PRESS.		I			0 to 1.25 kPa
S501-AE	CONTROL ROOM SMOKE ALARM	A			A	
S502-TA	CONTROL ROOM HIGH TEMP				A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-21

18.3.4.3 Sequence of Operation

Air handling unit S690-AHU shall run continuously through the "ON/OFF" hand switch. With the switch in the "ON" position, the supply fan shall be selected to run. The fan shall be monitored by the air flow switch S690-PS, which on loss of flow shall stop the fan, condensing unit S690-CU and the electric duct heater. The space thermostat S690-TS shall modulate the electric duct heater in sequence with the condensing unit to maintain the space temperature at 23°C (adjustable). On a demand for heat the thermostat will modulate the electric duct heater SCR controller S690-TZ to maintain space temperature. On a demand for cooling the electric duct heater will modulate to full close, and the space thermostat will cycle the outdoor condensing unit to maintain space setpoint.

Control Room HVAC System Operating Procedure - Graphic 5P:

1) Press 1D to select enable/disable (Control Room monitoring).

Note: Enable/disable is only activated when the McPhillips security system is on.

18.3.5 Hot Water Heating System

18.3.5.1 System Description

Two hot water booster pumps, S671-HWP and S672-HWP, circulate hot water from the boilers in the Service Building to the hot water heating loops in the Secondary Clarifier Area. This includes the heating coils of air handling units S684-AHU, S685-AHU, and S689-AHU. In addition, hot circulating water is also required by six unit heaters which provide supplemental heating to the Truck Bay Area, Scrubber Room, and the Ventilation Room.

A summary of the equipment described in this section is as follows:

1. Two hot water booster pumps: S671-HWP and S672-HWP;

2. One low flow switch: S671-FSL;
3. Six hot water unit heaters: S694-UH, S695-UH, S696-UH, S697-US, S698-UH, and S699-UH.

Equipment locations are found on the floor plans shown in Figures 18-22 and 18-23.

18.3.5.2 Monitoring and Control

Each hot water booster pump, S671-HWP & S672-HWP, is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the pump while the "COMP" position surrenders all control to the INFI 90. Pump "RUN" status indication is available at the MCC and FDP-S.

The section of FDP-S dedicated to the monitoring and control of these pumps is shown in Figure 18-24.

The INFI 90 monitors the following pump parameters:

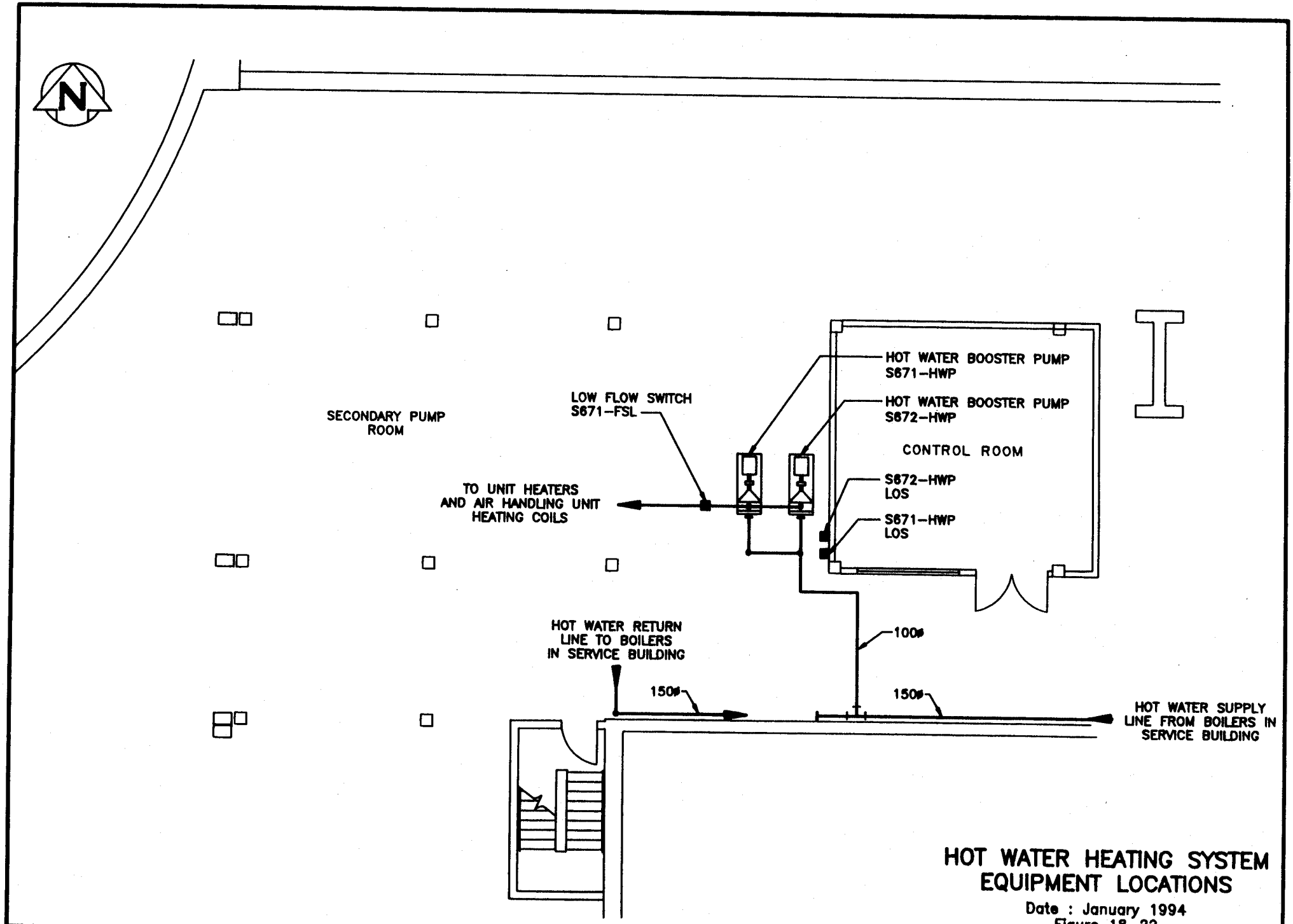
1. Pump "COMP/OFF/HAND" control switch status;
2. Pump "RUN" status.

Each pump may be shut down and locked-out using the "LOS" pushbutton field located near the unit. These pushbuttons are shown in Figure 18-22.

Low hot water flow is sensed by switch S671-FSL which will signal an alarm to the INFI 90. The location of this switch is shown in Figure 18-22.

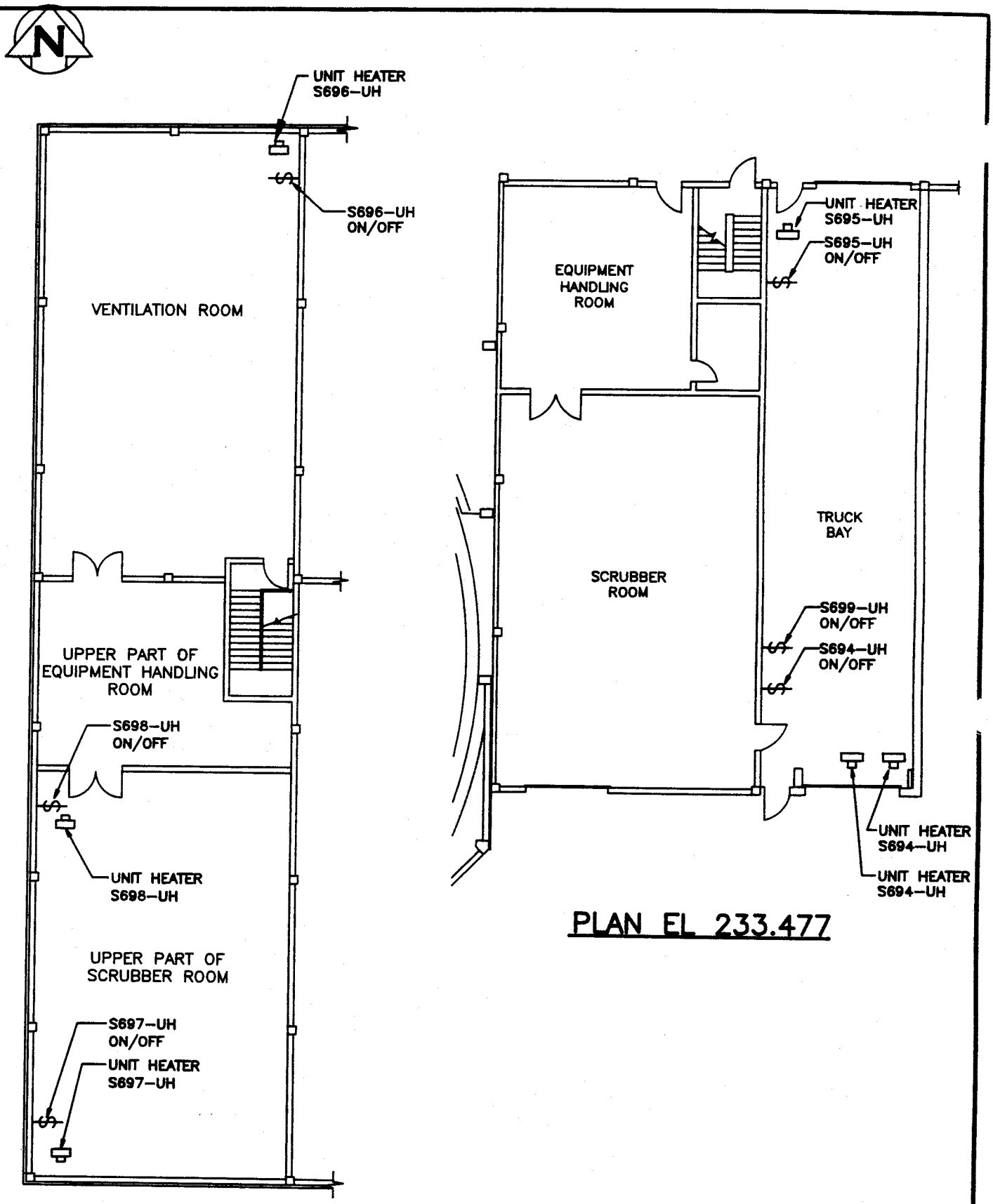
Each unit heater is controlled from an "ON/OFF" switch field located near the unit. Normally, this switch is in the "ON" position and the heater is activated by a local thermostat. The INFI 90 does not monitor or control these devices.

The locations of this equipment are shown in Figure 18-23.



HOT WATER HEATING SYSTEM EQUIPMENT LOCATIONS

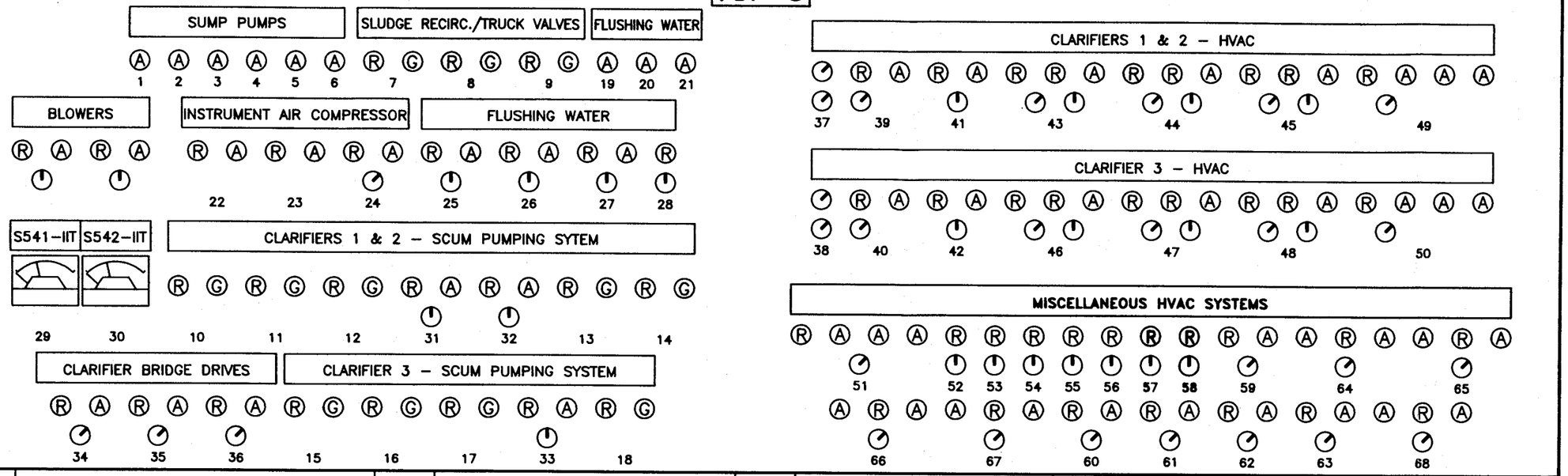
Date : January 1994
Figure 18-22



HOT WATER HEATING SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-23

FDP-S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	A Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	A B Ⓡ Ⓖ A – OPEN B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	A Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	A B Ⓡ Ⓐ A – RUN B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	A B Ⓡ Ⓐ A – RUN B – LOSS OF FLOW C ⊘ C – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	A B Ⓡ Ⓐ A – RUN B – PUMP FAIL C ① C – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A Ⓡ A – RUN B ① B – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	A B Ⓡ Ⓐ A – RUN B – FAIL C ① C – COMP/OFF/HAND D D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	A B Ⓡ Ⓐ A – RUN B – LOSS OF SEAL WATER C ① C – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	A B Ⓡ Ⓐ A – RUN B – HIGH TORQUE FAIL C ⊘ C – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A ⊘ A – COMP/HAND B ⊘ B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	A B Ⓡ Ⓐ A – RUN B – LOSS OF FLOW C ⊘ C – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	A B Ⓡ Ⓐ A – RUN B – LOSS OF FLOW C ① C – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	A B C Ⓡ Ⓡ Ⓐ A – SLOW B – FAST D ⊘ ① E C – LOSS OF FLOW D – SLOW/FAST E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	A B C D Ⓡ Ⓐ Ⓐ Ⓐ A – RUN B – GLYCOL FLOW FAIL E ⊘ C – FLUSH WATER FLOW FAIL D – LOW TEMP E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A Ⓡ A – RUN B ① B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	**HOT WATER PUMP – S671–HWP**
58	**HOT WATER PUMP – S672–HWP**
	A B Ⓡ Ⓐ A – RUN B – LOSS OF FLOW C ⊘ C – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	A B C Ⓐ Ⓡ Ⓐ A – LOSS OF FLOW B – RUN D ⊘ C – LOW TEMP D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

HOT WATER HEATING SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–24

Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-10. Equipment/Instrument Summary Table 18-11 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-25.

18.3.5.3 Sequence of Operation

The hot water booster pumps S671/S672-HWP shall operate on a duty/standby mode as designated by the INFI 90. If a low flow signal is received by the INFI 90 from the flow switch S671-FSL, the INFI 90 shall start the standby pump.

Hot water is supplied to unit heaters S694/S695/S696/S697/S698/S699-UH in area "S". All of the unit heaters are controlled by a space thermostat S694/S695/S696/S697/S698/S699-TS cycling the fan motor.

The two pumps operate as duty and standby. The standby pump is started if a flow failure occurs. The INFI 90 automatically changes the duty pump based on pump run time. The Operator may select the duty pump at any time.

1) The hot water booster pumps S671 and S672 are in service;
2) Both pumps must be in "COMPUTER" mode before starting the automatic sequence;
3) There must be a flow rate before the pumps will run;
4) Each pump will run for a 24 hour period and switch duty;

Hot Water Booster Pumps Start-Up Procedure: Graphic 5R:

1) Verify that both pumps are in "COMPUTER";
2) Press 1P and verify that pump S671 is in "auto";
3) Press 2P and verify that pump S672 is in "auto";
4) Press 3P and select the duty pump;
5) Press 4P and select "auto".

Note: The automatic sequence will now begin.

TABLE 18-10

HOT WATER HEATING SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S671-HWP	5-R	1P	5-R		5-R	5-R
S672-HWP	5-R	2P	5-R		5-R	5-R
S671-FA	5-R					

TABLE 18-11

HOT WATER HEATING SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S671-HS1	S671-HWP CONTROL (LOS)	S				
S671-HS2	S671-HWP CONTROL (COMP/OFF/HAND)			C	I	
S671-MN	S671-HWP CONTROL (START/STOP)				C	
S671-MM	S671-HWP STATUS - RUN		I	I	I	
S672-HS1	S672-HWP CONTROL (LOS)	S				
S672-HS2	S672-HWP CONTROL (COMP/OFF/HAND)			C	I	
S672-MN	S672-HWP CONTROL (START/STOP)				C	
S672-MM	S672-HWP STATUS - RUN		I	I	I	
S671-FA	HOT WATER LOW FLOW				A	
S694-HS	UNIT HEATER CONTROL (ON/OFF)	C				
S695-HS	UNIT HEATER CONTROL (ON/OFF)	C				
S696-HS	UNIT HEATER CONTROL (ON/OFF)	C				
S697-HS	UNIT HEATER CONTROL (ON/OFF)	C				
S698-HS	UNIT HEATER CONTROL (ON/OFF)	C				
S699-HS	UNIT HEATER CONTROL (ON/OFF)	C				

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-25

18.3.6 Cooling Water System

18.3.6.1 System Description

Portions of the plant are cooled during the summer season by chilled water. Water is cooled by chiller units S647-CH and S648-CH and pumped by chilled water pumps S667-CWP and S668-CWP through the cooling coils of air handling units S683-AHU and S685-AHU. The water chiller units require the use of a cooling tower. Water is circulated through the chiller units and the cooling tower sump by two cooling tower pumps designated S679-CWP and S680-CWP. Supplemental cooling to the water in the tower is provided by cooling tower fan S649-FN.

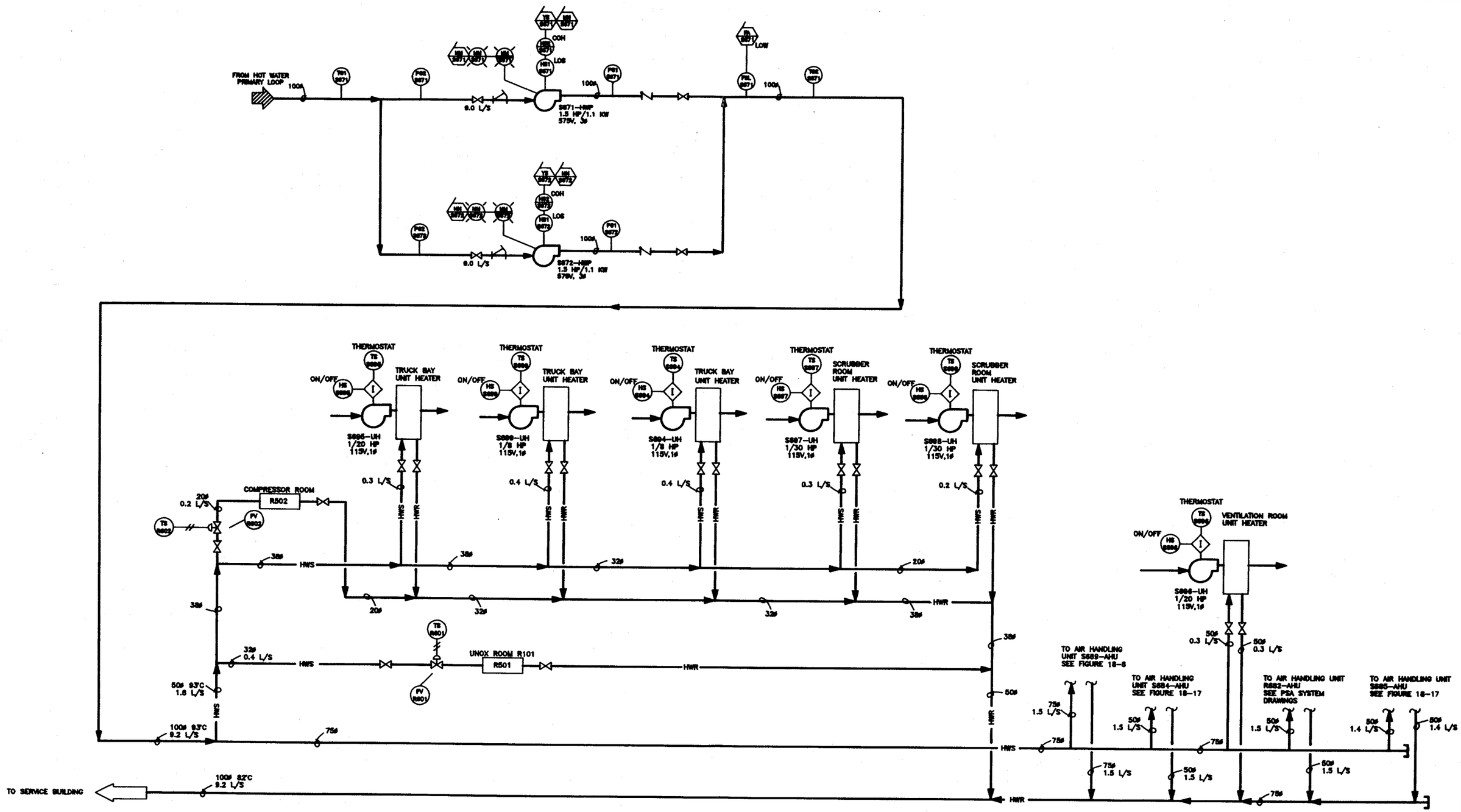
A summary of the equipment described in this section is as follows:

1. Two cooling water pumps: S667-CWP and S668-CWP;
2. Two chiller units: S647-CH and S648-CH;
3. One cooling tower fan: S649-FN;
4. Two cooling tower pumps: S679-CWP and S680-CWP;
5. Two low flow switches: S667-FSL and S679-FSL;
6. Two high and low temperature switches: S649-TSH & S649-TSL.

Equipment locations are found on the floor plan shown in Figure 18-26.

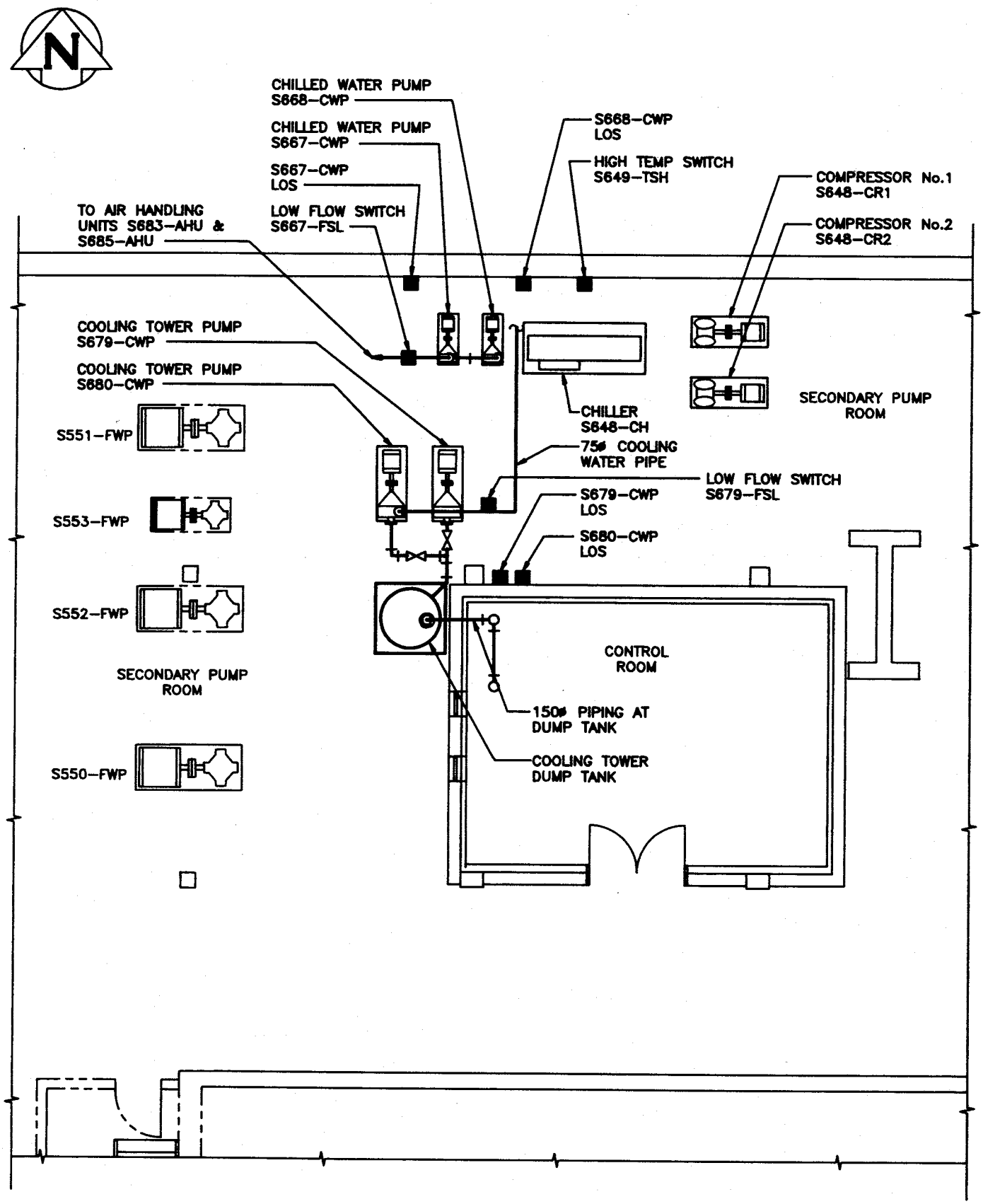
18.3.6.2 Monitoring and Control

Each of the four water pumps, S667-CWP, S668-CWP, S679-CWP, and S680-CWP, and the cooling water fan S649-FN is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the pump or fan while the "COMP" position surrenders all control to the INFI 90. Pump or fan "RUN" status indication is available at the MCC and FDP-S.



HOT WATER HEATING SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-25



BASEMENT FLOOR PLAN

COOLING WATER SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18–26

18.3.1.3 Sequence of Operation

Basement Area

Air handling unit S689-AHU is designed to run continuously with the outside air damper S689-VZ fully open. Fan operation is monitored by differential pressure switch S689-PS which on loss of flow shall shut down the unit and close the damper.

Discharge air temperature is maintained at 12.8°C by pneumatic temperature controller S689-TC which modulates the three way hot water heating valve S689-TV in response to the discharge air temperature sensed by S689-TE. The set point can be reset from the INFI 90.

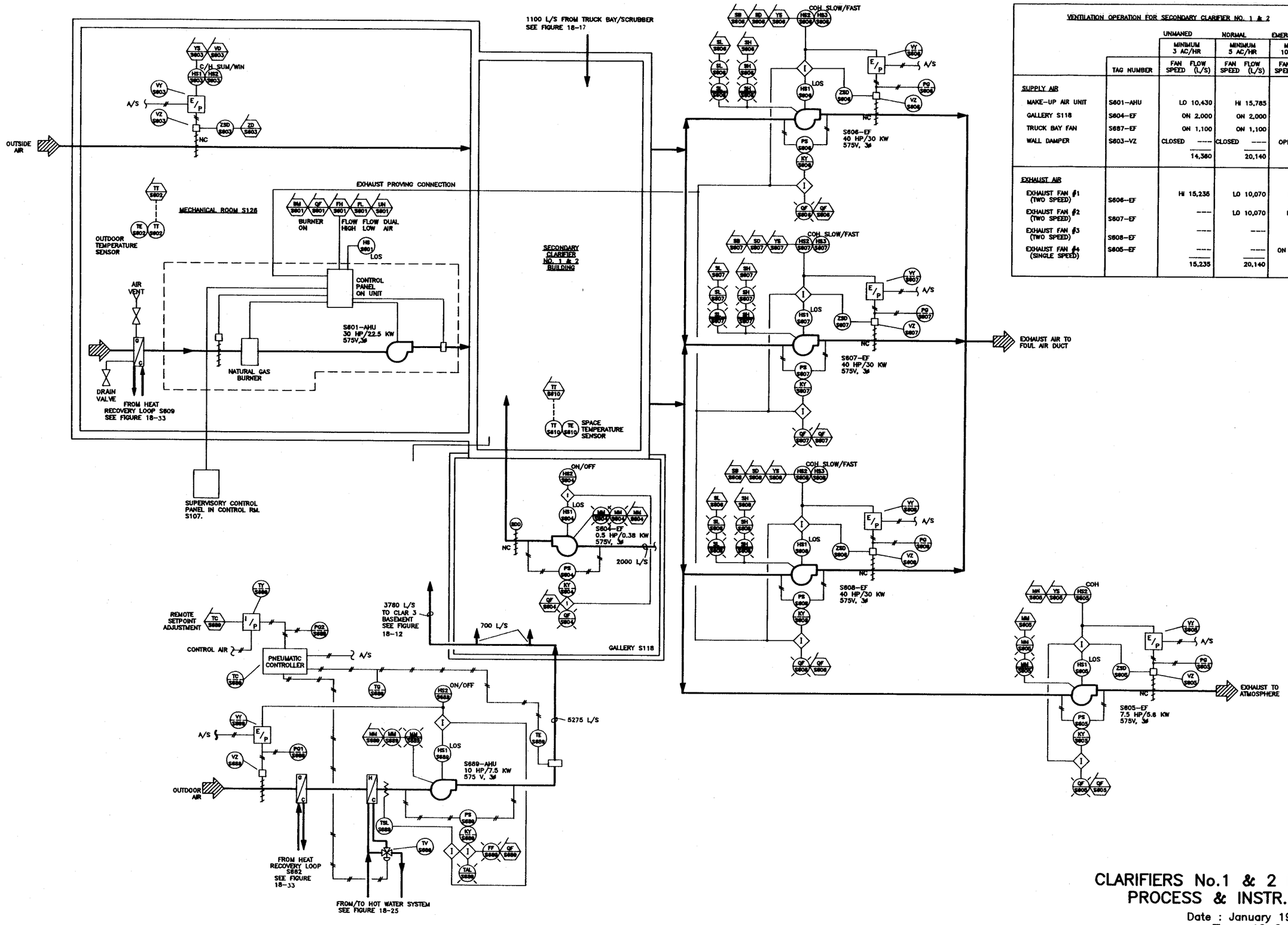
On discharge air temperature low limit (<2°C as sensed by switch S689-TSL) the unit shall shut down and close the damper.

Exhaust fan S604-EF is designed to run continuously.

Main Floor Area

Air handling unit S601-AHU is controlled by a supervisory control panel in the Control Room to maintain a minimum discharge temperature of 10°C. The unit is electrically interlocked so that it will only operate if any of the exhaust fans S606/S607/or S608-EF is running.

Upon a call for operation of any of the exhaust fans S605-EF, S606-EF, S607-EF, or S608-EF, the respective exhaust air damper is first opened. When a limit switch confirms the open status of the damper the fan is energized. Fan operation is monitored by a differential pressure switch which on loss of flow will shut down the fan and close the damper.



VENTILATION OPERATION FOR SECONDARY CLARIFIER NO. 1 & 2

		UNMANED MINIMUM 3 AC/HR		NORMAL MINIMUM 5 AC/HR		EMERG/MAINT MINIMUM 10 AC/HR	
	TAG NUMBER	FAN SPEED	FLOW (L/S)	FAN SPEED	FLOW (L/S)	FAN SPEED	FLOW (L/S)
SUPPLY AIR							
MAKE-UP AIR UNIT	S601-AHU	LO	10,430	HI	15,785	HI	15,785
GALLERY S118	S604-EF	ON	2,000	ON	2,000	ON	2,000
TRUCK BAY FAN	S687-EF	ON	1,100	ON	1,100	ON	1,100
WALL DAMPER	S803-VZ	CLOSED	----	CLOSED	----	OPEN	22,165
			14,360		20,140		42,305
EXHAUST AIR							
EXHAUST FAN #1 (TWO SPEED)	S806-EF	HI	15,235	LO	10,070	HI	15,235
EXHAUST FAN #2 (TWO SPEED)	S807-EF		----	LO	10,070	LO	10,070
EXHAUST FAN #3 (TWO SPEED)	S808-EF		----		----		----
EXHAUST FAN #4 (SINGLE SPEED)	S805-EF		----		----	ON	17,000
			15,235		20,140		42,305

CLARIFIERS No.1 & 2 HVAC SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-8

The ventilation system for this area has been designed to allow for operation of three, five, and ten air changes per hour (AC/hr). Three AC/hr is used during unmanned hours. Five AC/hr is used at all other times when the plant is operating normally. Ten AC/hr is used for maintenance purposes.

The following steps outline the ventilation control:

1. 3 AC/hr: S601-AHU is on low speed and one exhaust fan, S606-EF or S607-EF, is on high speed. If either fails, S608-EF will serve as back up;

2. 5 AC/hr: S601-AHU is on high speed and two exhaust fans, S606-EF and S607-EF, are on low speed. If either fails, S608-EF will serve as back up;

3. 10 AC/hr: S601-AHU is on high speed and high rate supply damper S603-VZ is open. Exhaust fan S606-EF is on high speed and S607-EF is on low speed. If either fails, S608-EF will serve as back up. Exhaust fan S605-EF is on.

Clarifiers No. 1 & 2 Building Area HVAC System Start-up Procedures - Graphic 5M:

1. Press 5C and select: ten (10) air changes. Note: 10 air changes is used only during plant emergency or maintenance;

2. Three (3) or five (5) air change start/stop times are automatically selected by the "Security and HVAC Plant Time Edit" Overview;

3. In the event of one or more fan failures, there will be alarms for each fan. To restart the system without re-entering the start and stop times (air changes):

   Press 6C 'reset' and select "reset" to clear the trips. Note: the system will restart automatically.

18.3.2 Clarifier No. 3 Building HVAC System

18.3.2.1 System Description

Ambient air is replaced with fresh air to provide a more reasonable operating environment. Heating and ventilating of the Secondary Clarifier No. 3 Building Area is provided by Air Handling Units S614-AHU and S689-AHU which draw in fresh air through inlet plenums. Each unit has heating coils to warm the air if necessary before it is discharged to the building area through ducts. Additional outside air can be drawn in during emergency ventilating conditions through air damper S616-VZ.

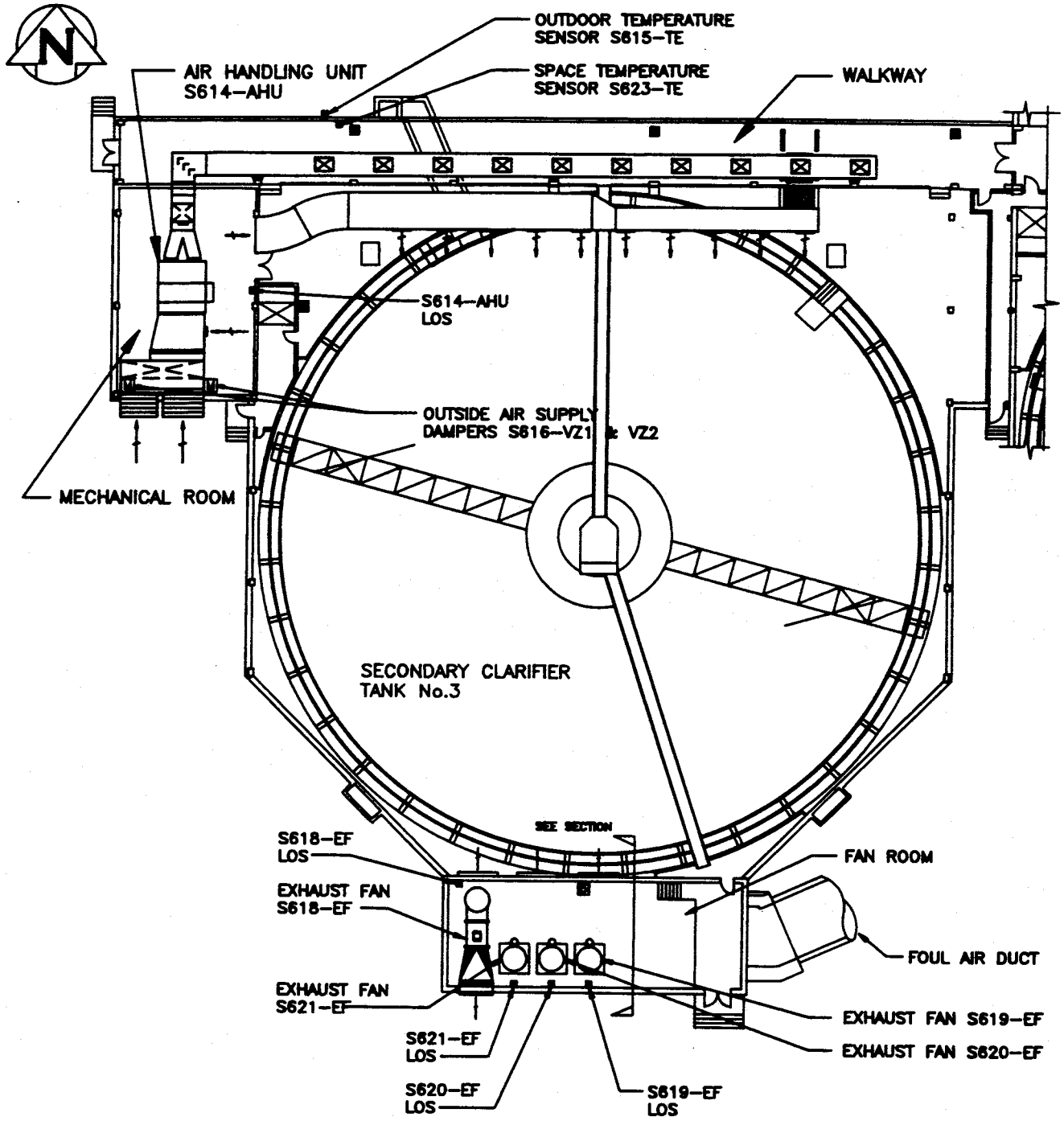
Air is exhausted from Gallery No. 3 into the main floor building area by Exhaust Fan S617-EF. The entire building air is exhausted into the foul air duct by three fans, S619-EF, S620-EF, and S621-EF. This duct connects to an outdoor odor control stack which vents the foul air at an elevation sufficiently high to allow for the dispersion of foul odors. Supplemental exhausting of air to the atmosphere can be provided during emergencies by Exhaust Fan S618-EF.

The space temperature in the building area and the outside air temperature are monitored by temperature sensors/transmitters.

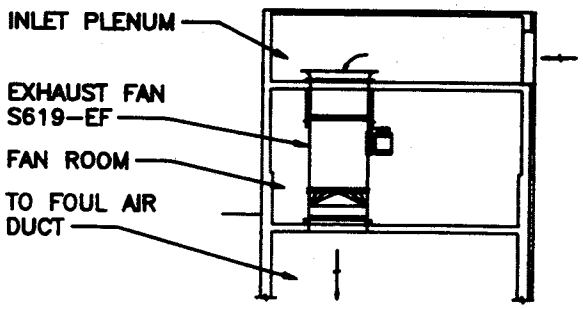
A summary of the equipment described in this section is as follows:

1. One air handling unit: S614-AHU;
2. One outside air damper: S616-VZ;
3. One basement exhaust fan: S617-EF;
4. Three foul air exhaust fans: S619-EF, S620-EF, and S621-EF;
5. One emergency exhaust fan: S613-EF;
6. Two temperature sensor/transmitters: S615-TE/TT & S623-TE/TT.

Equipment locations are found on the floor plans shown in Figures 18-9 and 18-10.



GROUND FLOOR PLAN



SECTION

CLARIFIER No.3 HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-9

18.3.2.2 Monitoring and Control

Air handling unit S614-AHU is controlled from a Supervisory Control Panel located in the Control Room. From here an operator can manipulate a Main Switch ("ON/OFF"), Heat Switch ("WINTER/SUMMER") and a Dual Air Switch ("HIGH/LOW"). Status indication for all these settings is available at the panel in addition to "SAFETY RELAY" and "FILTER LIGHT" warning indications. The INFI 90 can select "HIGH" or "LOW" for the dual air setting.

The location of this panel is found in Figure 18-4 while a layout is provided in Figure 18-5.

The INFI 90 monitors the following unit parameters:

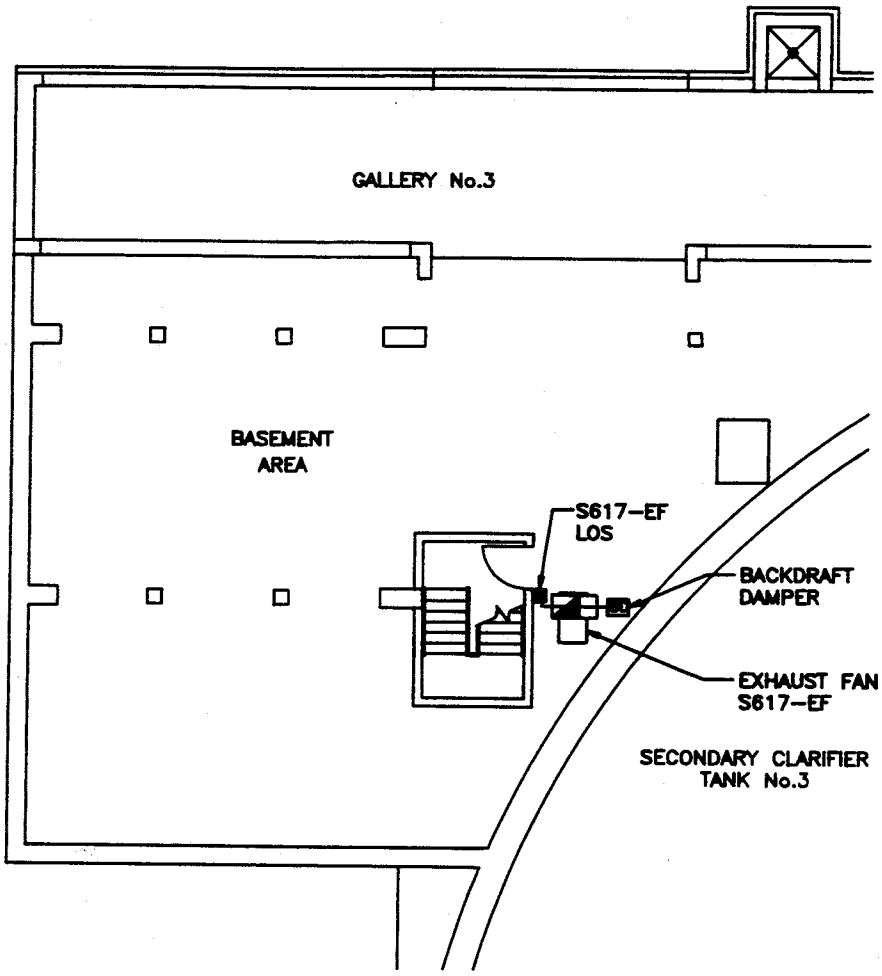
1. "BURNER ON" status;
2. "HIGH AIR FLOW" status;
3. "LOW AIR FLOW" status;
4. "FLAME FAILURE" alarm condition.

The unit may be shut down and locked-out using the "LOS" pushbutton field located near the unit. The pushbutton is shown in Figure 18-9.

Air handling unit S689-AHU provides heating and ventilating to the entire basement and gallery area of the Secondary Clarifier Area. A complete description of its monitoring, control, and sequence of operation has been provided in the previous section.

Outside air damper S616-VZ is controlled from a "COMP/HAND" switch at FDP-S. The "HAND" position allows an operator to manually control the damper using a "SUMMER/WINTER" position switch also at FDP-S. The "COMP" position surrenders damper control to the INFI 90.

The section of FDP-S dedicated to the control of this damper is shown in Figure 18-11.



BASEMENT FLOOR PLAN

CLARIFIER No.3 HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-10

The INFI 90 monitors the following damper parameters:

1. Damper "COMP/HAND" control switch status;
2. Damper "OPEN" status.

Gallery exhaust fan S617-EF is controlled from an "ON/OFF" switch at FDP-S. The fan is designed to run continuously so this switch should normally be in the "ON" position. Fan "RUN" status indication is available at the MCC and FDP-S. In addition, a fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S. The INFI 90 has no control over this fan.

The section of FDP-S dedicated to the monitoring and control of this fan is shown in Figure 18-11.

The INFI 90 monitors the following fan parameters:

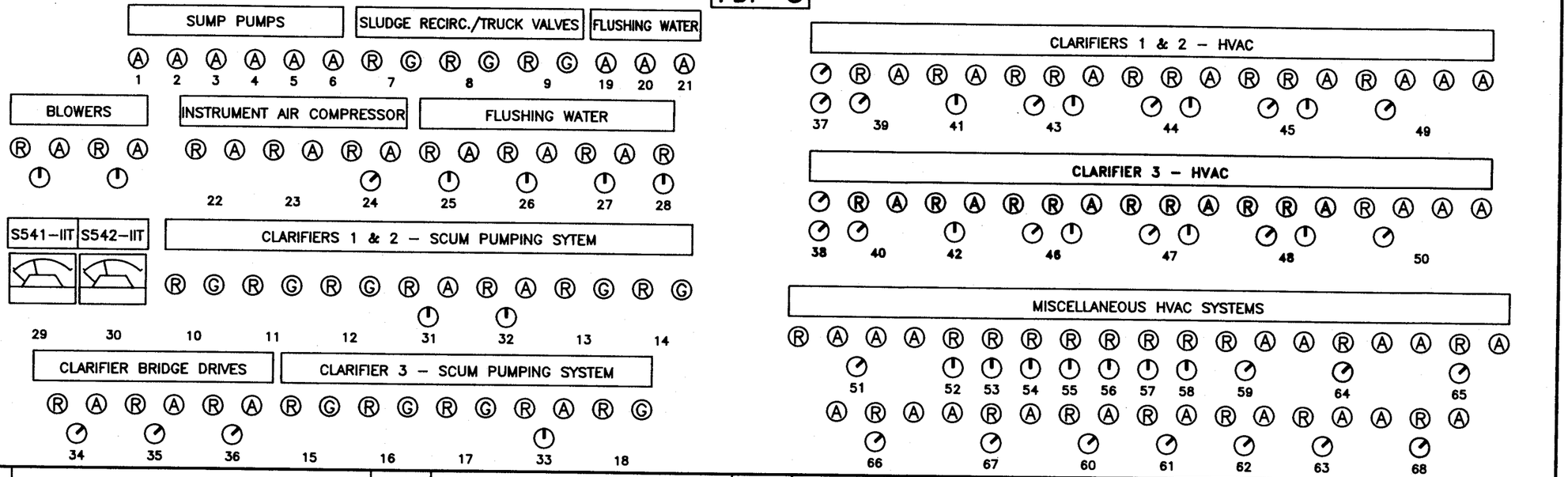
1. Fan "RUN" status;
2. Fan "FAILURE" alarm condition.

The fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. This pushbutton is shown in Figure 18-10.

Each of the building area exhaust fans, S619-EF, S620-EF, and S621-EF, is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "OFF" position disables the unit while the "HAND" position allows an operator to manually select fan speed using the "SLOW/FAST" switch also at FDP-S. The "COMP" position surrenders all fan control to the INFI 90 which can select fast or slow speed operation. Fan "SLOW SPEED" and "FAST SPEED" status indications are available at the MCC and FDP-S. In addition, a fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of these fans is shown in Figure 18-11.

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ⏲ – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION

Ⓐ A – HIGH LEVEL

No. 1–6

1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

Ⓡ Ⓒ A – OPEN, B – CLOSED

No. 7–18

7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV

Ⓐ A – LOSS OF SEAL WATER

No. 19–21

19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION

Ⓡ Ⓐ A – RUN, B – FAIL

No. 22–23

22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

Ⓡ Ⓐ, ⊘C: A – RUN, B – LOSS OF FLOW, C – OFF/ON

No.24

24	COMPRESSOR COOLING FAN – S537–FN

Ⓡ Ⓐ, ⏲C: A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND

No. 25–27

25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

Ⓡ A, ⏲B: A – RUN, B – COMP/OFF/HAND

No. 28

28	FLUSHING WATER PUMP – S553–FWP

Ⓡ Ⓐ, ⏲C, ▭D: A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT

No. 29–30

29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION

Ⓡ Ⓐ, ⏲C: A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND

No. 31–33

31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP

Ⓡ Ⓐ, ⊘C: A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON

No. 34–36

34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

⊘A: A – COMP/HAND
⊘B: B – SUMMER/WINTER

No. 37–38

37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

Ⓡ Ⓐ, ⊘C: A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 39–40

39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

Ⓡ Ⓐ, ⏲C: A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND

No. 41–42

41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION

Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW; ⊘D ⏲E: D – SLOW/FAST, E – COMP/OFF/HAND

No. 43–48

43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

Ⓡ Ⓐ Ⓐ ⊘E: A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON

No. 49–51

49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

Ⓡ B⏲: A – RUN, B – COMP/OFF/HAND

No. 52–58

52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

Ⓡ Ⓐ, ⊘C: A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 59–63

59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION

Ⓐ Ⓡ Ⓐ ⊘D: A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON

No. 64–68

64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

CLARIFIER No.3 HVAC SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–11

The INFI 90 monitors the following fan parameters:

1. Fan "COMP/OFF/HAND" control switch status;
2. Fan "SLOW SPEED" and "FAST SPEED" status;
3. Fan "FAILURE" alarm condition.

Each fan can be shut down and locked-out using the "LOS" pushbuttons field located near the unit. These pushbuttons are shown in Figure 18-9.

High speed exhaust fan S618-EF is controlled from a "COMP/OFF/HAND" switch at FDP-S. The "HAND" and "OFF" positions allow for manual control of the fan while the "COMP" position surrenders all control to the INFI 90. Fan "RUN" status indication is available at the MCC and FDP-S. In addition, a "LOSS OF FLOW" alarm condition is also monitored at FDP-S.

The section of FDP-S dedicated to the monitoring and control of this fan is shown in Figure 18-11.

The INFI 90 monitors the following fan parameters:

1. Fan "COMP/OFF/HAND" control switch status;
2. Fan "RUN" status;
3. Fan "FAILURE" alarm condition.

The fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. This pushbutton is shown in Figure 18-9.

Outside air temperature and building area temperature are monitored by temperature sensor/transmitters S615-TE/TT and S623-TE/TT respectively. The temperatures are displayed locally and reported to the INFI 90. Locations of the devices are shown in Figure 18-9.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-4. Equipment/Instrument Summary Table 18-5 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-12.

18.3.2.3 Sequence of Operation

Main Floor Area

Air handling unit S614-AHU is controlled by a supervisory control panel in the Control Room to maintain a minimum discharge temperature of 15°C. The unit is electrically interlocked so that it will only operate if any of the exhaust fans S619/S620/or S621-EF is running.

Upon a call for operation of any of the exhaust fans S619-EF, S620-EF, S621-EF, or S618-EF, the respective exhaust air damper is first opened. When a limit switch confirms the open status of the damper the fan is energized. Fan operation is monitored by a differential pressure switch which on loss of flow will shut down the fan and close the damper.

Exhaust fan S617-EF is designed to run continuously.

The ventilation system for this area has been designed to allow for operation of three, five, and ten air changes per hour (AC/hr). Three AC/hr is used during unmanned hours. Five AC/hr is used at all other times when the plant is operating normally. Ten AC/hr is used for maintenance purposes.

The following steps outline the ventilation control:

1. 3 AC/hr: S614-AHU is on low speed and one exhaust fan, S619-EF or S620-EF, is on high speed. If either fails, S621-EF will serve as back up;

TABLE 18-4

SECONDARY CLARIFIER NO. 3 HVAC SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S614-AHU	5-N	2F			5-N	5-N
S616-VZ	5-N	1F			5-N	5-N
S617-EF	5-N					5-N
S618-EF	5-N, OVERVIEW	6F			5-N	5-N
S619-EF	5-N, OVERVIEW	3F			5-N	5-N
S620-EF	5-N, OVERVIEW	4F			5-N	5-N
S621-EF	5-N, OVERVIEW	5F			5-N	5-N
S615-TI	5-N		5-N			5-N
S623-TI	5-N		5-N			5-N

TABLE 18-5

SECONDARY CLARIFIER NO. 3 HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S614-HS1	S614-AHU CONTROL (LOS)	S				
S614-UN	S614-AHU CONTROL (DUAL AIR)				C	
S614-BM	S614-AHU STATUS - BURNER ON				I	
S614-FH	S614-AHU STATUS - HIGH FLOW				I	
S614-FL	S614-AHU STATUS - LOW FLOW				I	
S614-QF	S614-AHU FLAME FAILURE				Q	
S616-HS1	S616-VZ CONTROL (COMP/HAND)			C	I	
S616-HS2	S616-VZ CONTROL (SUMMER/WINTER)			C		
S616-VD	S616-VZ CONTROL (OPEN)				C	
S616-ZD	S616-VZ STATUS - OPEN				I	
S617-HS1	S617-EF CONTROL (LOS)	S				
S617-HS2	S617-EF CONTROL (ON/OFF)			C		
S617-MM	S617-EF STATUS - RUN		I	I	I	
S617-QF	S617-EF FAN FAILURE			Q	Q	
S618-HS1	S618-EF CONTROL (LOS)	S				
S618-HS2	S618-EF CONTROL (COMP/OFF/HAND)			C	I	
S618-MN	S618-EF CONTROL (START/STOP)				C	
S618-MM	S618-EF STATUS - RUN		I	I	I	
S618-QF	S618-EF FAN FAILURE			Q	Q	
S619-HS1	S619-EF CONTROL (LOS)	S				
S619-HS2	S619-EF CONTROL (COMP/OFF/HAND)			C	I	
S619-HS3	S619-EF CONTROL (SLOW/FAST)			C		
S619-SB	S619-EF CONTROL (SLOW)				C	
S619-SD	S619-EF CONTROL (FAST)				C	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-12

(continued)

TABLE 18-5 (continued)

SECONDARY CLARIFIER NO. 3 HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S619-SL	S619-EF STATUS - SLOW		I	I	I	
S619-SH	S619-EF STATUS - FAST		I	I	I	
S619-QF	S619-EF FAN FAILURE			Q	Q	
S620-HS1	S620-EF CONTROL (LOS)	S				
S620-HS2	S620-EF CONTROL (COMP/OFF/HAND)			C	I	
S620-HS3	S620-EF CONTROL (SLOW/FAST)			C		
S620-SB	S620-EF CONTROL (SLOW)				C	
S620-SD	S620-EF CONTROL (FAST)				C	
S620-SL	S620-EF STATUS - SLOW		I	I	I	
S620-SH	S620-EF STATUS - FAST		I	I	I	
S620-QF	S620-EF FAN FAILURE			Q	Q	
S621-HS1	S621-EF CONTROL (LOS)	S				
S621-HS2	S621-EF CONTROL (COMP/OFF/HAND)			C	I	
S621-HS3	S621-EF CONTROL (SLOW/FAST)			C		
S621-SB	S621-EF CONTROL (SLOW)				C	
S621-SD	S621-EF CONTROL (FAST)				C	
S621-SL	S621-EF STATUS - SLOW		I	I	I	
S621-SH	S621-EF STATUS - FAST		I	I	I	
S621-QF	S621-EF FAN FAILURE			Q	Q	
S615-TT	OUTDOOR AIR TEMP.	I			I	-50 to 50°C
S623-TT	CLAR. NO. 3 BLDG TEMP.	I			I	0 to 30°C

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-12

2. 5 AC/hr: S614-AHU is on high speed and two exhaust fans, S619-EF and S620-EF, are on low speed. If either fails, S621-EF will serve as back up;

3. 10 AC/hr: S614-AHU is on high speed and high rate supply damper S616-VZ is open. Exhaust fan S619-EF is on high speed and S620-EF is on low speed. If either fails, S621-EF will serve as back up. Exhaust fan S618-EF is on.

Clarifier No. 3 Building Area HVAC System Start-up Procedures - Graphic 5N:

1. Press 5C and select: ten (10) air changes. Note: 10 air changes is used only during plant emergency or maintenance;

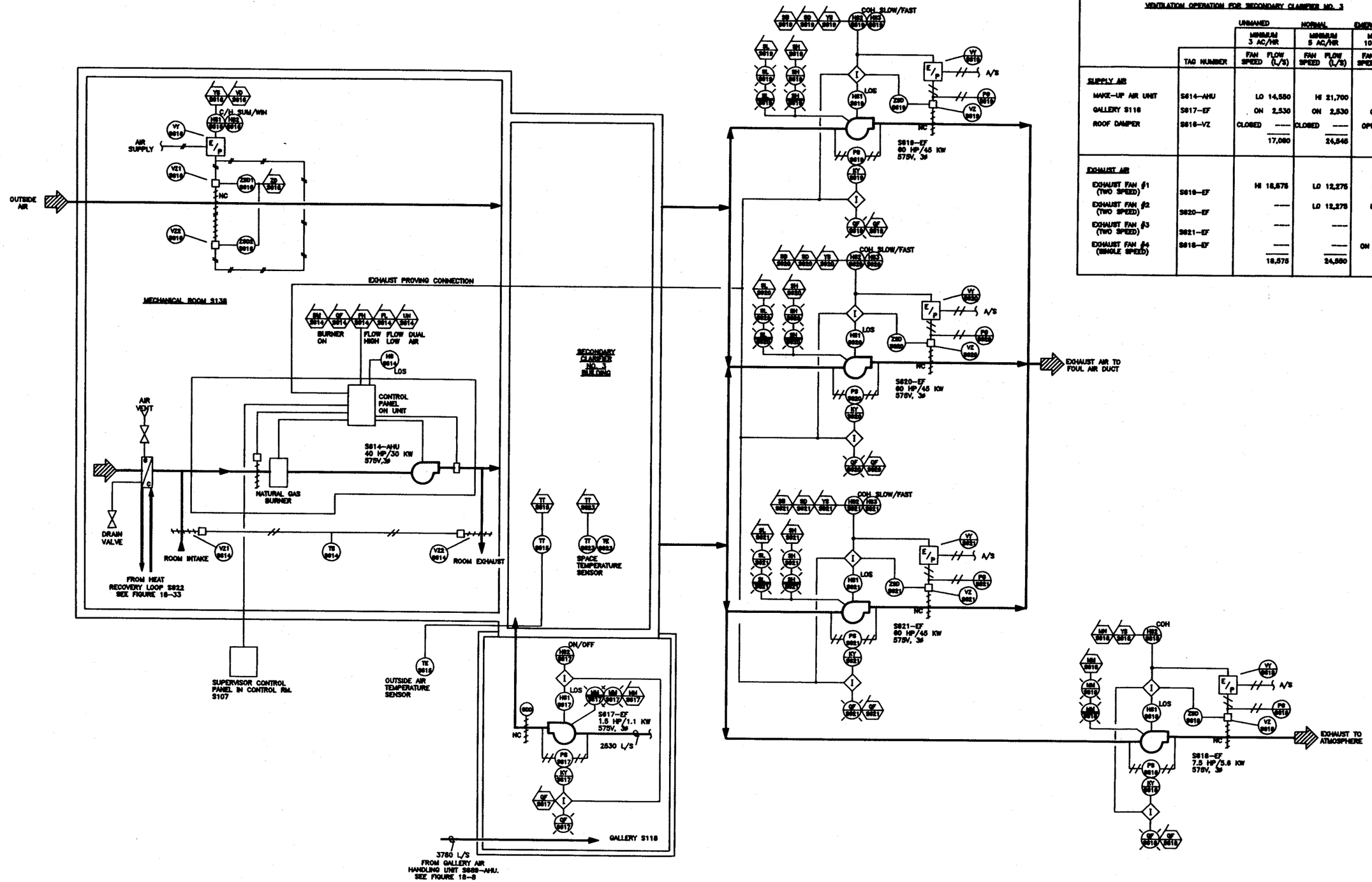
2. Three (3) or five (5) air change start/stop times are automatically selected by the "Security and HVAC Plant Time Edit" Overview;

3. In the event of one or more fan failure, there will be alarms for each fan. To restart the system without re-entering the start and stop times (air changes): Press 6C 'reset' and select "reset" to clear the trips. Note: the system will restart automatically.

18.3.3 Miscellaneous Area "S" HVAC System

18.3.3.1 System Description

Ambient air is replaced with fresh air to provide a more reasonable operating environment. Heating, cooling, and ventilating of the Electrical Room, Scrubber Room and Truck Bay Area, and the Secondary Pump Room is provided by Air Handling Units S683-AHU, S684-AHU, and S685-AHU respectively. Each unit has heating and/or cooling coils to warm or cool the air if necessary before discharging it into a specific area through ducts.

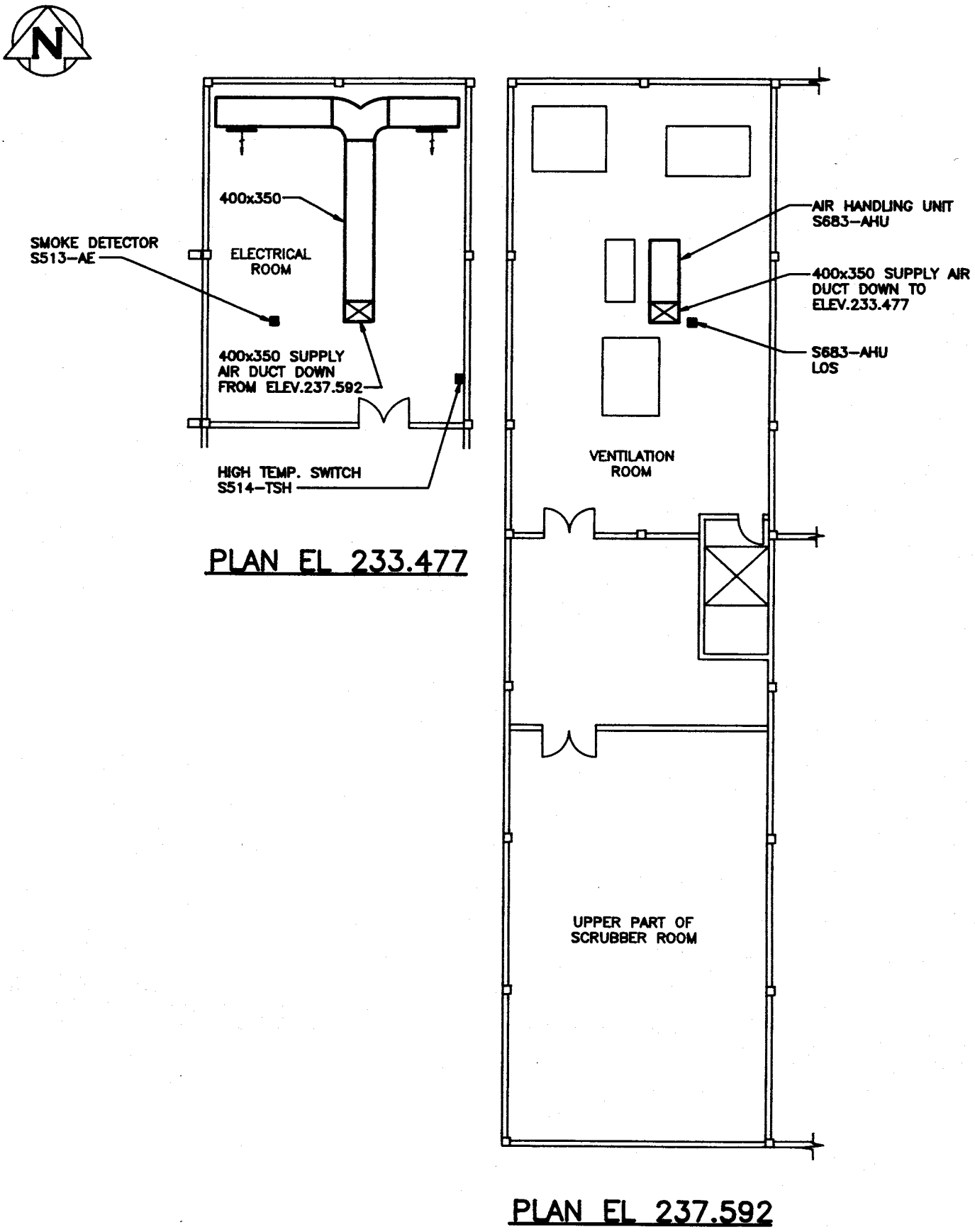


VENTILATION OPERATION FOR SECONDARY CLARIFIER NO. 3

	TAG NUMBER	UNMANED MINIMUM 3 AC/HR FAN SPEED	FLOW (L/s)	NORMAL MINIMUM 5 AC/HR FAN SPEED	FLOW (L/s)	EMERG/MAINT MINIMUM 10 AC/HR FAN SPEED	FLOW (L/s)
SUPPLY AIR							
MAKE-UP AIR UNIT	S814-AHU	LO	14,550	HI	21,700	HI	21,700
GALLERY S118	S817-EF	ON	2,530	ON	2,530	ON	2,530
ROOF DAMPER	S816-VZ	CLOSED	----	CLOSED	----	OPEN	23,305
			17,080		24,845		47,880
EXHAUST AIR							
EXHAUST FAN #1 (TWO SPEED)	S818-EF	HI	18,575	LO	12,275	HI	18,575
EXHAUST FAN #2 (TWO SPEED)	S820-EF		----	LO	12,275	LO	12,275
EXHAUST FAN #3 (TWO SPEED)	S821-EF		----		----		----
EXHAUST FAN #4 (SINGLE SPEED)	S816-EF		----		----	ON	17,000
			18,575		24,550		47,880

CLARIFIER No.3 HVAC SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-12



ELECTRICAL ROOM HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-13

Air is exhausted from the Secondary Pump Room by Exhaust Fan S686-EF to the atmosphere. Air is exhausted from the Truck Bay Area, the Scrubber Room, and the Compressor Room by Exhaust Fans S687-EF, S691-EF, and S611-EF respectively into the Clarifier No. 1 and 2 Building Area. From here the exhaust fans described in the previous section discharge the air to the foul air duct.

High temperature and smoke alarm conditions in the Electrical Room are monitored.

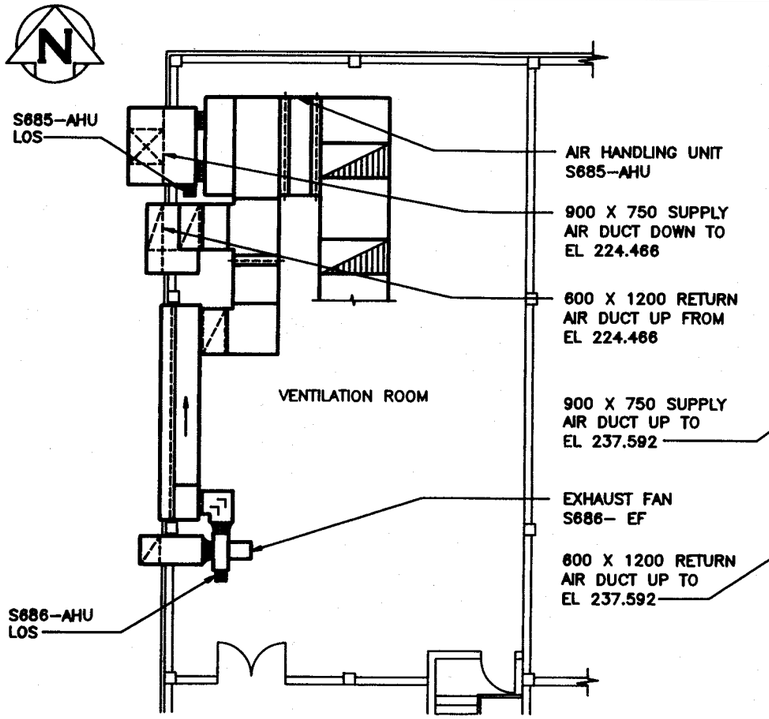
A summary of the equipment described in this section is as follows:

1. Three air handling units: S683-AHU, S684-AHU, and S685-AHU;
2. Four exhaust fans: S686-EF, S687-EF, S691-EF, and S611-EF;
3. One high temperature switch: S514-TSH;
4. One smoke detector: S513-AE.

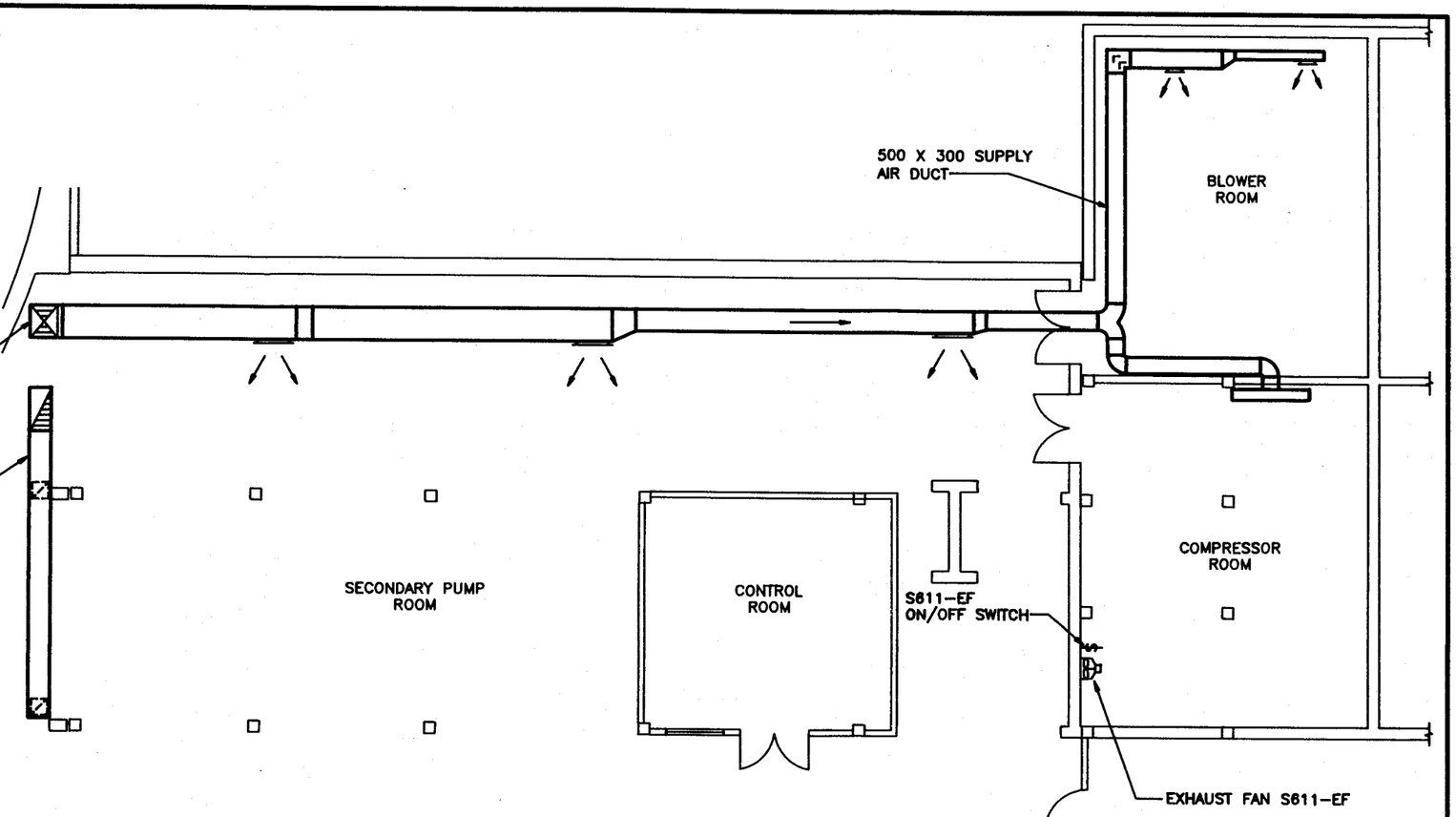
Equipment locations are found on the floor plans shown in Figures 18-13, 18-14, and 18-15.

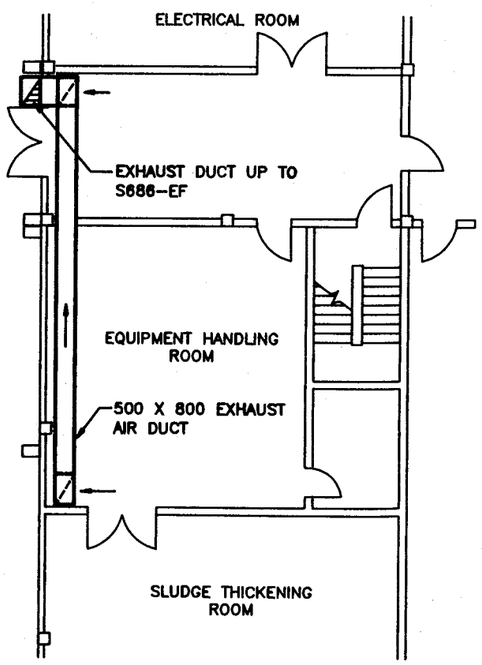
18.3.3.2 Monitoring and Control

Each of the air handling units, S683-AHU, S684-AHU, and S685-AHU, is controlled from an "ON/OFF" switch at FDP-S. The unit is designed to run continuously so this switch should manually be in the "ON" position. Unit "RUN" status indication is available at the MCC and FDP-S. "LOW TEMP FREEZE" and "LOSS OF FLOW" alarm conditions are also monitored at FDP-S. The setpoint at which the unit will maintain space temperature is set from the INFI 90. The INFI 90 has no other control over the unit. The unit supply air temperature is displayed on a gauge at ventilation panel SCP-1 located in the Ventilation Room. In addition, the mixed air temperature for units S683-AHU and S685-AHU is also displayed on gauges at SCP-1.

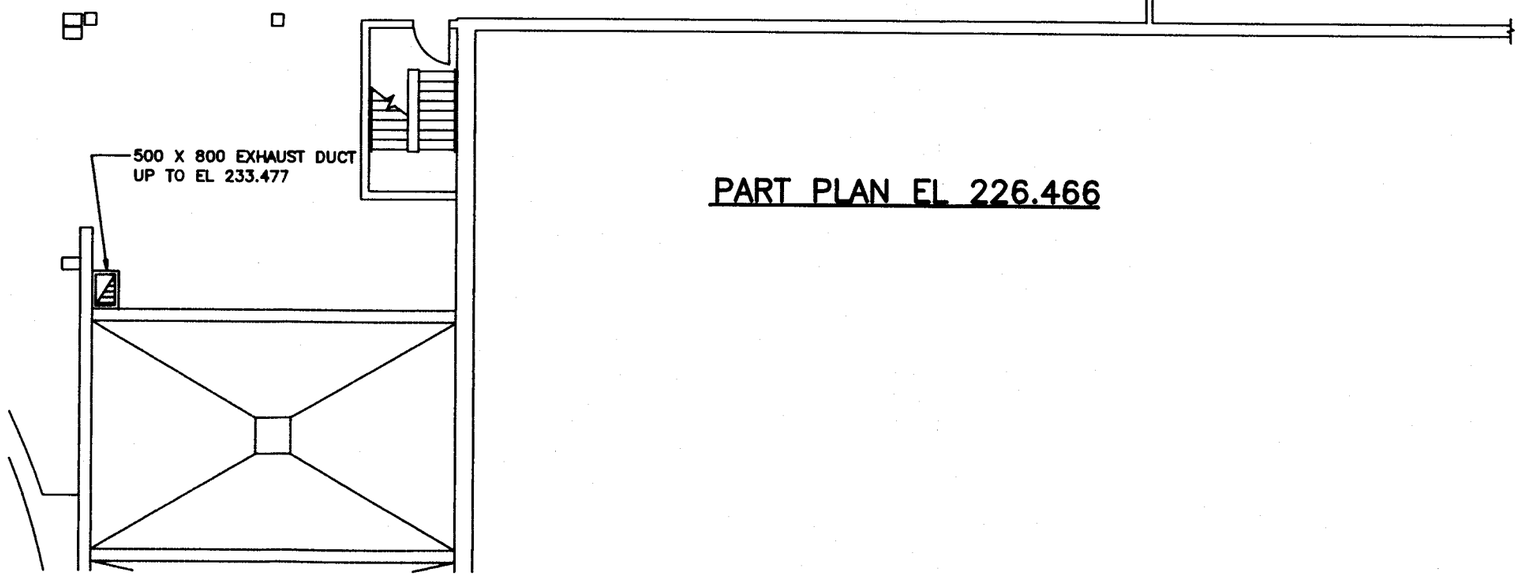


PART PLAN EL 237.592





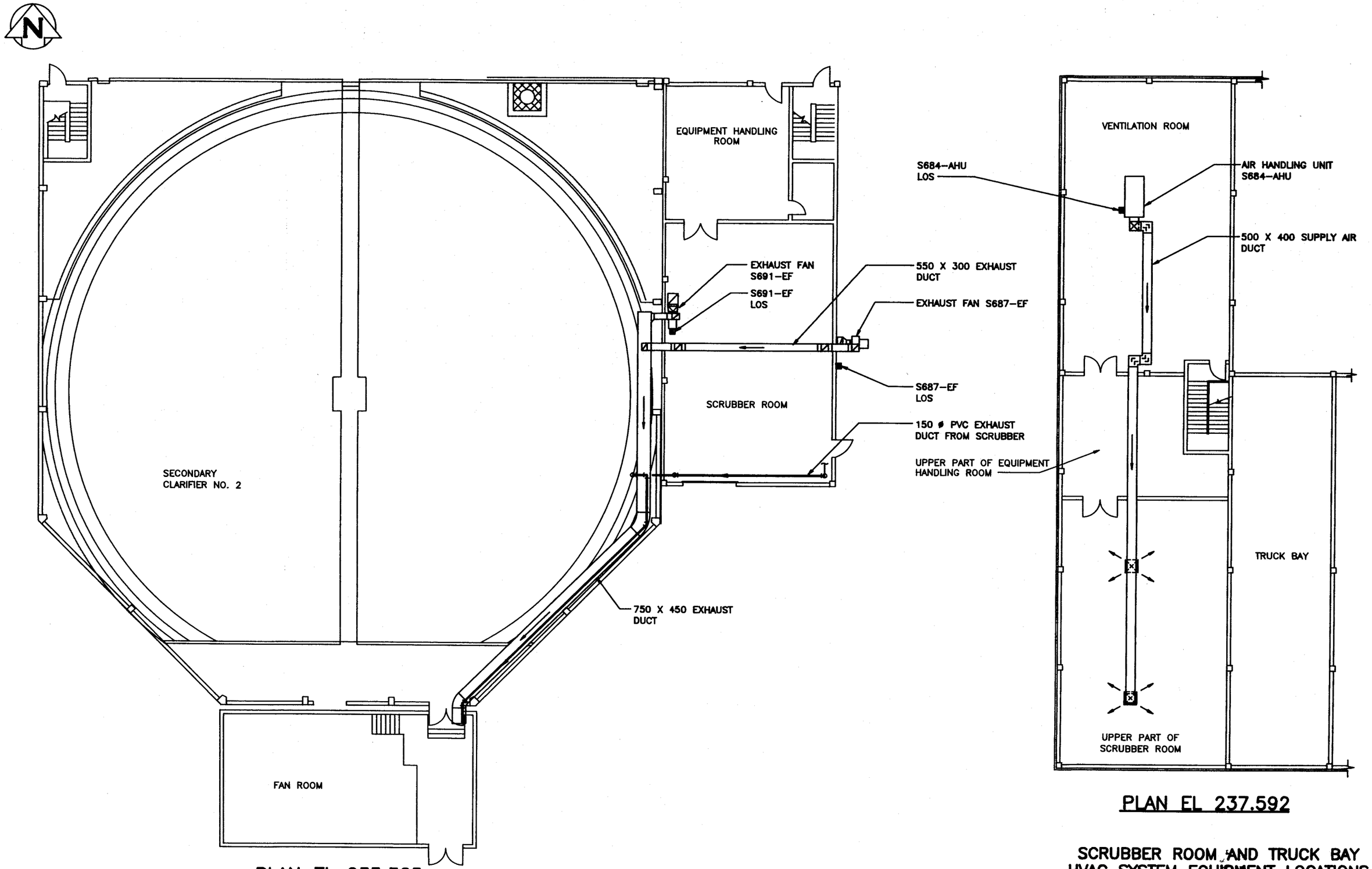
PART PLAN EL 233.477



PART PLAN EL 226.466

SECONDARY PUMP ROOM
HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18–14



PLAN EL 235.305

PLAN EL 237.592

SCRUBBER ROOM AND TRUCK BAY HVAC SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18–15

The sections of FDP-S dedicated to the monitoring and control of these units is shown in Figure 18-16. The location of panel SCP-1 is shown in Figure 18-3 while a layout is provided in Figure 18-7.

The INFI 90 monitors the following unit parameters:

1. Unit "RUN" status;
2. Unit "COMMON FAILURE" alarm condition due to low temperature freeze or loss of flow.

Each unit may be shut down and locked-out using the "LOS" pushbutton field located near the unit. These pushbuttons are shown in Figures 18-13, 18-14, and 18-15.

Each of the area exhaust fans S686-EF, S687-EF, and S691-EF is controlled from an "ON/OFF" switch at FDP-S. The fan is designed to run continuously so this switch should normally be in the "ON" position. Fan "RUN" status indication is available at the MCC and FDP-S. In addition, a fan "LOSS OF FLOW" alarm condition is also monitored at FDP-S. The INFI 90 has no control over this fan.

The section of FDP-S dedicated to the monitoring and control of these fans is shown in Figure 18-16.

The INFI 90 monitors the following fan parameters:

1. Fan "RUN" status;
2. Fan "FAILURE" alarm condition.

Each fan can be shut down and locked-out using the "LOS" pushbutton field located near the unit. These pushbuttons are shown in Figures 18-14 and 18-15.

Compressor Room fan S611-EF is controlled from a wall mounted "ON/OFF" switch located near the unit. The fan is designed to run continuously so this switch should

normally be in the "ON" position. There is no other formal monitoring or control of this fan. The fan and switch location is shown in Figure 18-14.

The INFI 90 monitors the following parameters:

1. Electrical Room smoke alarm condition;
2. Electrical Room high temperature alarm condition.

The locations of these devices are shown in Figure 18-13.

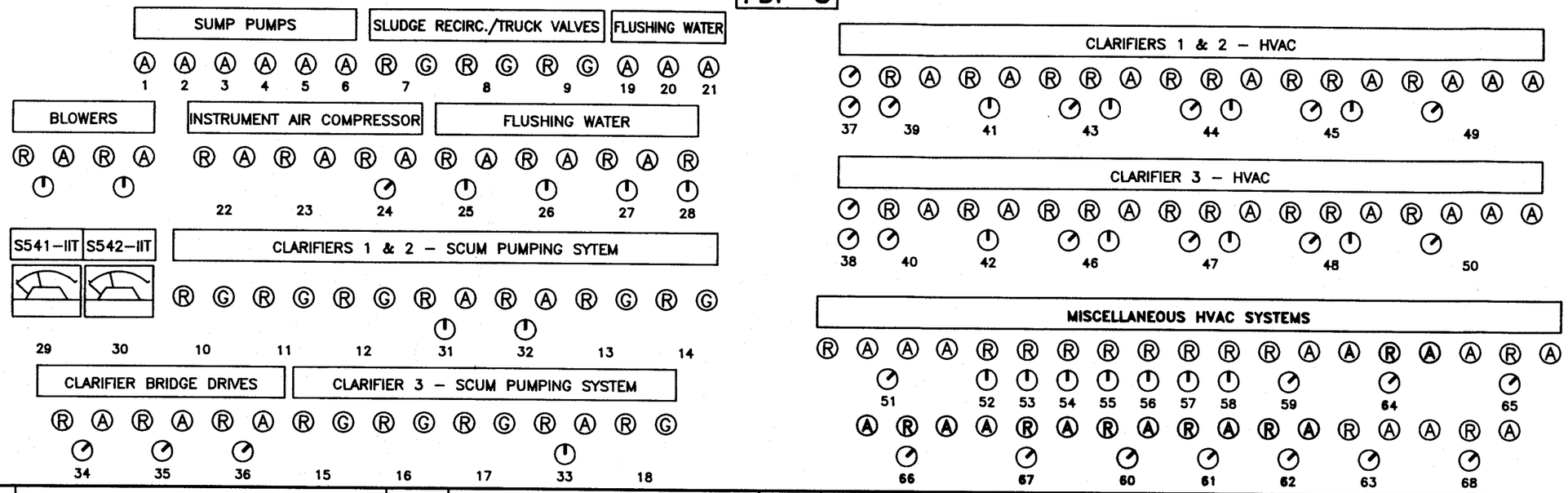
Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-6. Equipment/Instrument Summary Table 18-7 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-17.

18.3.3.3 Sequence of Operation

Electrical Room air handling unit S683-AHU is designed to cool the Electrical Room utilizing the plant cooling water system. It runs continuously with the control switch at FDP-S in the "ON" position. E/P relay S683-VY1 is switched to enable mixed air temperature modulation, as sensed by the mixed air transmitter S683-TE3, through dampers S683-VZ1 and S683-VZ2 and as controlled by pneumatic temperature controller S683-TC3.

With outdoor air temperature below 18°C discharge air temperature shall be maintained at 12.8°C by pneumatic temperature controller S683-TC which will modulate the face and bypass dampers S683-VZ3, and the three way control valve S683-TV in response to the discharge air temperature sensed by the discharge air transmitter S683-TE2. The discharge air set point can be reset from the INFI 90.

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	Ⓐ A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	Ⓡ Ⓖ A – OPEN, B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	Ⓐ A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ C – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	Ⓡ Ⓐ A – RUN, B – PUMP FAIL, C① C – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A Ⓡ, B① A – RUN, B – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	Ⓡ Ⓐ A – RUN, B – FAIL, C① C – COMP/OFF/HAND, D D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	Ⓡ Ⓐ A – RUN, B – LOSS OF SEAL WATER, C① C – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	Ⓡ Ⓐ A – RUN, B – HIGH TORQUE FAIL, C⊘ C – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A⊘ A – COMP/HAND, B⊘ B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ C – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C① C – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW, D⊘ E① D – SLOW/FAST, E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	Ⓡ Ⓐ Ⓐ Ⓐ A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E⊘ E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	AⓇ A – RUN, B① B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	Ⓡ Ⓐ A – RUN, B – LOSS OF FLOW, C⊘ C – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – R681–EF

No.	DESCRIPTION
	Ⓐ Ⓡ Ⓐ D⊘ A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – R682–AHU

AREA 'S' HVAC SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–16

TABLE 18-6

AREA "S" HVAC SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S683-AHU	5-O	1T		5-O		5-O
S684-AHU	5-O	2T		5-O		5-O
S685-AHU	5-O	3T		5-O		5-O
S686-EF	5-O					5-O
S687-EF	5-O					5-O
S691-EF	5-O					5-O
S513-XA	5-O					5-O
S514-TH	5-O					5-O

TABLE 18-7

AREA "S" HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-1	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S683-HS1	S683-AHU CONTROL (LOS)	S				
S683-HS2	S683-AHU CONTROL (ON/OFF)			C		
S683-MM	S683-AHU STATUS - RUN	I*		I	I	* AT MCC
S683-FF	S683-AHU LOSS OF FLOW			A		
S683-TAL	S683-AHU LOW TEMP FREEZE			A		<2°C
S683-QF	S683-AHU COMMON FAILURE				Q	
S683-TC	S683-AHU TEMP. SETPOINT				C	
S683-TG1	S683-AHU OUTSIDE AIR TEMP.		I			-40 to 120°F
S683-TG2	S683-AHU SUPPLY AIR TEMP.		I			0 to 100°F
S683-TG3	S683-AHU MIXED AIR TEMP.		I			0 to 100°F
S684-HS1	S684-AHU CONTROL (LOS)	S				
S684-HS2	S684-AHU CONTROL (ON/OFF)			C		
S684-MM	S684-AHU STATUS - RUN	I*		I	I	* AT MCC
S684-FF	S684-AHU LOSS OF FLOW			A		
S684-TAL	S684-AHU LOW TEMP FREEZE			A		<2°C
S684-QF	S684-AHU COMMON FAILURE				Q	
S684-TC	S684-AHU TEMP. SETPOINT				C	
S684-TG	S684-AHU SUPPLY AIR TEMP.		I			0 to 100°F
S685-HS1	S685-AHU CONTROL (LOS)	S				
S685-HS2	S685-AHU CONTROL (ON/OFF)			C		
S685-MM	S685-AHU STATUS - RUN	I*		I	I	* AT MCC
S685-FF	S685-AHU LOSS OF FLOW			A		
S685-TAL	S685-AHU LOW TEMP FREEZE			A		<2°C
S685-QF	S685-AHU COMMON FAILURE				Q	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-17

(contin...)

TABLE 18-7 (continued)

AREA "S" HVAC SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	SCP-1	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S685-TC	S685-AHU TEMP. SETPOINT				C	
S685-TG1	S685-AHU MIXED AIR TEMP.		I			0 to 100°F
S685-TG2	S685-AHU SPACE TEMP.		I			50 to 100°F
S686-HS1	S686-EF CONTROL (LOS)	S				
S686-HS2	S686-EF CONTROL (ON/OFF)			C		
S686-MM	S686-EF STATUS - RUN	I*		I	I	* AT MCC
S686-QF	S686-EF FAN FAILURE			Q	Q	
S687-HS1	S687-EF CONTROL (LOS)	S				
S687-HS2	S687-EF CONTROL (ON/OFF)			C		
S687-MM	S687-EF STATUS - RUN	I*		I	I	* AT MCC
87-QF	S687-EF FAN FAILURE			Q	Q	
S691-HS1	S691-EF CONTROL (LOS)	S				
S691-HS2	S691-EF CONTROL (ON/OFF)			C		
S691-MM	S691-EF STATUS - RUN	I*		I	I	* AT MCC
S691-QF	S691-EF FAN FAILURE			Q	Q	
S513-AE	ELECTRICAL ROOM SMOKE ALARM	A			A	
S514-TA	ELECTRICAL ROOM HIGH TEMP.				A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-17

With outdoor air temperature above 18°C, as sensed by outdoor air temperature sensor S683-TE1, through pneumatic switch S683-VY2 the three way cooling control valve S683-TV will open to the full cool position and the pneumatic controller S683-TC will modulate only the face and bypass dampers S683-VZ3 to maintain desired discharge air temperature.

Fan operation shall be monitored by differential pressure switch S683-PS which on loss of flow shall shut down fan, cause the chilled water control valve S683-TV and the outdoor air and return air dampers to go to the fail safe position.

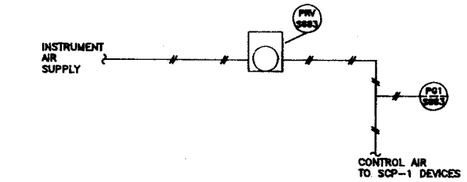
On a low limit indication by the low limit switch S683-TSL (below 2°C), the fan shall be stopped, the dampers S683-VZ1/VZ2/VZ3 and the control valve shall all move to their fail safe positions.

There shall be a high temperature alarm indication by high limit thermostat S514-TSH if the space temperature exceeds the high limit set point.

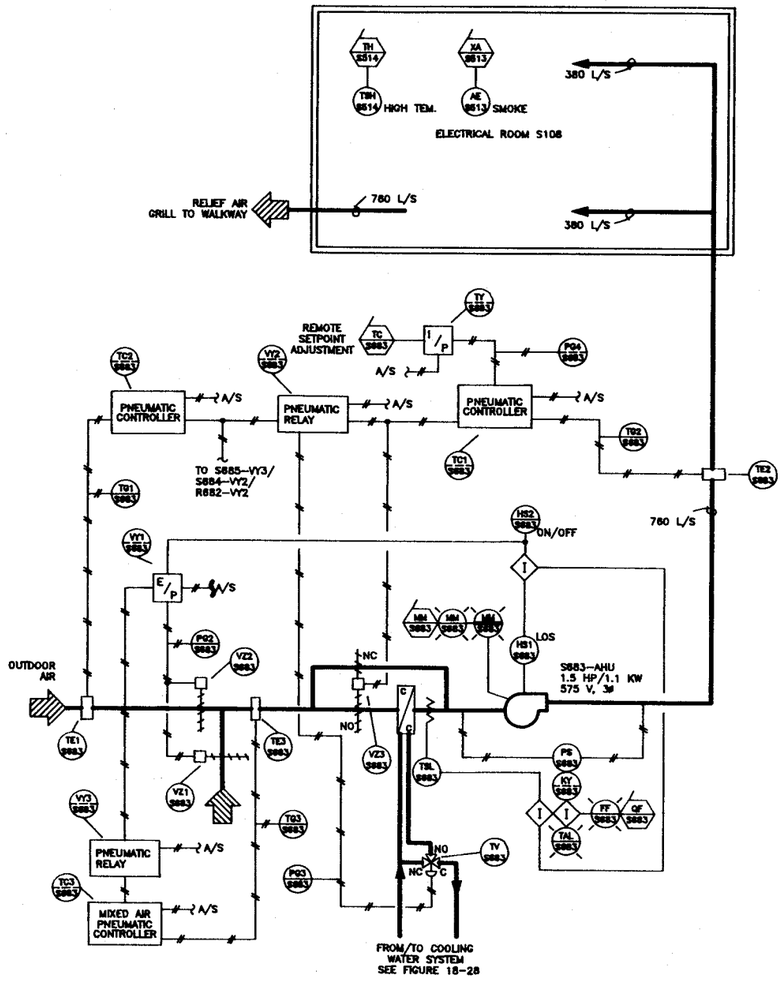
The sludge thickening and truck bay rooms are heated by an air handling unit S684-AHU which utilizes the plant heat recovery system and hot water heating system. It runs continuously with the control switch at FDP-S in the "ON" position. E/P relay S684-VY1 shall drive outdoor air damper S684-VZ1 to the fully open position.

With outdoor air temperature above 4°C as sensed by outdoor air temperature sensor S683-TE1, the positioning relay S684-VY2 shall allow the temperature controller S684-TC to modulate the face and bypass dampers S684-VZ2, and the three way hot water heating valve S684-TV to maintain the discharge air temperature as sensed by ductstat S684-TE. The discharge air set point can be reset from the INFI 90.

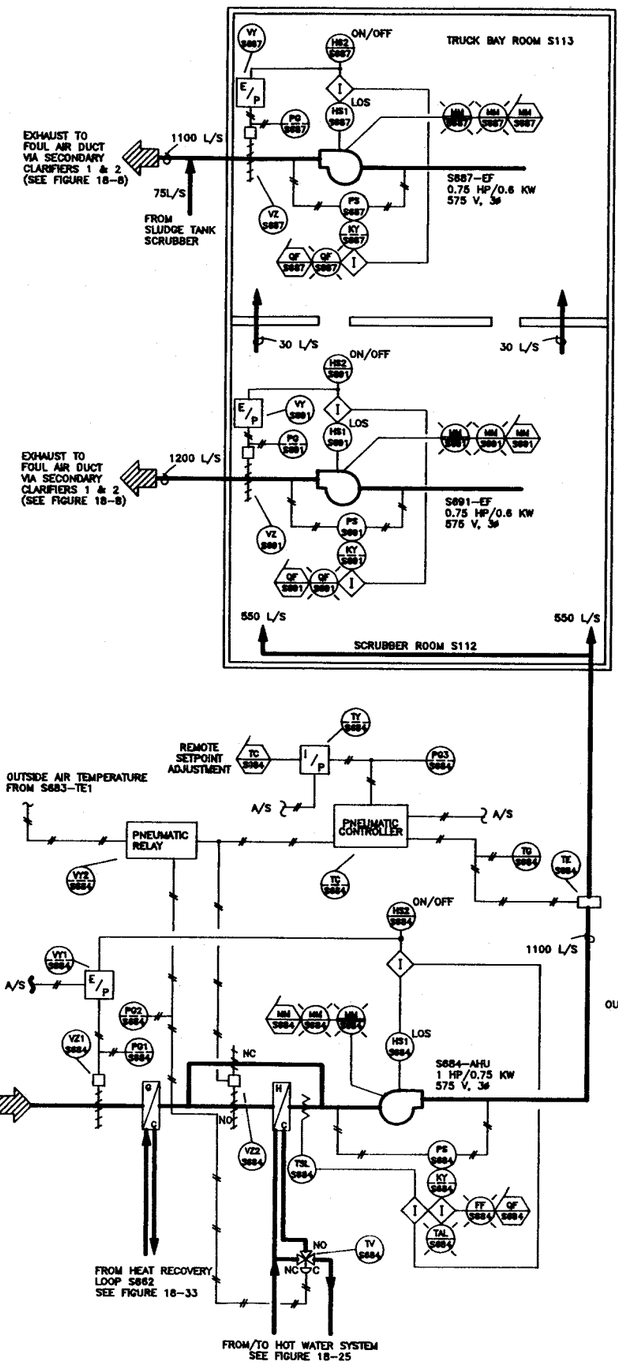
With outside air temperature below 4°C, through pneumatic relay S684-VY2, the three way hot water control valve S684-TV will move to full heat position. Discharge air temperature shall be maintained at 12.8°C by pneumatic temperature controller S684-TC, which will modulate the face and bypass dampers S684-VZ2 in response to the discharge air temperature sensed by the ductstat discharge air transmitter S684-TE.



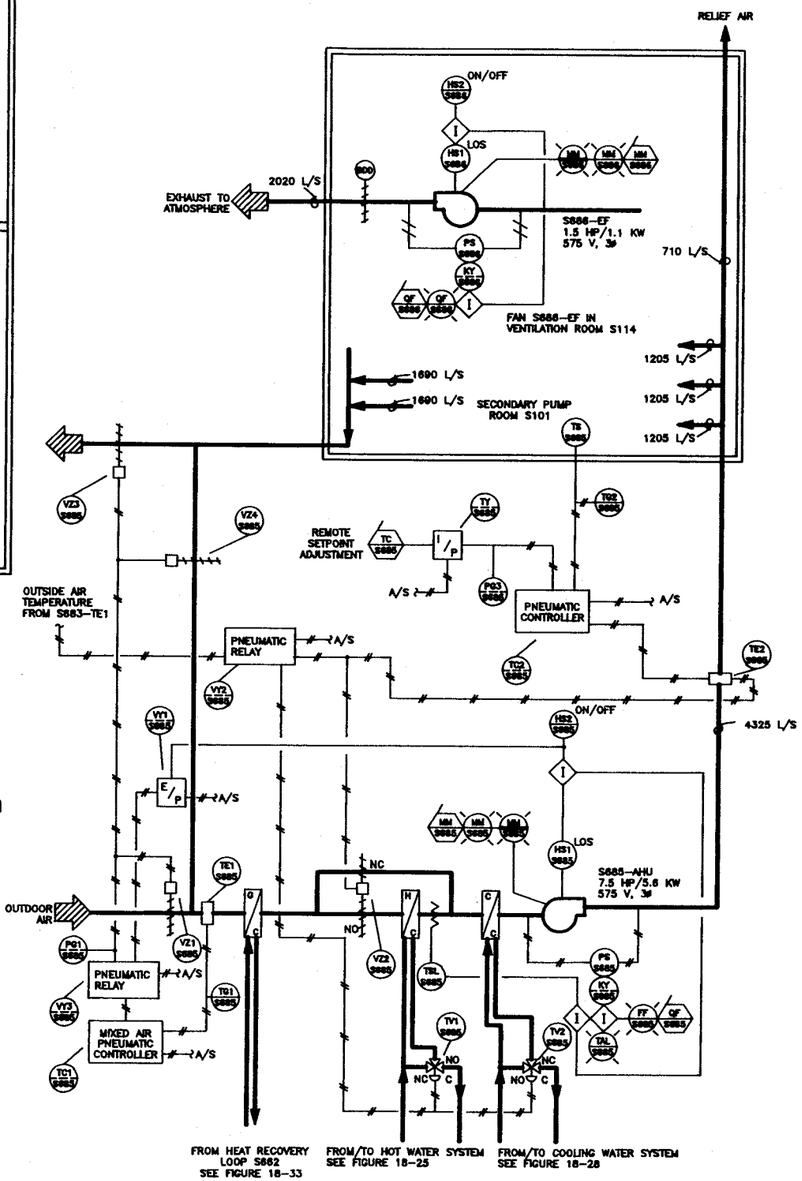
HVAC PRESSURE REDUCING STATION



ELECTRICAL ROOM VENTILATION SYSTEM



SCRUBBER ROOM & TRUCK BAY VENTILATION SYSTEM



SECONDARY PUMP ROOM VENTILATION SYSTEM

AREA 'S' HVAC SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-17

The section of FDP-S dedicated to the monitoring and control of these devices is shown in Figure 18-27.

The INFI 90 monitors the following pump or fan parameters:

1. Unit "COMP/OFF/HAND" control switch status;
2. Unit "RUN" status.

Each pump or fan may be shut down and locked-out using the "LOS" pushbutton field located near the unit. These pushbuttons are shown in Figure 18-26.

Low cooling water flow in both loops is sensed by switches S667-FSL and S679-FSL. High and low cooling water temperature is sensed by switches S649-TSH and S649-TSL. These switches signal an alarm to the INFI 90 and are located in Figure 18-26.

The two chiller units, S647-CH and S648-CH, run automatically on their own integral controls as determined by the system conditions. The INFI 90 has no control over these units; however, it does monitor the following parameters:

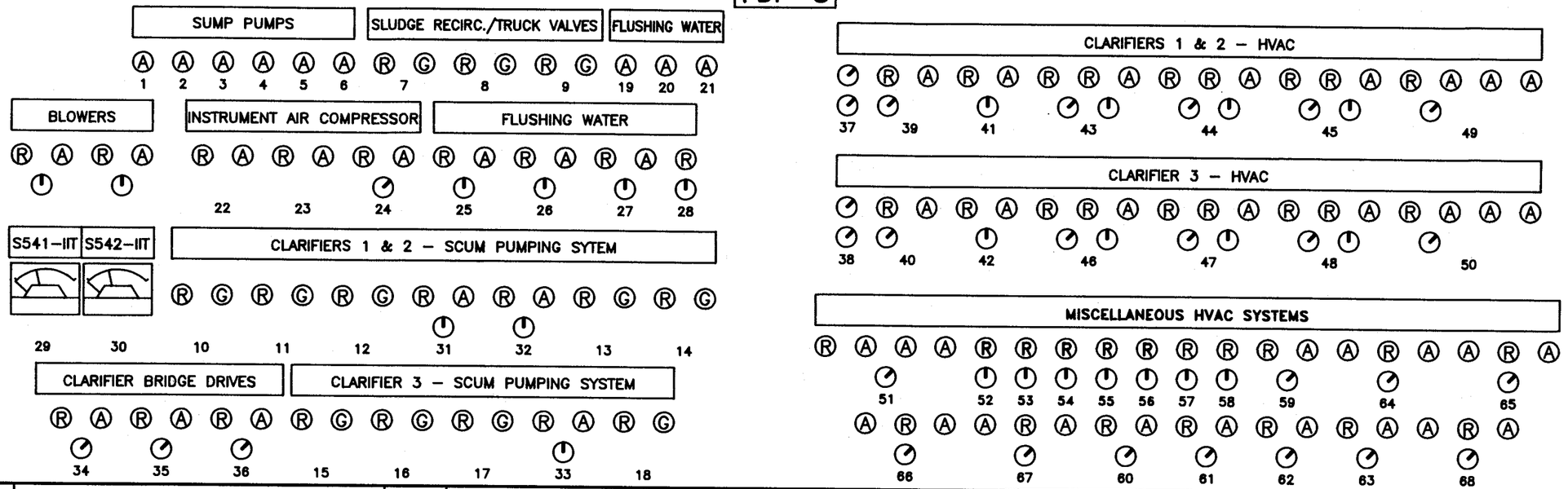
1. Chiller unit "RUN" status;
2. Chiller unit "FAILURE" alarm condition.

Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-12. Equipment/Instrument Summary Table 18-13 provides a detailed summary of all control, monitoring, and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-28.

18.3.6.3 Sequence of Operation

The cooling tower pumps are selected to run manually or automatically, controlled by the "COMP/OFF/HAND" switch. In "HAND" mode the pumps run until switched "OFF". In

FDP–S



LEGEND

- Ⓡ – RED PILOT LIGHT
- Ⓐ – AMBER PILOT LIGHT
- Ⓖ – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION

Ⓐ A – HIGH LEVEL

No. 1–6

1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP

Ⓡ Ⓖ A – OPEN, B – CLOSED

No. 7–18

7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV

Ⓐ A – LOSS OF SEAL WATER

No. 19–21

19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION

Ⓡ Ⓐ A – RUN, B – FAIL

No. 22–23

22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC

Ⓡ Ⓐ ⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON

No.24

24	COMPRESSOR COOLING FAN – S537–FN

Ⓡ Ⓐ ① A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND

No. 25–27

25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP

Ⓡ ① A – RUN, B – COMP/OFF/HAND

No. 28

28	FLUSHING WATER PUMP – S553–FWP

Ⓡ Ⓐ ① A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT

No. 29–30

29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION

Ⓡ Ⓐ ① A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND

No. 31–33

31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP

Ⓡ Ⓐ ⊘ A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON

No. 34–36

34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC

A⊘ A – COMP/HAND
B⊘ B – SUMMER/WINTER

No. 37–38

37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ

Ⓡ Ⓐ ⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 39–40

39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF

Ⓡ Ⓐ ① A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND

No. 41–42

41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION

Ⓡ Ⓡ Ⓐ A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND

No. 43–48

43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF

Ⓡ Ⓐ Ⓐ Ⓐ ⊘ A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON

No. 49–51

49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP

A Ⓡ A – RUN
B① B – COMP/OFF/HAND

No. 52–58

52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP

Ⓡ Ⓐ ⊘ A – RUN, B – LOSS OF FLOW, C – OFF/ON

No. 59–63

59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION

Ⓐ Ⓡ Ⓐ D⊘ A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON

No. 64–68

64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

COOLING WATER SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–27

TABLE 18-12

COOLING WATER SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S667-CWP	5-Q	2P	5-Q		5-Q	5-Q
S668-CWP	5-Q	3P	5-Q		5-Q	5-Q
S667-FA	5-Q					5-Q
S647-CH	5-Q					5-Q
S648-CH	5-Q					5-Q
S649-FN	5-Q	5P			5-Q	5-Q
S649-TH	5-Q					5-Q
S649-TL	5-Q					5-Q
S679-CWP	5-Q	7P	5-Q		5-Q	5-Q
S680-CWP	5-Q	8P	5-Q		5-Q	5-Q
S679-FA	5-Q					5-Q

TABLE 18-13

COOLING WATER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S667-HS1	S667-CWP CONTROL (LOS)	S				
S667-HS2	S667-CWP CONTROL (COMP/OFF/HAND)			C	I	
S667-MN	S667-CWP CONTROL (START/STOP)				C	
S667-MM	S667-CWP STATUS - RUN		I	I	I	
S668-HS1	S668-CWP CONTROL (LOS)	S				
S668-HS2	S668-CWP CONTROL (COMP/OFF/HAND)			C	I	
S668-MN	S668-CWP CONTROL (START/STOP)				C	
S668-MM	S668-CWP STATUS - RUN		I	I	I	
S667-FA	CHILLED WATER LOW FLOW				A	
S647-MM	CHILLER COMP. #1 STATUS - RUN				I	
S647-QF	CHILLER COMP. #1 FAILURE				Q	
S648-MM	CHILLER COMP. #2 STATUS - RUN				I	
S648-QF	CHILLER COMP. #2 FAILURE				Q	
S649-HS1	S649-EF CONTROL (LOS)	S				
S649-HS2	S649-EF CONTROL (COMP/OFF/HAND)			C	I	
S649-MN	S649-EF CONTROL (START/STOP)				C	
S649-MM	S649-EF STATUS - RUN		I	I	I	
S649-TAH	TOWER INPUT WATER HIGH TEMP.				A	
S649-TAL	TOWER DISCHARGE WATER LOW TEMP.				A	
S679-HS1	S679-CWP CONTROL (LOS)	S				
S679-HS2	S679-CWP CONTROL (COMP/OFF/HAND)			C	I	
S679-MN	S679-CWP CONTROL (START/STOP)				C	
S679-MM	S679-CWP STATUS - RUN		I	I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-28

(continued)

TABLE 18-13 (continued)

COOLING WATER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S680-HS1	S680-CWP CONTROL (LOS)	S				
S680-HS2	S680-CWP CONTROL (COMP/OFF/HAND)			C	I	
S680-MN	S680-CWP CONTROL (START/STOP)				C	
S680-MM	S680-CWP STATUS - RUN		I	I	I	
S679-PG	TOWER WATER SYSTEM PRESS	I				0 to 60 psi
S679-FA	TOWER WATER LOW FLOW				A	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-28

"COMPUTER" mode pumps S679-CWP and S680-CWP shall operate on a duty/standby mode as designated by the INFI 90. If a low flow signal is received by the INFI 90 from the flow switch S679-FSL, the INFI 90 shall start the standby pump.

Chilled water pumps S667-CWP and S668-CWP operate in the same way as cooling tower pumps S679-CWP and S680-CWP, using switch S667-FSL to start the standby pump from the INFI 90.

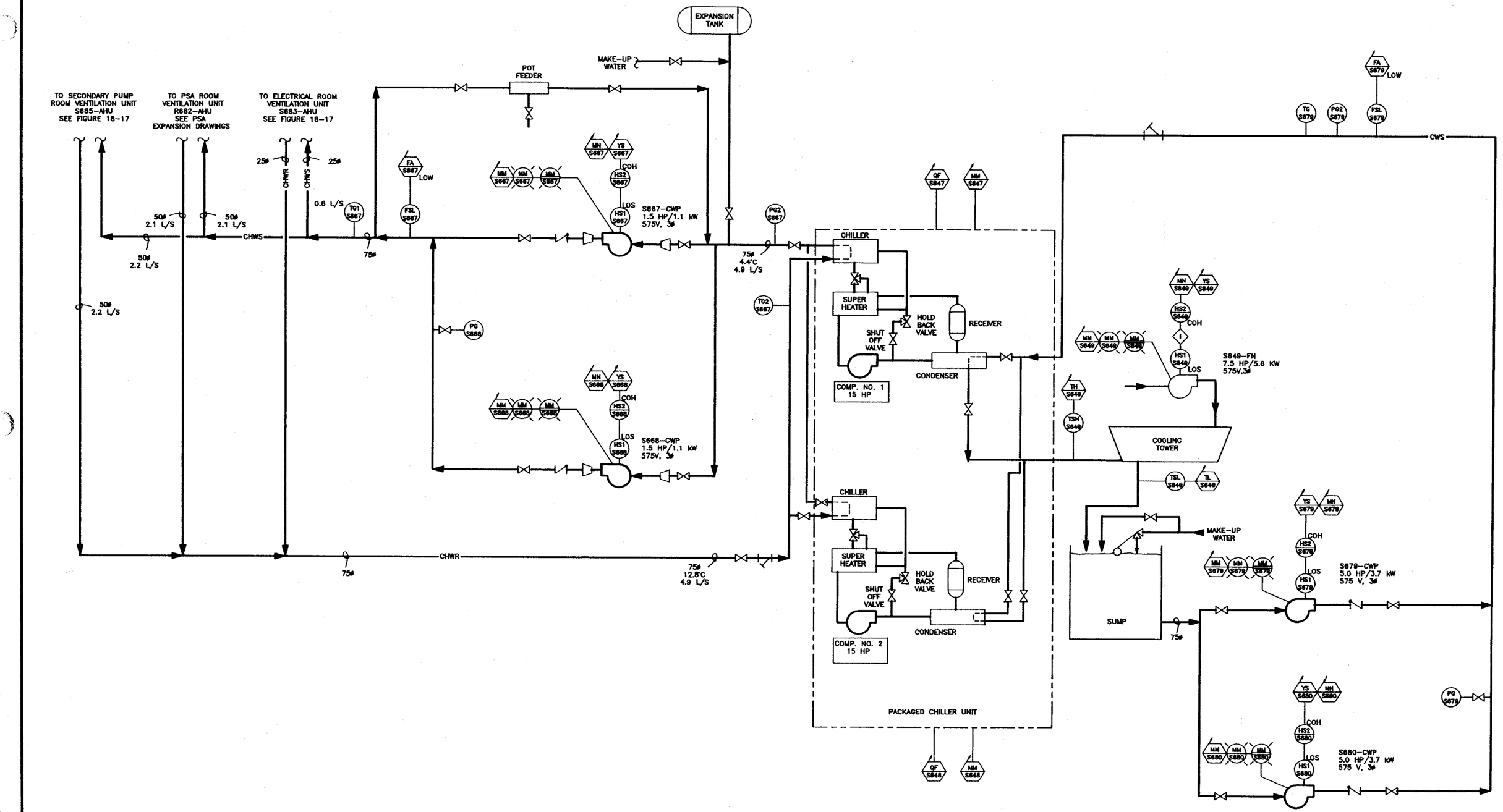
The reciprocating chiller S648-CH shall run on its integral controls.

Cooling tower fan S649-FN is selected to be manually or automatically controlled by "COMPUTER/OFF/HAND" switch. In the "HAND" mode, the fan is selected to run and operates until the switch is turned to "OFF" position. In the "COMPUTER" mode, the INFI 90 starts and stops the fan as required. The fan will only be permitted to start when the INFI 90 has received the run signal from chiller S648-CH.

When the temperature of the water entering the cooling tower rises above 6°C as sensed by the temperature switch S649-TSH, the cooling tower fan will be started. If the temperature of the water leaving the cooling tower falls below 6°C as sensed by the temperature switch S649-TSL the INFI 90 shall stop the cooling tower fan.

The duty cooling tower pump S679/S680-CWP is initially selected by the Operator and changed by the INFI 90 periodically based on hours of pump operation. The Operator may change the duty pump at any time. If the duty pump fails, the INFI 90 will start the standby pump.

The duty chilled water pump S667/S668-CWP is initially selected by the Operator and changed by the INFI 90 periodically based on hours of pump operation. The Operator may change the duty pump at any time. If the duty pump fails, the INFI 90 will start the standby pump.



COOLING WATER SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-28

Cooling Water System Start-Up Procedures - Graphic 5Q:

1) Verify that all pumps are in "COMPUTER" and that the fan is in "COMPUTER";
2) Press 2P "Cool Water Pump #1, S667" and verify that it is in "auto";
3) Press 3P "Cool Water Pump #2, S668" and verify that it is in "auto";
4) Press 4P "Cool Water Pump Select" and select the duty pump: S667 = Pump #1 or S668 = Pump #2;
5) Press 1P "Cool Water Auto Start" and select "auto";
6) Press 5P "Cool Water Fan S649" and verify that it is in "auto";
7) Press 7P "Cool Water Pump #3, S679" and verify that it is in "auto";
8) Press 8P "Cool Water Pump #4, S680" and verify that it is in "auto";
9) Press 9P "Cool Water Pump Select" and select the duty pump: S679 = Pump #3 or S680 = Pump #4;
10) Press 6P "Cool Water Pump Auto Start" and select "auto".

The automatic sequence will begin.

18.3.7 Heat Recovery System

18.3.7.1 System Description

The heat recovery system utilizes the ambient heat otherwise wasted contained in the plant effluent taken from the flushing water system (approximately 10°C) to provide for some of the heating requirements in the Secondary Clarifier Area. Three heat exchanger/ glycol pump circulating systems are in place to accomplish this.

Plant effluent is drawn off the flushing water header and passed through an effluent filter, S609-FE, and then passed through heat exchanger S609-HX. Glycol circulating pump, S609-GP, circulates a glycol solution through the heat exchanger which draws heat from the flushing water. The glycol solution is pumped to a pre-heat coil on air handling unit S601-AHU. In doing so, the regular heating coil on S601-AHU draws less hot water from the plant boilers and creates an energy and cost saving.

Two similar systems are in place comprised of effluent filters S622-FE and S662-FE, heat exchangers S622-HX and S662-HX, and glycol circulating pumps S622-GP and S662-GP. S622-GP pumps heated glycol to a pre-heat coil on air handling unit S614-AHU while S662-GP pumps heated glycol to pre-heat coils on air handling units S689-AHU, S684-AHU, and S685-AHU.

A summary of the equipment described in this section is as follows:

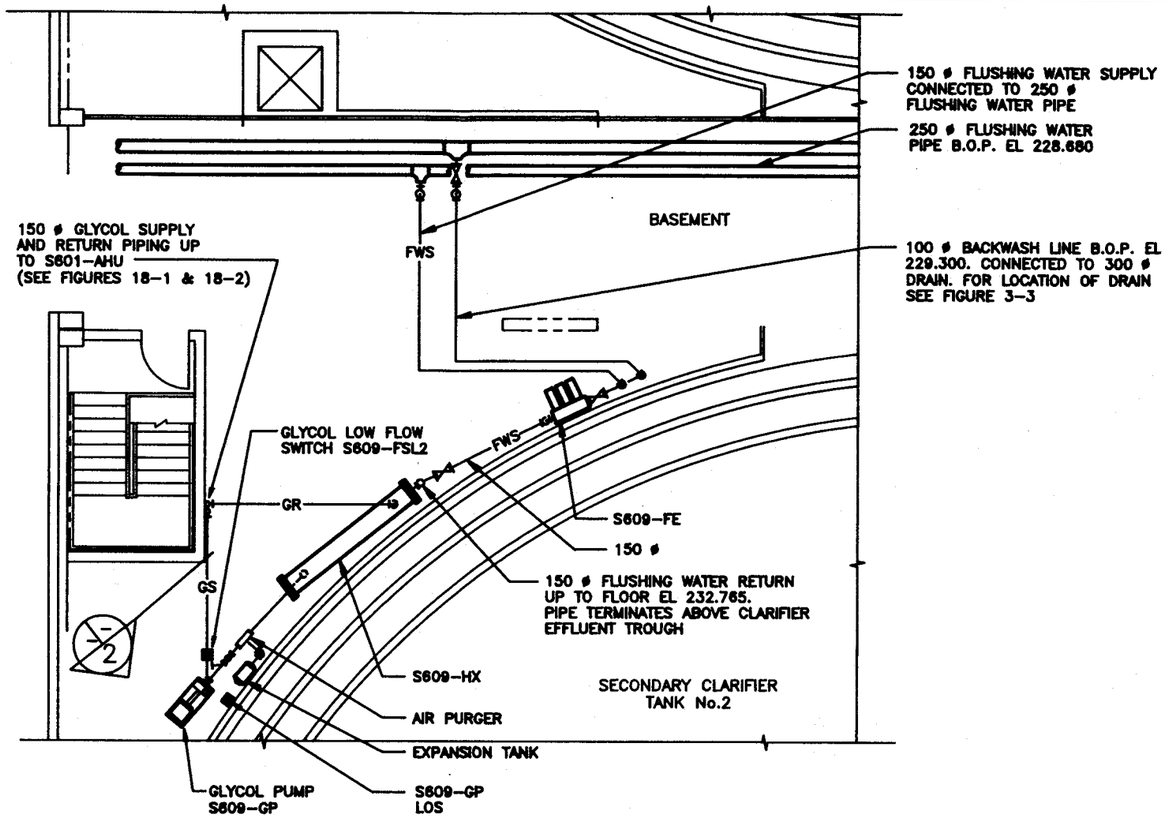
1. Three glycol circulating pumps: S609-GP, S622-GP, and S662-GP;
2. Three glycol/flushing water heat exchangers: S609-HX, S622-HX, and S662-HX;
3. Three effluent filters: S609-FE, S622-FE, and S662-FE;
4. Six low flow switches: S609-FSL1 & FSL2, S622-FSL1 & FSL2, and S662-FSL1 & FLS2;
5. Three low temperature switches: S609-TSL, S622-TSL, and S662-TSL.

Equipment locations for the three systems are found in the floor plans shown in Figures 18-29, 18-30, and 18-31 respectively.

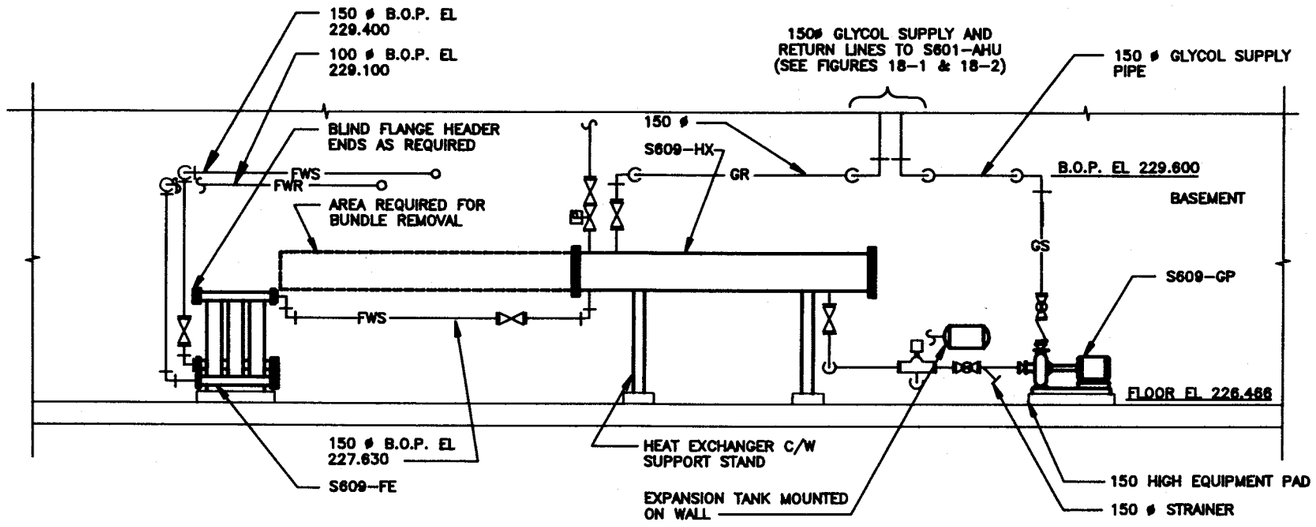
18.3.7.2 Monitoring and Control

Each of the glycol circulating pumps, S609-GP, S622-GP, and S662-GP, is controlled from an "ON/OFF" switch at FDP-S. The pump is designed to run continuously so this switch should normally be in the "ON" position. Pump "RUN" status indication is available at the MCC and FDP-S. In addition, "GLYCOL FLOW FAIL", "FLUSH WATER FLOW FAIL", and "FLUSH WATER LOW TEMP" alarm conditions are also monitored at FDP-S. The INFI 90 has no control over the pump.

The section of FDP-S dedicated to the monitoring and control of these pumps is shown in Figure 18-32.



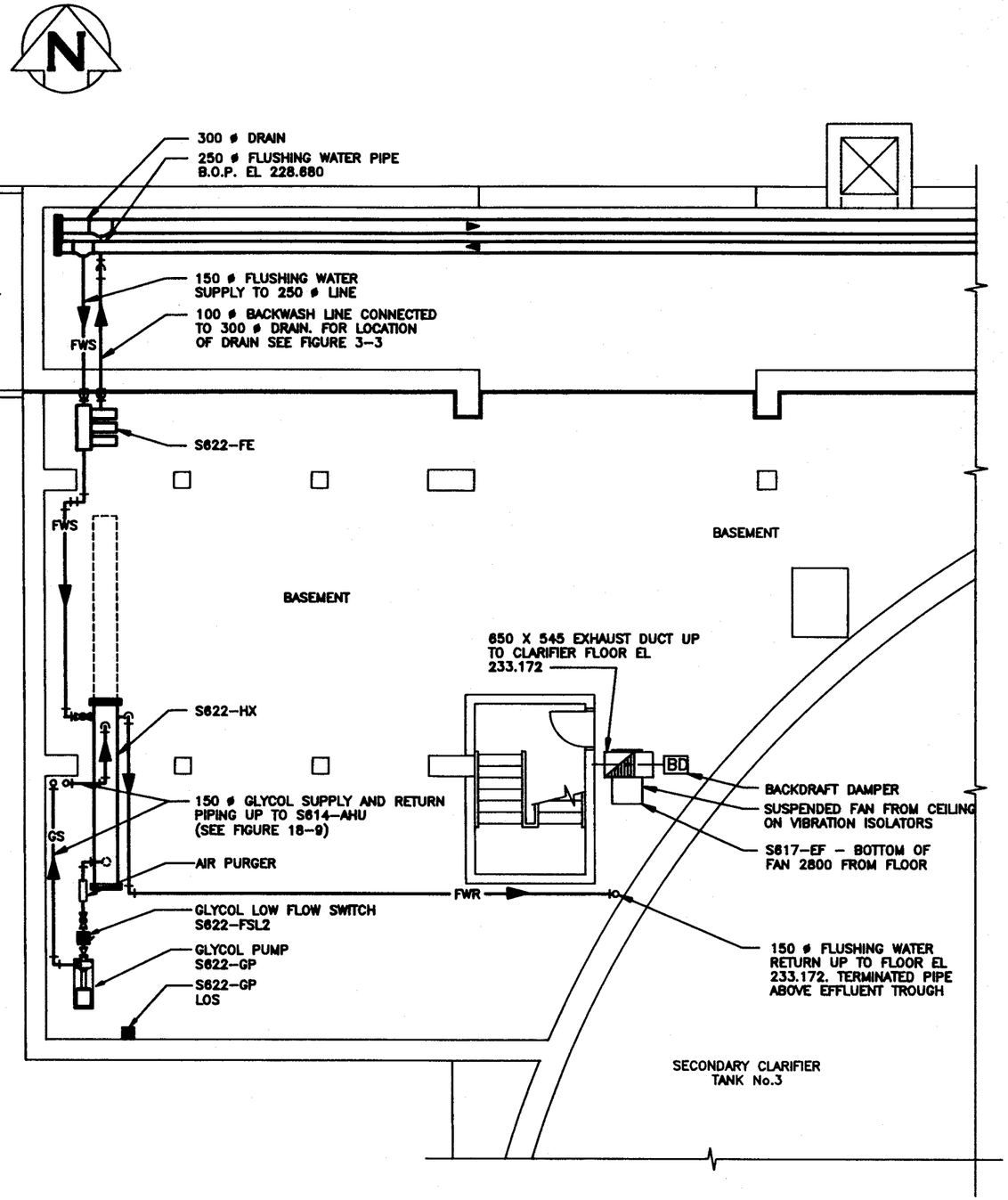
PART PLAN AT ELEV. 226.466

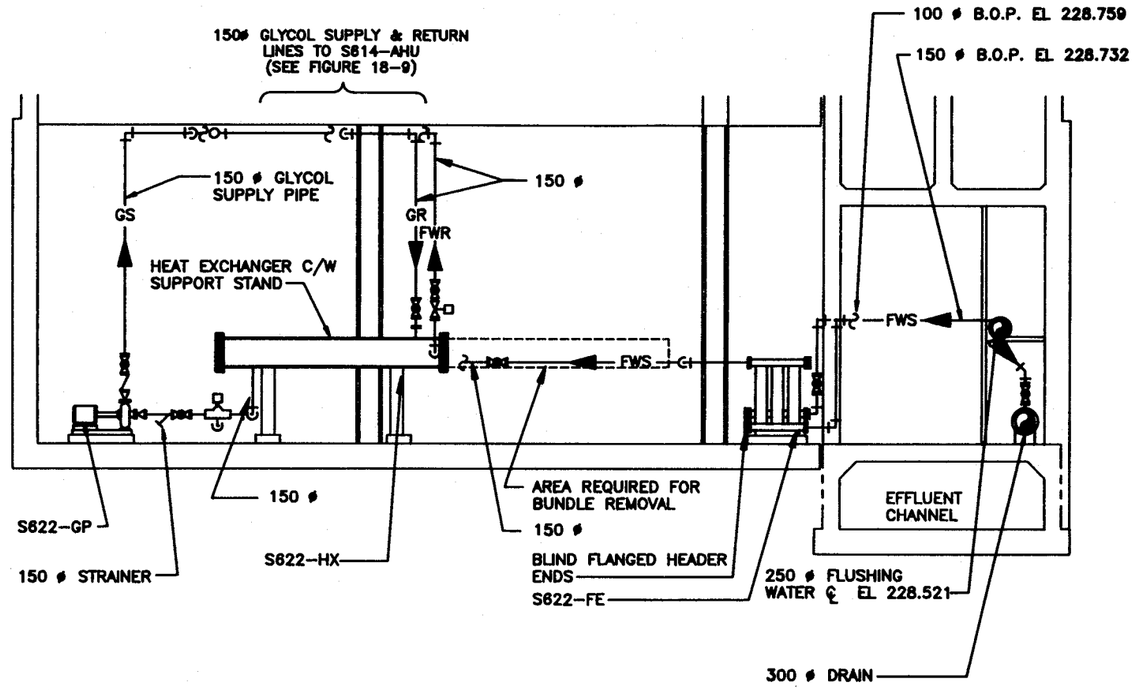


SECTION

CLARIFIERS No.1 & 2 HEAT RECOVERY SYSTEM EQUIPMENT LOCATIONS

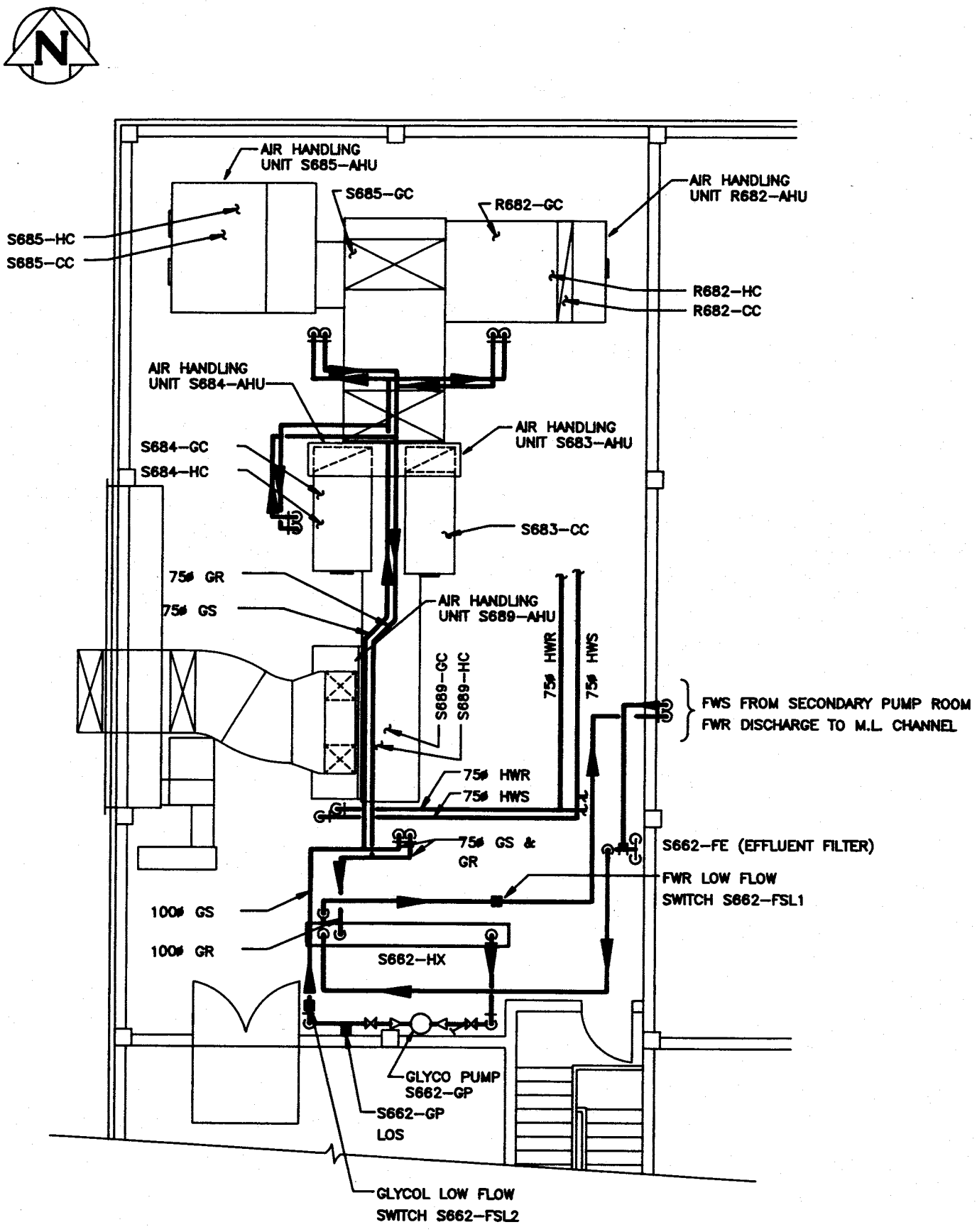
Date : January 1994
Figure 18-29





CLARIFIER No.3
HEAT RECOVERY SYSTEM
EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-30



VENTILATION ROOM AIR HANDLING UNITS HEAT RECOVERY SYSTEM EQUIPMENT LOCATIONS

Date : January 1994
Figure 18-31

The INFI 90 monitors the following pump parameters:

1. Pump "RUN" status;
2. Pump "FAILURE" alarm condition due to glycol flow fail, flushing water flow fail, or flushing water low temperature.

Each pump can be shut down and locked-out using the "LOS" pushbutton field located near the unit. These pushbuttons are shown in Figures 18-29, 18-30, and 18-31.

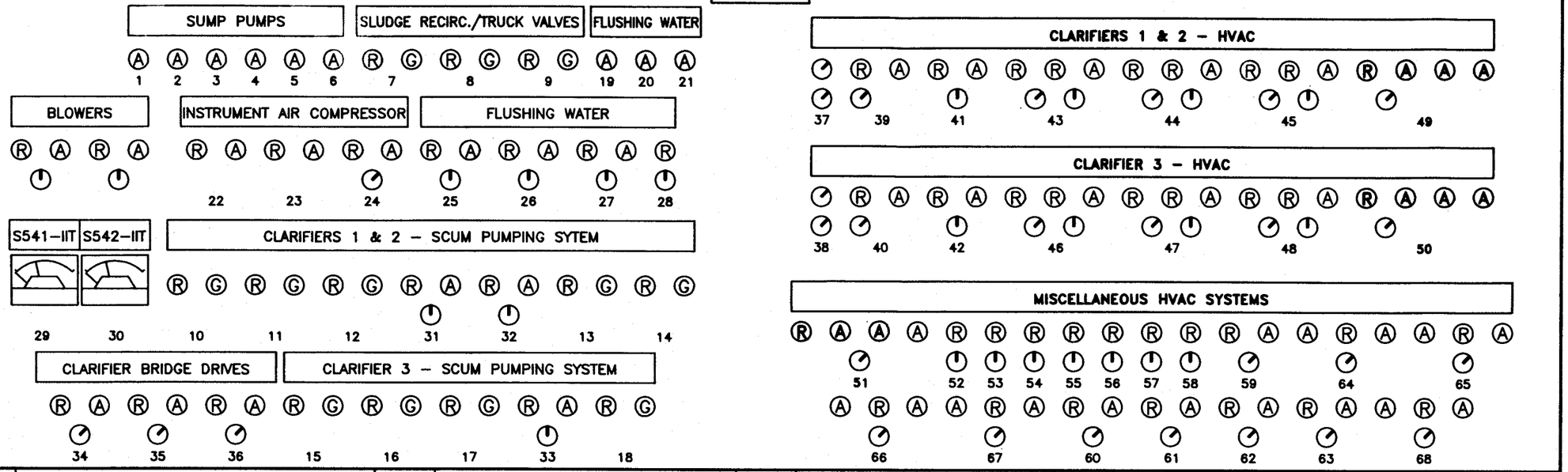
Cross references between this equipment and the INFI 90 may be found in Bridging Table 18-14. Equipment/Instrument Summary Table 18-15 provides a detailed summary of all control, monitoring and alarm devices associated with this system. A listing of these alarms may be found in HVAC Alarms Summary Table 1-5. Further control information is provided in the Process and Instrumentation Diagram shown in Figure 18-33.

18.3.7.3 Sequence of Operation

When air handling unit S601-AHU is in operation glycol circulating pump S609-GP is started using the "ON/OFF" switch at FDP-S. When in the run mode EP relay S609-VY fully opens the flushing control valve S609-TV. Flow switches S609-FSL1 and S609-FSL2 monitor flow in the flushing water and glycol circulating loops respectively. Low temperature switch S609-TSL monitors the flushing water temperature. A low flow in either loop or a low temperature in the flushing water loop shuts down the pump and sends a general alarm signal to the INFI 90.

When air handling unit S614-AHU is in operation glycol circulating pump S622-GP is started using the "ON/OFF" switch at FDP-S. When in the run mode EP relay S622-VY fully opens the flushing control valve S622-TV. Flow switches S622-FSL1 and S622-FSL2 monitor flow in the flushing water and glycol circulating loops respectively. Low temperature switch S622-TSL monitors the flushing water temperature. A low flow in either loop or a low temperature in the flushing water loop shuts down the pump and sends a general alarm signal to the INFI 90.

FDP-S



LEGEND

- R – RED PILOT LIGHT
- A – AMBER PILOT LIGHT
- G – GREEN PILOT LIGHT
- ① – 3 POSITION SEL. SWITCH
- ⊘ – 2 POSITION SEL. SWITCH

No.	DESCRIPTION
	A — A – HIGH LEVEL
No. 1–6	
1	SUMP PUMPS – S569/S570–SMP
2	SUMP PUMP – S575–SMP
3	SUMP PUMPS – S576/S577–SMP
4	SUMP PUMPS – S578/S579–SMP
5	SUMP PUMPS – S580/S581–SMP
6	SUMP PUMPS – S582/S583–SMP
	A B — A – OPEN, B – CLOSED
No. 7–18	
7	SLUDGE RECIRCULATION VALVE – S403–FV
8	SLUDGE TO TRUCK VALVE – S404–FV
9	FLUSHING WATER CLEANING VALVE – S419–FV
10	RECIRCULATION VALVE – S301–FV
11	SYSTEM VALVE – S302–FV
12	FLUSHING WATER CLEANING VALVE – S306–FV
13	SCUM TROUGH No.1 CLEANING VALVE – S303–FV
14	SCUM TROUGH No.2 CLEANING VALVE – S304–FV
15	RECIRCULATION VALVE – S310–FV
16	SYSTEM VALVE – S311–FV
17	FLUSHING WATER CLEANING VALVE – S313–FV
18	SCUM TROUGH CLEANING VALVE – S312–FV
	A — A – LOSS OF SEAL WATER
No. 19–21	
19	FLUSHING WATER PUMP – S551–FWP
20	FLUSHING WATER PUMP – S552–FWP
21	FLUSHING WATER PUMP – S553–FWP

No.	DESCRIPTION
	A B — A – RUN, B – FAIL
No. 22–23	
22	INSTRUMENT AIR COMPRESSOR – S535–AC
23	INSTRUMENT AIR COMPRESSOR – S536–AC
	A B C — A – RUN, B – LOSS OF FLOW, C – OFF/ON
No.24	
24	COMPRESSOR COOLING FAN – S537–FN
	A B C — A – RUN, B – PUMP FAIL, C – COMP/OFF/HAND
No. 25–27	
25	FLUSHING WATER PUMP – S550–FWP
26	FLUSHING WATER PUMP – S551–FWP
27	FLUSHING WATER PUMP – S552–FWP
	A B — A – RUN, B – COMP/OFF/HAND
No. 28	
28	FLUSHING WATER PUMP – S553–FWP
	A B C D — A – RUN, B – FAIL, C – COMP/OFF/HAND, D – CURRENT
No. 29–30	
29	CHANNEL AERATION BLOWER – S541–AB
30	CHANNEL AERATION BLOWER – S542–AB

No.	DESCRIPTION
	A B C — A – RUN, B – LOSS OF SEAL WATER, C – COMP/OFF/HAND
No. 31–33	
31	SCUM PUMP – S307–SP
32	SCUM PUMP – S308–SP
33	SCUM PUMP – S309–SP
	A B C — A – RUN, B – HIGH TORQUE FAIL, C – OFF/ON
No. 34–36	
34	CLARIFIER No.1 BRIDGE – S765–SC
35	CLARIFIER No.2 BRIDGE – S766–SC
36	CLARIFIER No.3 BRIDGE – S767–SC
	A B — A – COMP/HAND, B – SUMMER/WINTER
No. 37–38	
37	OUTDOOR AIR DAMPER – S603–VZ
38	OUTDOOR AIR DAMPER – S616–VZ
	A B C — A – RUN, B – LOSS OF FLOW, C – OFF/ON
No. 39–40	
39	GALLERY EXHAUST FAN – S604–EF
40	GALLERY EXHAUST FAN – S617–EF
	A B C — A – RUN, B – LOSS OF FLOW, C – COMP/OFF/HAND
No. 41–42	
41	EXHAUST FAN – S605–EF
42	EXHAUST FAN – S618–EF

No.	DESCRIPTION
	A B C D E — A – SLOW, B – FAST, C – LOSS OF FLOW, D – SLOW/FAST, E – COMP/OFF/HAND
No. 43–48	
43	EXHAUST FAN – S606–EF
44	EXHAUST FAN – S607–EF
45	EXHAUST FAN – S608–EF
46	EXHAUST FAN – S619–EF
47	EXHAUST FAN – S620–EF
48	EXHAUST FAN – S621–EF
	A B C D E — A – RUN, B – GLYCOL FLOW FAIL, C – FLUSH WATER FLOW FAIL, D – LOW TEMP, E – OFF/ON
No. 49–51	
49	GLYCOL PUMP – S609–GP
50	GLYCOL PUMP – S622–GP
51	GLYCOL PUMP – S662–GP
	A B — A – RUN, B – COMP/OFF/HAND
No. 52–58	
52	COOLING TOWER FAN – S649–FN
53	CHILLED WATER PUMP – S667–CWP
54	CHILLED WATER PUMP – S668–CWP
55	COOLING TOWER PUMP – S679–CWP
56	COOLING TOWER PUMP – S680–CWP
57	HOT WATER PUMP – S671–HWP
58	HOT WATER PUMP – S672–HWP
	A B C — A – RUN, B – LOSS OF FLOW, C – OFF/ON
No. 59–63	
59	CONTROL ROOM AIR HANDLING UNIT – S690–AHU
60	PUMP ROOM EXHAUST FAN – S686–EF
61	TRUCK BAY EXHAUST FAN – S687–EF
62	SCRUBBER ROOM EXHAUST FAN – S691–EF
63	JUNCTION CHAMBER EXHAUST FAN – S681–EF

No.	DESCRIPTION
	A B C D — A – LOSS OF FLOW, B – RUN, C – LOW TEMP, D – OFF/ON
No. 64–68	
64	ELECTRICAL ROOM AIR HANDLING UNIT – S683–AHU
65	GALLERY AIR HANDLING UNIT – S689–AHU
66	SCRUBBER ROOM AIR HANDLING UNIT – S684–AHU
67	PUMP ROOM AIR HANDLING UNIT – S685–AHU
68	PSA ROOM AIR HANDLING UNIT – S682–AHU

HEAT RECOVERY SYSTEM
FIELD DEVICE PANEL FDP–S

Date : January 1994
Figure 18–32

TABLE 18-14

HEAT RECOVERY SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S609-GP	5-R					5-R
S622-GP	5-R					5-R
S662-GP	5-R					5-R

TABLE 18-15

HEAT RECOVERY SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	MCC	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S609-HS1	S609-GP CONTROL (LOS)	S				
S609-HS2	S609-GP CONTROL (ON/OFF)			C		
S609-MM	S609-GP STATUS - RUN		I	I	I	
S609-QF	S609-GP FAILURE				Q	
S609-TAL	S609-GP FLUSH. WATER LOW TEMP.			A		
S609-FAL1	S609-GP FLUSH. WATER LOW FLOW			A		
S609-FAL2	S609-GP GLYCOL LOW FLOW			A		
S609-PG1	S609-GP SUCTION PRESSURE	I				0 to 400 kPa
S609-PG2	S609-GP DISCHARGE PRESSURE	I				0 to 700 kPa
S622-HS1	S622-GP CONTROL (LOS)	S				
S622-HS2	S622-GP CONTROL (ON/OFF)			C		
S622-MM	S622-GP STATUS - RUN		I	I	I	
S622-QF	S622-GP FAILURE				Q	
S622-TAL	S622-GP FLUSH. WATER LOW TEMP.			A		
S622-FAL1	S622-GP FLUSH. WATER LOW FLOW			A		
S622-FAL2	S622-GP GLYCOL LOW FLOW			A		
S622-PG1	S622-GP SUCTION PRESSURE	I				0 to 400 kPa
S622-PG2	S622-GP DISCHARGE PRESSURE	I				0 to 700 kPa
S662-HS1	S662-GP CONTROL (LOS)	S				
S662-HS2	S662-GP CONTROL (ON/OFF)			C		
S662-MM	S662-GP STATUS - RUN		I	I	I	

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-33

(continued)

TABLE 18-15 (Continued)

HEAT RECOVERY SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S662-QF	S662-GP FAILURE				Q	
S662-TAL	S662-GP FLUSH. WATER LOW TEMP.			A		
S662-FAL1	S662-GP FLUSH. WATER LOW FLOW			A		
S662-FAL2	S662-GP GLYCOL LOW FLOW			A		
S662-PG1	S662-GP SUCTION PRESSURE	I				0 to 400 kPa
S662-PG2	S662-GP DISCHARGE PRESSURE	I				0 to 1100 kPa

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

All instruments on this page found in Figure 18-33

When air handling units S684-AHU, S685-AHU, and/or S689-AHU are in operation glycol circulating pump S662-GP is started using the "ON/OFF" switch at FDP-S. When in the run mode EP relay S662-VY fully opens the flushing control valve S662-TV. Flow switches S662-FSL1 and S662-FSL2 monitor flow in the flushing water and glycol circulating loops respectively. Low temperature switch S662-TSL monitors the flushing water temperature. A low flow in either loop or a low temperature in the flushing water loop shuts down the pump and sends a general alarm signal to the INFI 90.

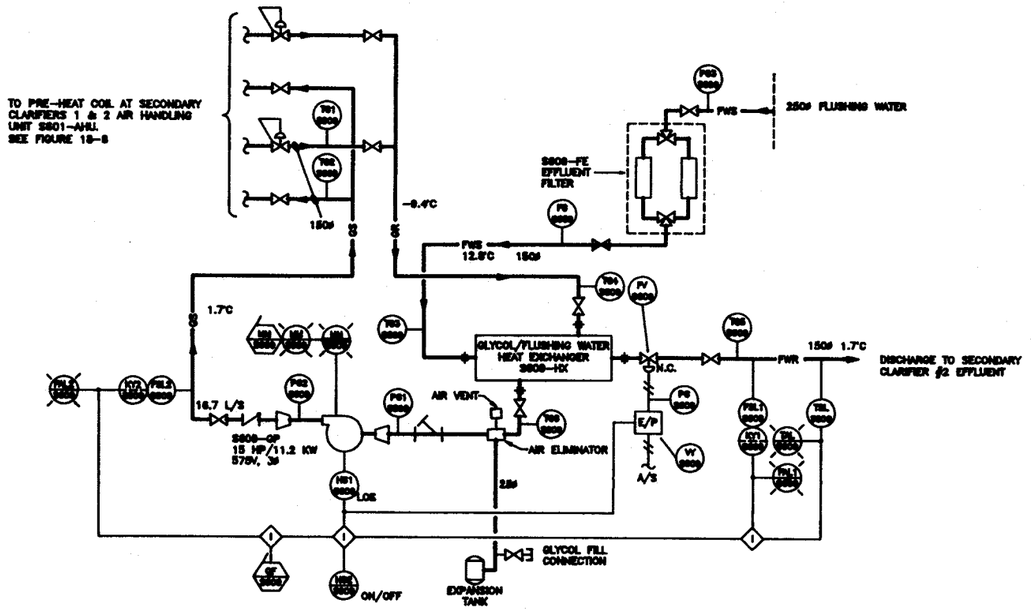
18.4 ROUTINE CHECKS

1. Check that all pumps and unit heaters are operating free from excessive noise or vibration;
2. Check that all air handling unit filters are clean;
3. Check that hot water, cooling water, and heat recovery piping systems are free from leaks;
4. Check that differential pressure gauges on the Control Room air handling unit filters are within the acceptable range of less than 115 Pa;
5. During start-up of the heat recovery systems in the fall, check to ensure the glycol/water mixture is sufficient for -36°C operation.

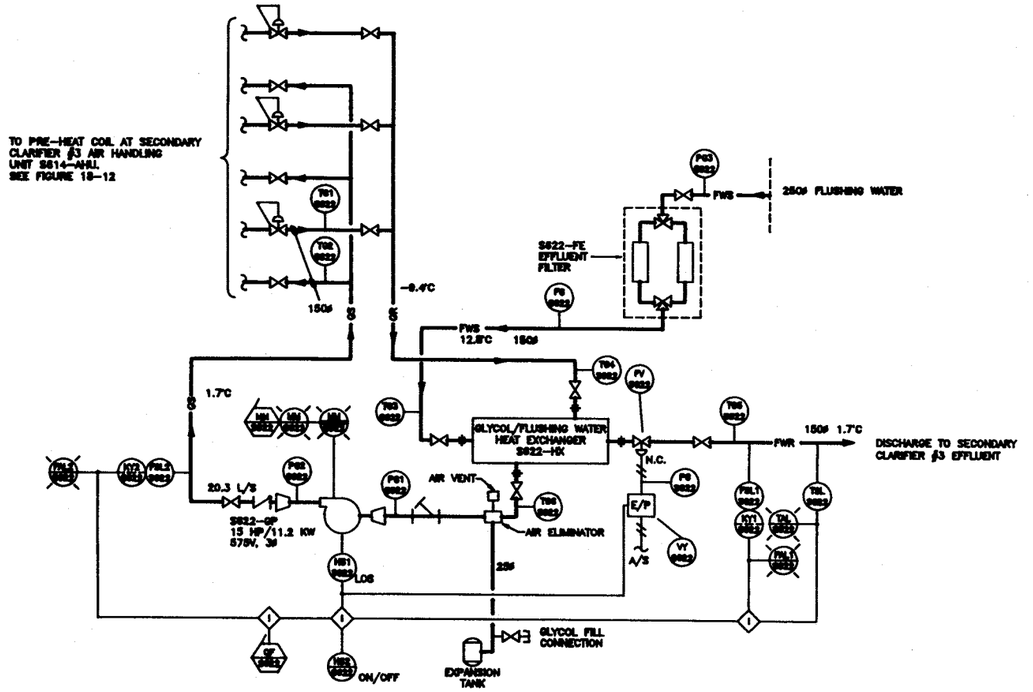
18.5 EQUIPMENT DATA

1. **<u>Air Handling Unit:</u> S601-AHU**

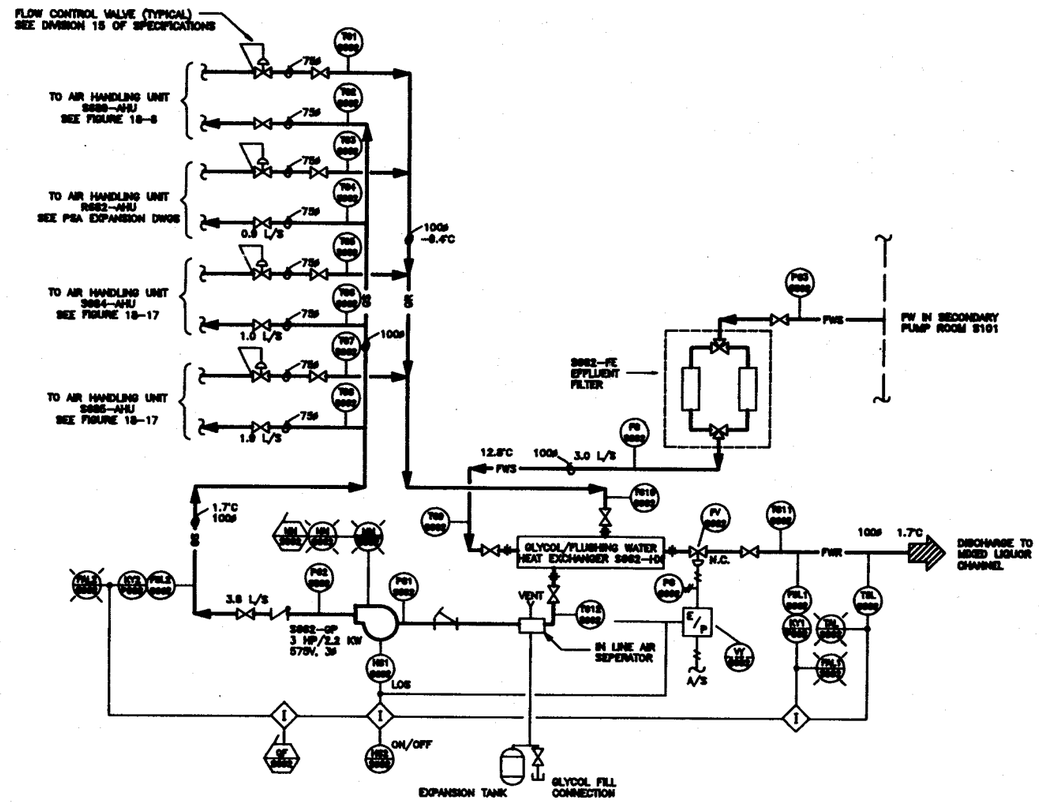
Location:	Mechanical Room north of Tank No. 1	
Purpose:	Provide heating and venting to Secondary Clarifiers No. 1 and 2 Building Area	
Manufacturer:	Unit -	ICE 10430/15785 L/s
	Motor -	18.6 kw (25 hp), 575V, 3ph, 60 Hz, 23.5 FLA



FLUSHING WATER/GLYCOL HEAT RECOVERY SYSTEM – SECONDARY CLARIFIERS 1 & 2



FLUSHING WATER/GLYCOL HEAT RECOVERY SYSTEM – SECONDARY CLARIFIER 3



FLUSHING WATER/GLYCOL HEAT RECOVERY SYSTEM – AIR HANDLING UNITS RM S114

HEAT RECOVERY SYSTEM PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 18-33

2. **Air Handling Unit: S689-AHU**

Location:	Ventilation Room	
Purpose:	Provide heating and venting to Gallery No. 3 and Basement Area	
Manufacturer:	Unit -	Trane 5275 L/s
	Motor -	5.6 kw (7.5 hp), 575V, 3ph, 60Hz, 7.6 FLA

3. **Air Handling Unit: S614-AHU**

Location:	Mechanical Room northwest of Tank No. 3	
Purpose:	Provide heating and venting to Secondary Clarifier No. 3 Building Area	
Manufacturer:	Unit -	ICE 14550/21700 L/s
	Motor -	30 kw (40 hp), 575v, 3ph, 60Hz, 36.5 FLA

4. **Air Handling Unit: S683-AHU**

Location:	Ventilation Room	
Purpose:	Provide heating, cooling, and venting to the Electrical Room	
Manufacturer:	Unit -	Durham Bush of Canada Ltd. Model HAH-22, 760 L/s
	Motor -	Westinghouse 1.19 kw (1.5 hp), 575V, 3ph, 60Hz, 1730 rpm, 1.6 FLA

5. **Air Handling Unit: S684-AHU**

Location:	Ventilation Room	
Purpose:	Provide heating and venting to Scrubber Room and Truck Bay Area.	
Manufacturer:	Unit -	Durham Bush of Canada Ltd. Model HAH-32B, 1100 L/s
	Motor -	Reliance Electric Ltd. 1.19 kw (1.5 hp), 575V, 3ph, 60Hz 1730 rpm, 2.2 FLA

6. **Air Handling Unit: S685-AHU**

Location:	Ventilation Room	
Purpose:	Provide heating, cooling, and venting to Secondary Pump Room	
Manufacturer:	Unit -	Durham Bush of Canada Ltd. Model HAH-100
	Motor -	5.6 kw (7.5 hp), 575V, 3ph, 60Hz, 7.8 FLA

7. **Air Handling Unit: S690-AHU**

Location:	Roof of Control Room	
Purpose:	Provide pressurized and recirculated air for heating, cooling and venting to Control Room	
Manufacturer:	Unit -	Circulaire CPU 20 C3H, 950 L/s
	Motor -	3.7 kw (5 hp) 575V, 3ph, 60Hz, 2860 rpm, 5.8 FLA

8. **Exhaust Fan: S604-EF**

Location:	Basement Area near Tank No. 1	
Purpose:	Provide for exhausting of Gallery No. 3 and Basement Area	
Manufacturer:	Fan -	Northern Blower, 2000 L/s
	Motor -	.38 kw (.5 hp), 575V, 3ph, 60Hz, 0.6 FLA

9. **Exhaust Fan: S605-EF**

Location:	Fan Room south of Tank No. 2	
Purpose:	Provide for emergency exhausting of Secondary Clarifiers No. 1 and 2 Building Area	
Manufacturer:	Fan -	Northern Blower Size 5425, 17000 L/s
	Motor -	Leroy - Somer 5.6 kw (7.5 hp), 575V, 3ph, 60Hz, 7.6 FLA

10. **Exhaust Fans: S606-EF, S607-EF, and S608-EF**

Location:	Fan Room south of Tank No. 2	
Purpose:	Provide for exhausting of Secondary Clarifiers No. 1 and 2 Building Area	
Manufacturer:	Fan -	Northern Blower
		Size 4450, 10070/15235 L/s
	Motor -	Leroy - Somer
		13/30 kw (18/40 hp), 575V, 3ph, 60Hz
		1190/1785 rpm, 26.6/41.7 FLA

11. **Exhaust Fan: S617-EF**

Location:	Basement Area near Tank No. 3	
Purpose:	Provide for exhausting of Gallery No. 3 and Basement Area	
Manufacturer:	Fan -	Northern Blower, 2530 L/s
	Motor -	1.2 kw (1.5 hp), 575V, 3ph, 60Hz, 1.5 FLA

12. **Exhaust Fan: S618-EF**

Location:	Fan Room south of Tank No. 3	
Purpose:	Provide for emergency exhausting of Secondary Clarifier No. 3 Building Area	
Manufacturer:	Fan -	Northern Blower
		Size 5425, 17000 L/s
	Motor -	Leroy - Somer
		5.6 kw (7.5 hp), 575v, 3ph, 60Hz, 7.5 FLA

13. **Exhaust Fans: S619-EF, S620-EF, and S621-EF**

Location:	Fan Room south of Tank No. 3	
Purpose:	Provide for exhausting of Secondary Clarifier No. 3 Building Area	
Manufacturer:	Fan -	Northern Blower
		Size 4900, 12275/18575 L/s

Motor - Leroy - Somer
20/45 kw (27/60 hp), 575V, 3ph, 60Hz
1185/1775 rpm, 27.6/56 FLA

14. **Exhaust Fan: S686-EF**

Location: Ventilation Room
Purpose: Provide for exhausting of Secondary Pump Room
Manufacturer: Fan - Northern Blower, 2020 L/s
Motor - Westinghouse
1.1 kw (1.5 hp), 575V, 3ph, 60Hz, 1.4 FLA

15. **Exhaust Fan: S687-EF**

Location: Truck Bay
Purpose: Provide for exhausting of Truck Bay Area
Manufacturer: Fan - Northern Blower, 1100 L/s
Motor - 0.5 kw (0.75 hp), 575V, 3ph, 60Hz, 0.84 FLA

16. **Exhaust Fan: S691-EF**

Location: Scrubber Room
Purpose: Provide for exhausting of Scrubber Room
Manufacturer: Fan - Northern Blower, 1200 L/s
Motor - 0.56 kw (0.75 hp), 575V, 3ph, 60Hz, 1.31 FLA

17. **Cooling Tower Fan: S649-FN**

Location: Top of cooling tower
Purpose: Circulate cooling air through chiller cooling tower
Manufacturer; Motor - 3.5 kw (5 hp), 575V, 3ph, 60Hz, 5.1 FLA

18. **Chiller Unit: S648-CH**

Location: Secondary Pump Room
Purpose: Provide chilled water for chilled water pumps
S667-CWP and S668-CWP

Manufacturer:	Unit -	Durham Bush of Canada Ltd.
		Model # PC - 050 - T
	Motor -	37.5 kw (50 hp), 575V, 3ph, 60Hz, 50.0 FLA

19. **Chilled Water Pumps: S667-CWP and S668-CWP**

Location:	Secondary Pump Room	
Purpose:	Provide chilled water from chiller unit S648-CH to cooling coils of air handling units S683-AHU and S685-AHU	
Manufacturer:	Pump -	4.9 L/s
	Motor -	Leroy - Somer
		1.1 kw (1.5 hp), 575V, 3ph, 60Hz
		1145 rpm, 1.9 FLA

20. **Cooling Tower Pumps: S679-CWP and S680-CWP**

Location:	Secondary Pump Room	
Purpose:	Circulate cooling water through chiller unit S648-CH cooling tower and sump	
Manufacturer:	Motor -	Leroy - Somer
		3.5 kw (5 hp), 575V, 3ph, 60Hz
		1720 rpm, 5.15 FLA

21. **Hot Water Booster Pumps: S671-HWP and S672-HWP**

Location:	Secondary Pump Room	
Purpose:	Provide hot circulating water to heating coils of air handling units S684-AHU, S685-AHU, and S689-AHU in addition to the six unit heaters.	
Manufacturer:	Pump -	H.F. Clarke Ltd. Model 15-8
		142 GPM @ 17 TDH
	Motor -	Leland - Newman
		1.1 kw (1.5 hp), 575V, 3ph, 60Hz
		1710 rpm, 2.0 FLA

22. **Glycol Pump: S609-GP**

Location:	Basement Area near Tank No. 2	
Purpose:	Provide hot circulating glycol to pre-heating coil of air handling unit S601-AHU	
Manufacturer:	Pump -	Bell & Gossett
		265 GPM @ 110 TDH
	Motor -	Leroy - Somer
		11.2 kw (15 hp), 575V, 3ph, 60Hz
		1770 rpm, 15.2 FLA

23. **Glycol Pump: S622-GP**

Location:	Basement Area near Tank No. 3	
Purpose:	Provide hot circulating glycol to pre-heating coil of air handling unit S614-AHU	
Manufacturer:	Pump -	Bell & Gossett
		322 GPM @ 95' TDH
	Motor -	Leroy - Somer
		11.2 kw (15 hp), 575V, 3ph, 60Hz
		1770 rpm, 15.2 FLA

24. **Glycol Pump: S662-GP**

Location:	Ventilation Room	
Purpose:	Provide hot circulating glycol to pre-heating coil of air handling units S684-AHU, S685-AHU, and S689-AHU.	
Manufacturer:	Pump -	Bell & Gossett
		131 GPM @ 47' TDH
	Motor -	Leroy - Somer
		2.2 kw (3 hp), 575V, 3ph, 60Hz
		1755 rpm, 3.0 FLA

19.0 ELECTRICAL POWER SYSTEM

19.1 PURPOSE

The electrical power system is designed to distribute electrical power to all necessary equipment at the 600, 347, 208, and 120 volt levels.

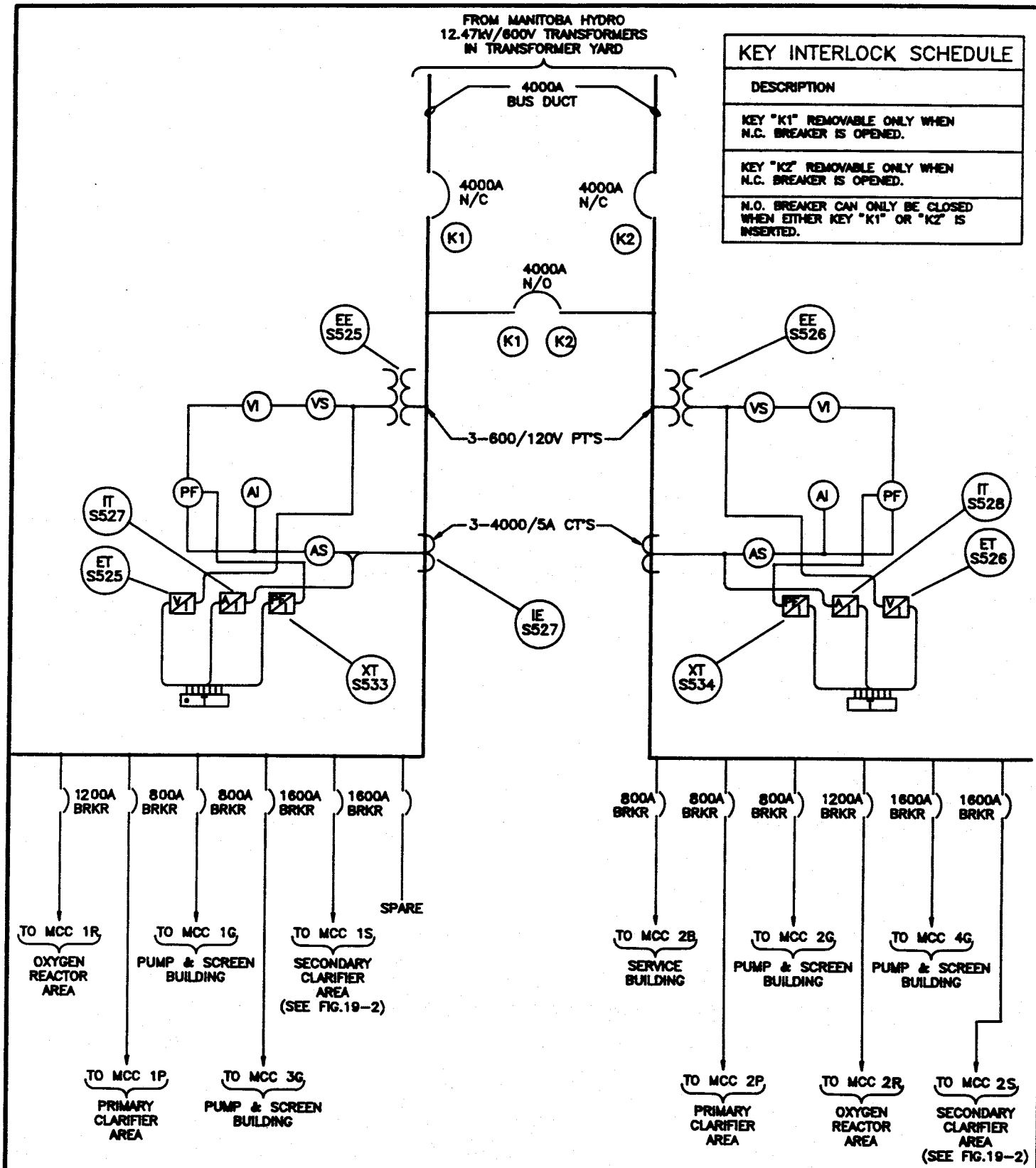
19.2 SYSTEM DESCRIPTION

The electrical distribution system for the plant area is located in the Secondary Clarifier Area. 600 V power is brought in from the Manitoba Hydro transformers in the yard outside the Electrical Room to a main distribution panel. From this panel, circuit breakers subfeed power to the eleven motor control centres (MCCs) in the plant via bus duct. Two MCCs located in the Electrical Room, MCC-1S and MCC-2S, supply all the non-essential Secondary Clarifier Area electrical loads.

Non-essential 600 volt power is utilized where required via the MCCs or stepped down by transformers to 347, 208, or 120 volts. From this level the power is then distributed to equipment through power and lighting panels. This system has no emergency power back-up; therefore, should a power failure occur for any reason, the loads on this system would be without power.

Essential 600 volt power is brought in to power panel CDP-E2 from the Service Building and is immediately transformed down to 347, 208, and 120 volts. From this level the power is then distributed to equipment through power and lighting panels. Panel CDP-E2 is wired via a transfer switch to an 85 kW emergency back-up generator located in the Service Building. Consequently, should a power failure occur, these loads would be provided with emergency power for as long as the generator remains operational.

A single line diagram representing the electrical distribution system is shown in Figures 19-1, 19-2, and 19-3.

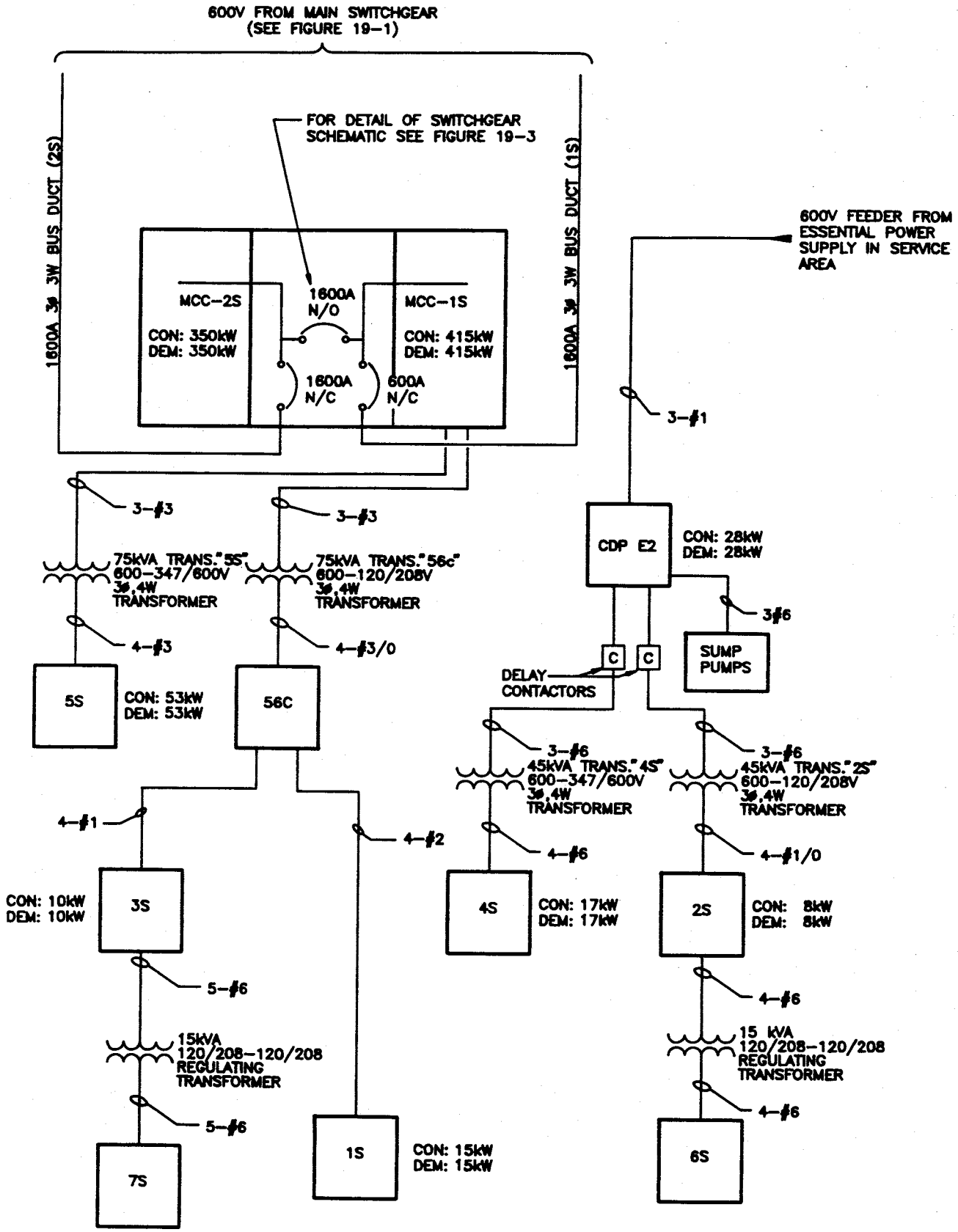


KEY INTERLOCK SCHEDULE
DESCRIPTION
KEY "K1" REMOVABLE ONLY WHEN N.C. BREAKER IS OPENED.
KEY "K2" REMOVABLE ONLY WHEN N.C. BREAKER IS OPENED.
N.O. BREAKER CAN ONLY BE CLOSED WHEN EITHER KEY "K1" OR "K2" IS INSERTED.

VS – VOLT METER SWITCH
VI – VOLT METER
AS – AMMETER SWITCH
AI – AMMETER
A/I – AMPERAGE TO Ma CONVERTER
V/I – VOLTAGE TO Ma CONVERTER
PF – POWER FACTOR METER
PF/I – POWER FACTOR TO Ma CONVERTOR
T – TERMINALS

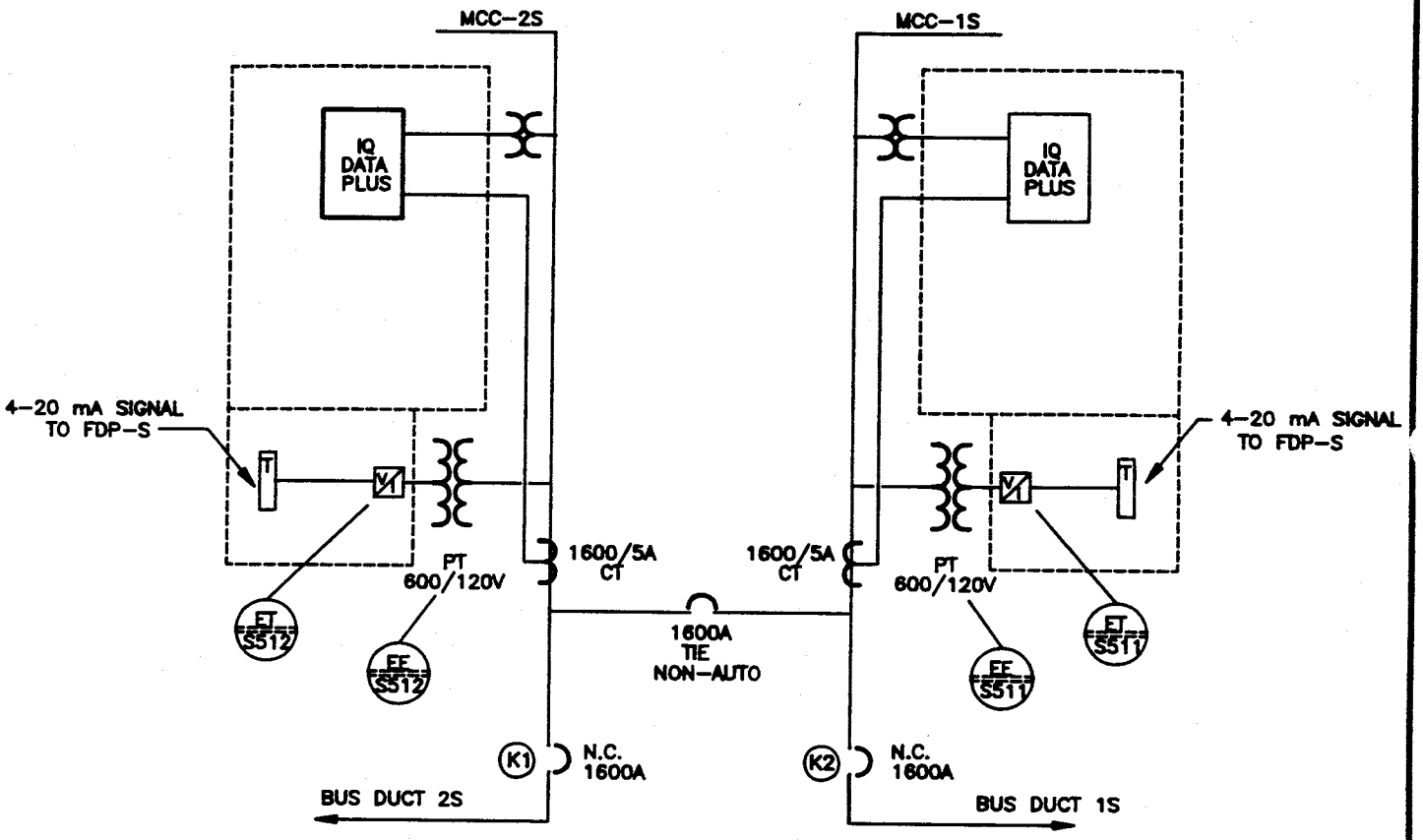
PLANT AREA
600V DISTRIBUTION SYSTEM

Date : January 1994
Figure 19-1



SECONDARY CLARIFIER AREA
SINGLE LINE DIAGRAM

Date : January 1994
Figure 19-2



SWITCHGEAR SCHEMATIC

Date : January 1994
Figure 19–3

A summary of the equipment described in this section is as follows:

1. One 600 V main distribution panel;
2. Two 600 V motor control centres: MCC-1S and MCC-2S;
3. Two 75 KVA lighting panel transformers: "5S" and "56C";
4. Two 45 KVA lighting panel transformers: "4S" and "2S";
5. Two 15 KVA lighting panel regulating transformers;
6. One 600 V power panel: CDP-E2;
7. Two 347/600 V lighting panels: "4S" and "5S";
8. Six 120/208 V lighting panels: "1S", "2S", "3S", "6S", "7S" and "56C".

Equipment locations are provided on the ground floor and basement floor plans shown in Figures 19-4 and 19-5.

19.3 DISTRIBUTION EQUIPMENT DESCRIPTION

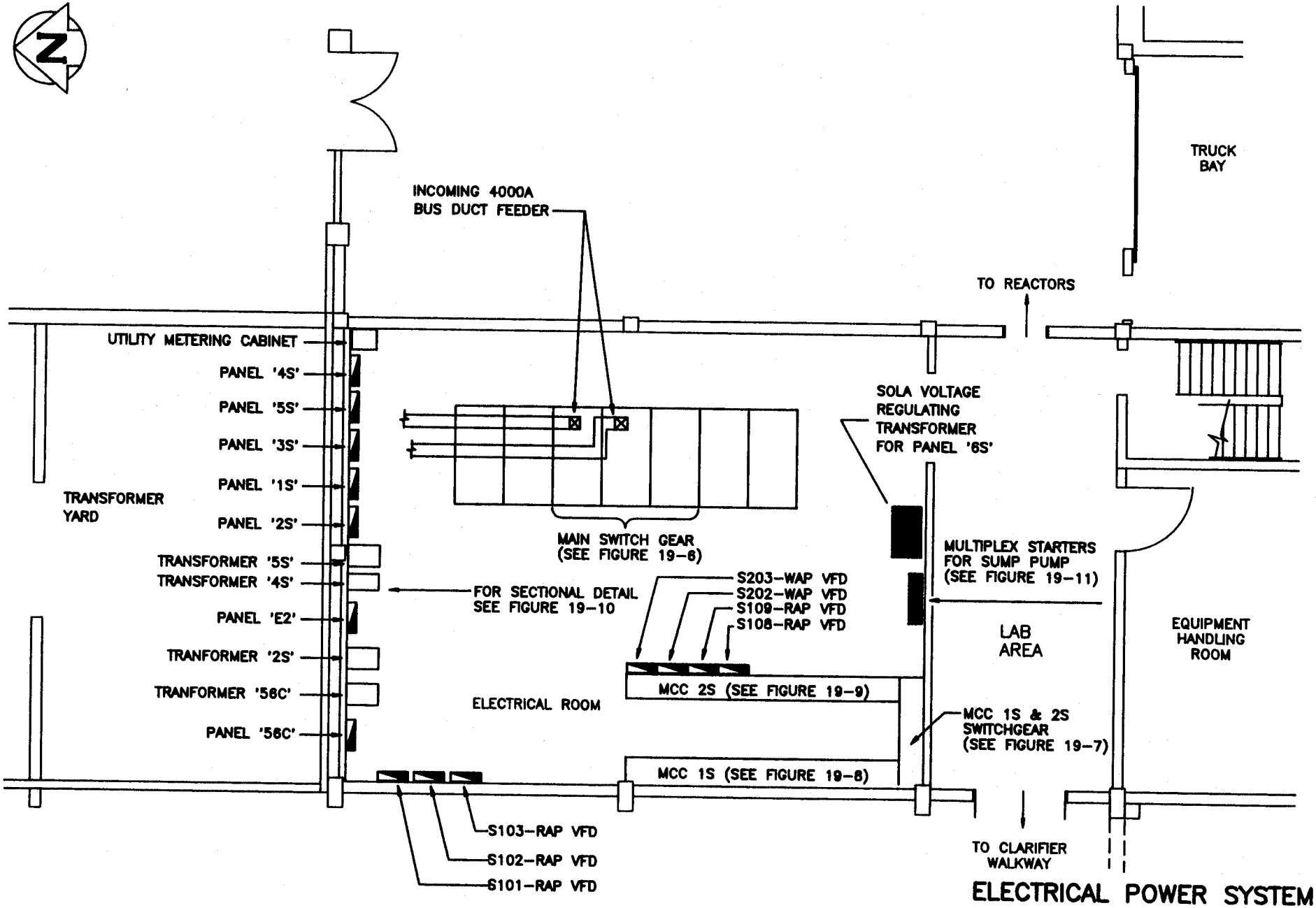
19.3.1 347/600 V Distribution Equipment

19.3.1.1 Non-Essential Service

The 600 V main distribution panel feeds all eleven MCCs in the plant area. These MCCs provide all the plant area non-essential 600 V service. A layout of the distribution panel is shown in Figure 19-6.

600 V power from MCCs 1S and 2S supply most of the pumps, motors, and HVAC equipment in the Secondary Clarifier area. The locations of the MCCs are shown in Figure 19-4 and layouts provided in Figures 19-7, 19-8, and 19-9.

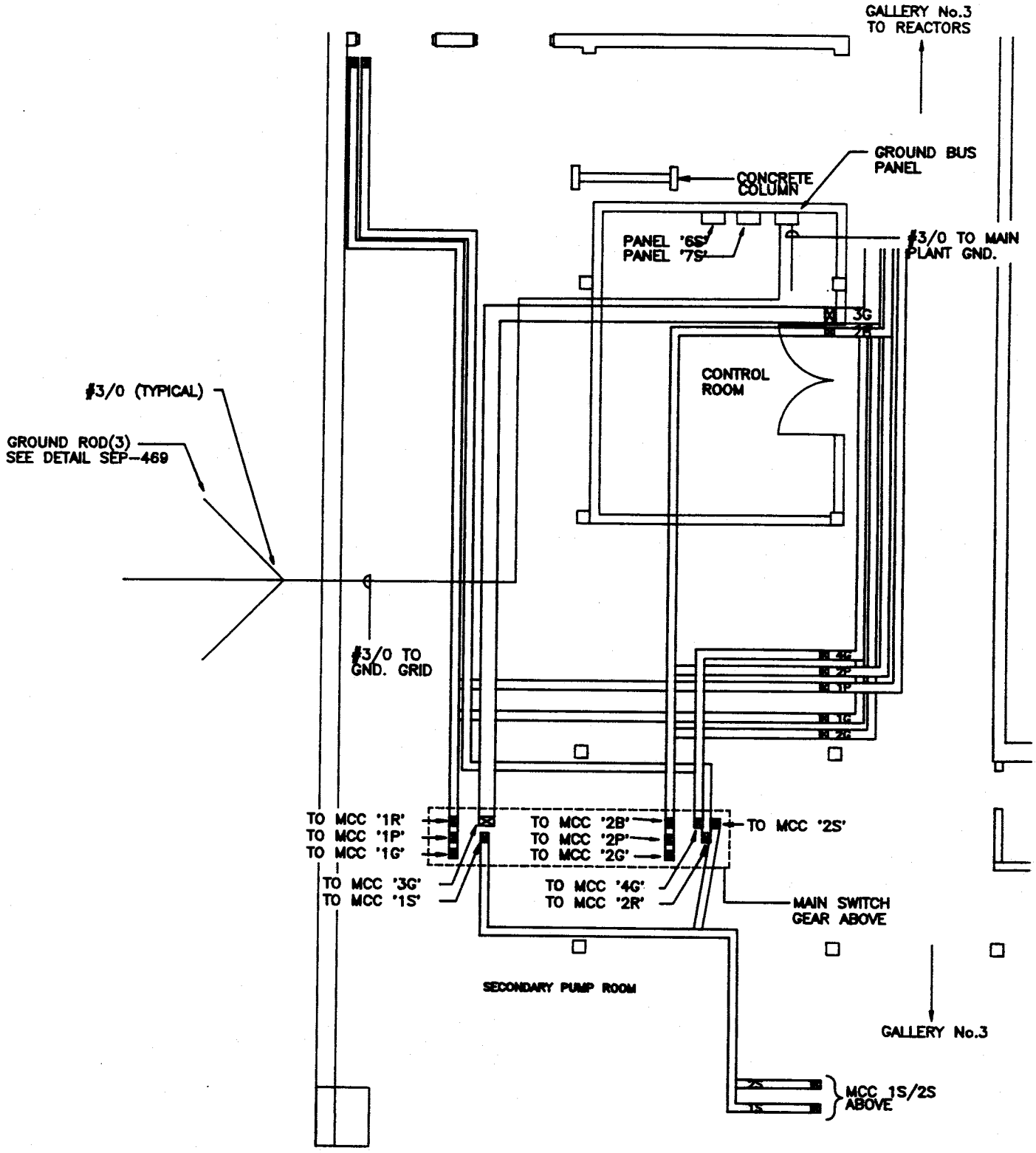
Transformer "5S" draws 600 V power from MCC-1S and provides 347/600 V to panel "5S". All of the area's non-essential 347 V service is taken from this panel. The locations of this transformer and panel are shown in Figure 19-4 while a description of the equipment supplied by panel "5S" is provided in Panel Function Summary Table 19-1.



GROUND FLOOR PLAN

ELECTRICAL POWER SYSTEM EQUIPMENT LOCATIONS

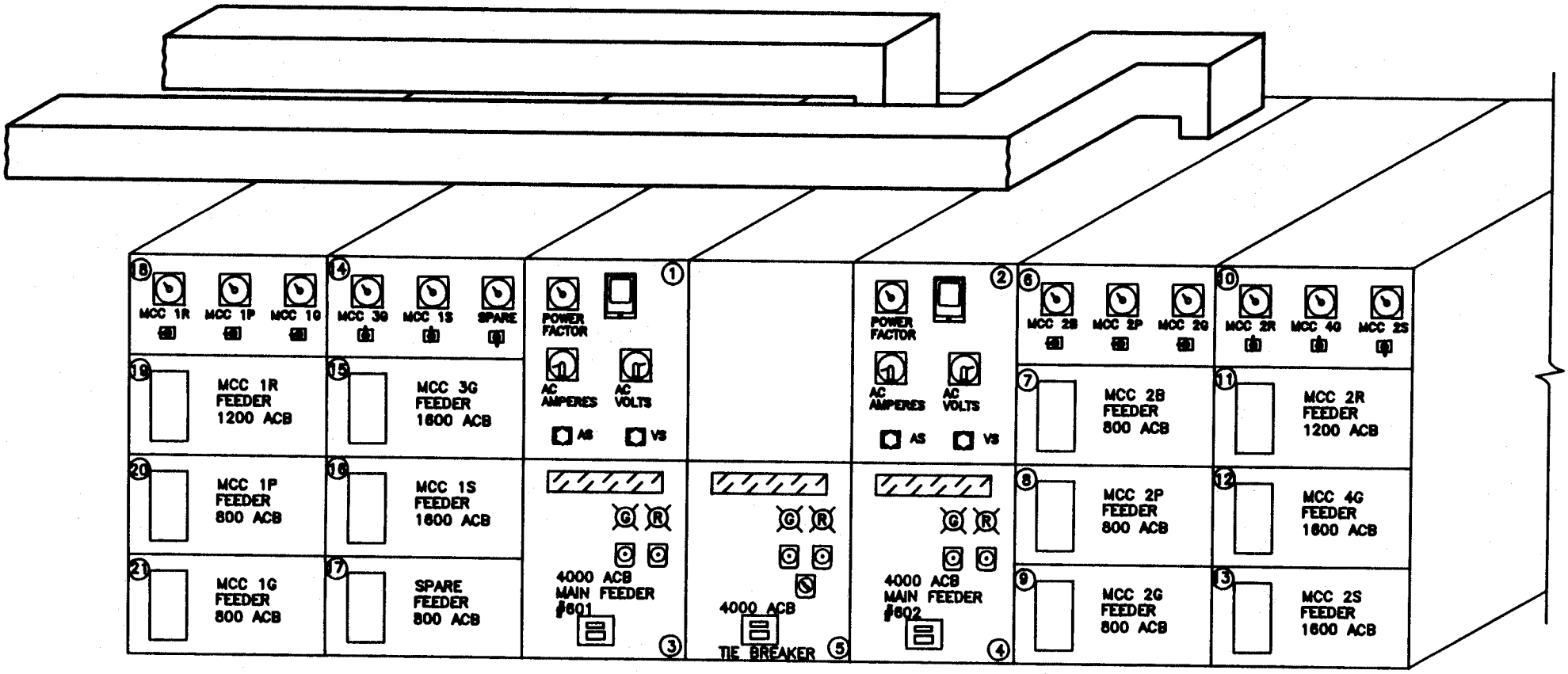
Date : January 1994
Figure 19-4



BASEMENT FLOOR PLAN

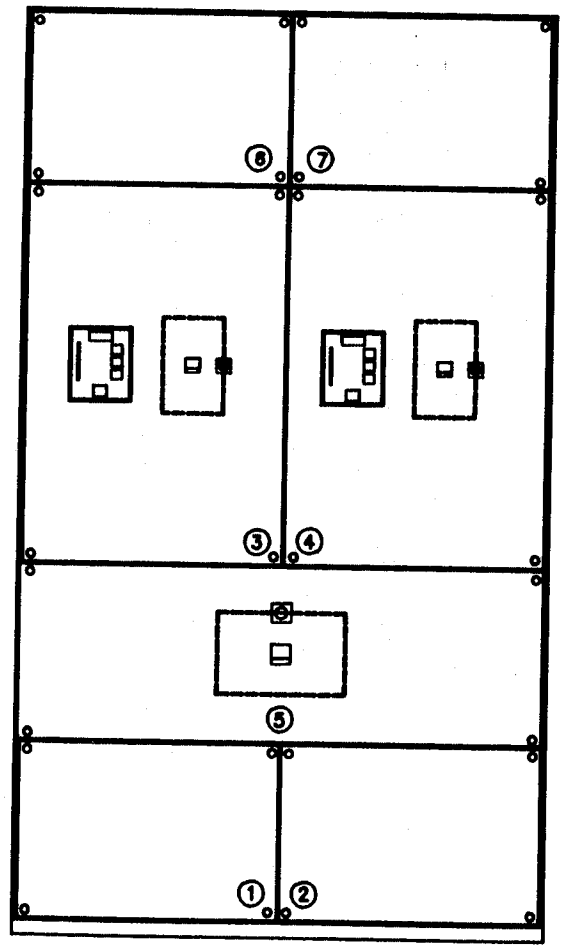
600V BUS DUCT LAYOUT

Date : January 1994
Figure 19-5



PLANT AREA MAIN
600V DISTRIBUTION SWITCHGEAR

Date : January 1994
Figure 19–6



FRONT ELEVATION

MCC 1S & MCC 2S SWITCH GEAR

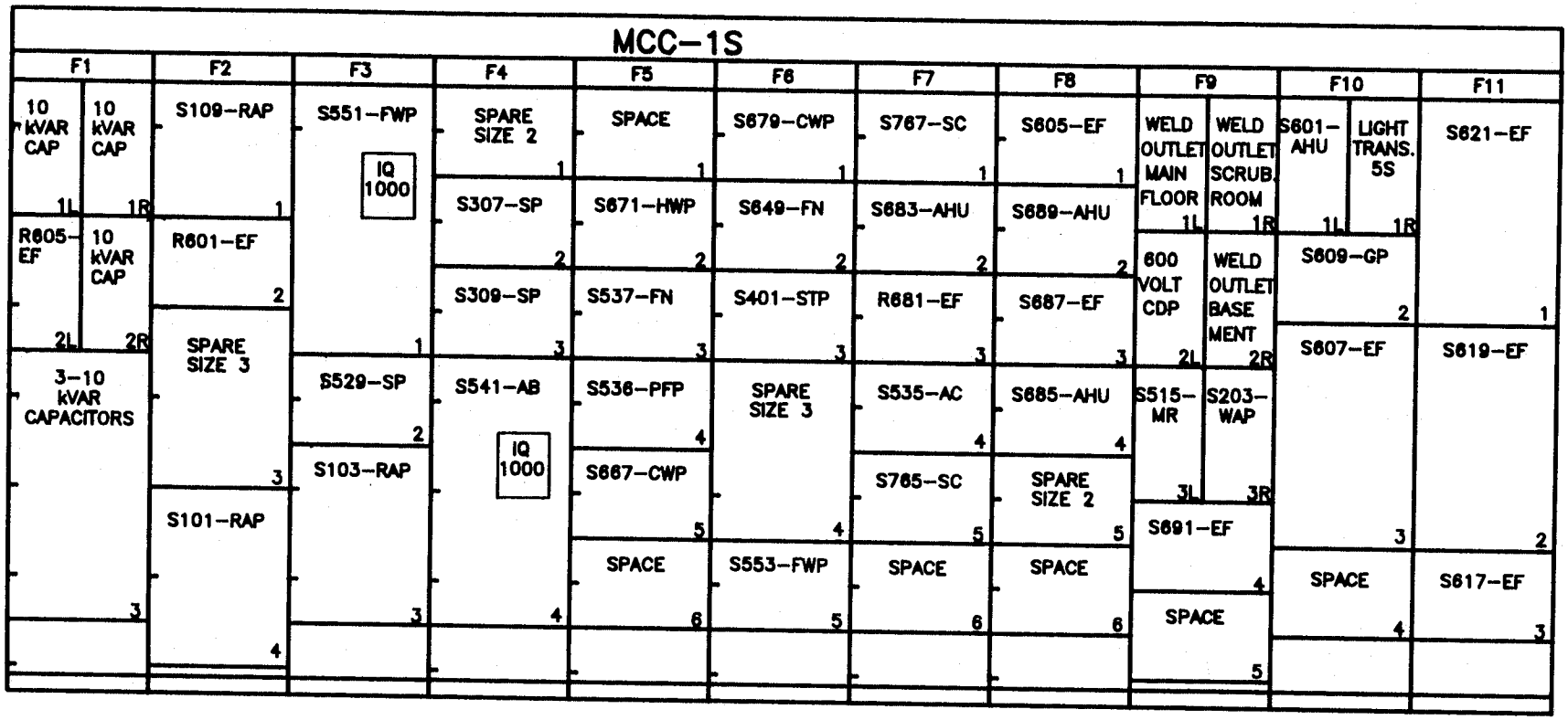
UNIT No.	DESCRIPTION	FEEDER			CIRCUIT BREAKER			REMARKS
		CAP IN AMPS	SIZE	TYPE	VOLTS	FRAME SIZE	TRIP SETTING	
①	600V INCOMING AND TIE LUGS	1600A		LOW Z BUS DUCT				
②	600V INCOMING AND TIE LUGS	1600A		LOW Z BUS DUCT				
③	CIRCUIT BREAKER	1600A			600V	1600A	1600	KEYINTERLOCK
④	CIRCUIT BREAKER	1600A			600V	1600A	1600	KEYINTERLOCK
⑤	TIE CIRCUIT BREAKER	1600A			600V	1600A	1600	NON-AUTO KEYINTERLOCK
⑥	600V MAIN LUGS	1600A		BUS BAR				MCC 1S METERING VIA IQ DATA PLUS
⑦	600V MAIN LUGS	1600A		BUS BAR				MCC 2S METERING VIA IQ DATA PLUS

KEY INTERLOCK SCHEDULE

BREAKER UNIT No.	DESCRIPTION
3	KEY "K1" REMOVABLE ONLY WHEN N.C. BREAKER IS OPENED.
4	KEY "K2" REMOVABLE ONLY WHEN N.C. BREAKER IS OPENED.
5	N.O. BREAKER CAN ONLY BE CLOSED WHEN EITHER KEY "K1" OR "K2" IS INSERTED.

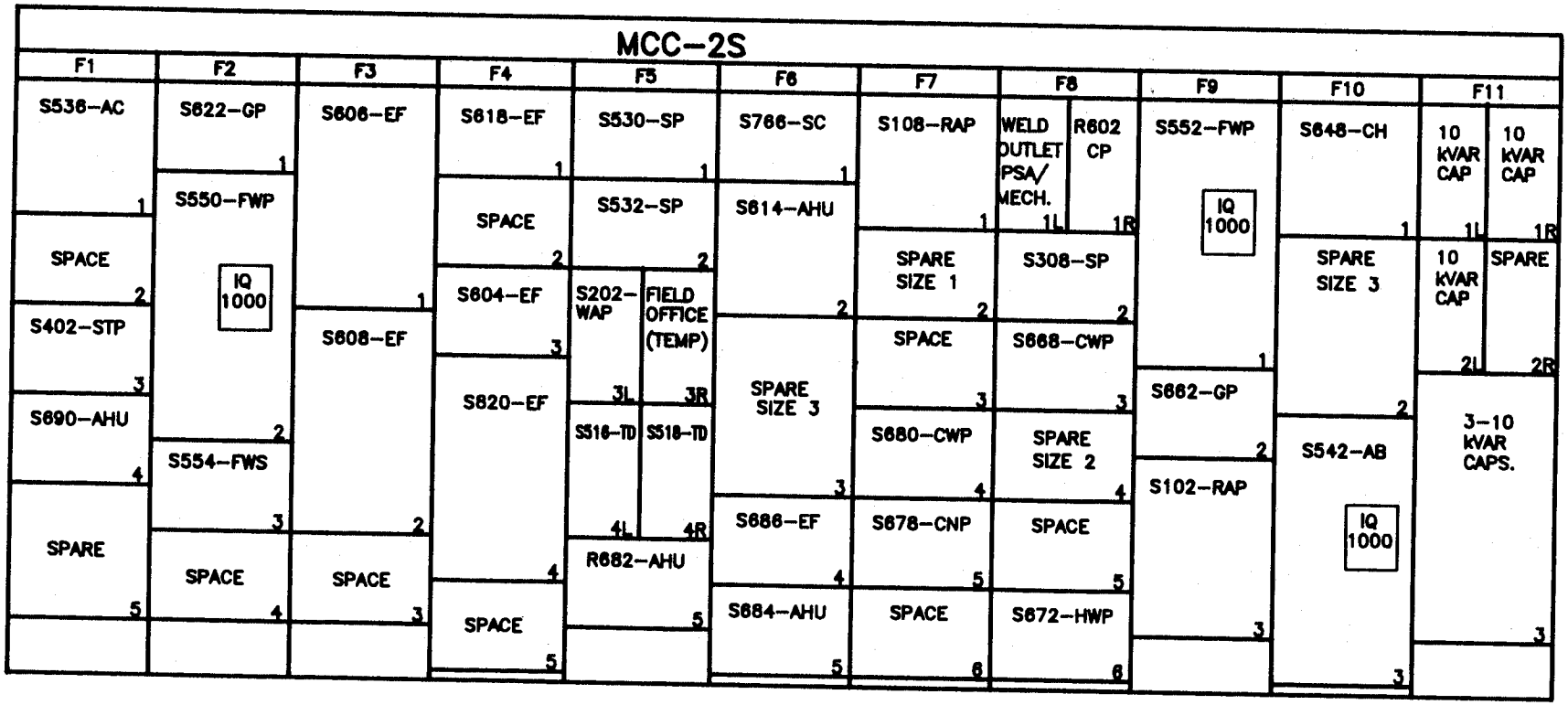
MCC 1S & MCC 2S SWITCHGEAR LAYOUT

Date : January 1994
Figure 19-7



MCC 1S LAYOUT

Date : January 1994
Figure 19–8



MCC 2S LAYOUT

Date : January 1994
Figure 19–9

A summary of the equipment described in this section is as follows:

1. One 600 V main distribution panel;
2. Two 600 V motor control centres: MCC-1S and MCC-2S;
3. Two 75 KVA lighting panel transformers: "5S" and "56C";
4. Two 45 KVA lighting panel transformers: "4S" and "2S";
5. Two 15 KVA lighting panel regulating transformers;
6. One 600 V power panel: CDP-E2;
7. Two 347/600 V lighting panels: "4S" and "5S";
8. Six 120/208 V lighting panels: "1S", "2S", "3S", "6S", "7S" and "56C".

Equipment locations are provided on the ground floor and basement floor plans shown in Figures 19-4 and 19-5.

19.3 DISTRIBUTION EQUIPMENT DESCRIPTION

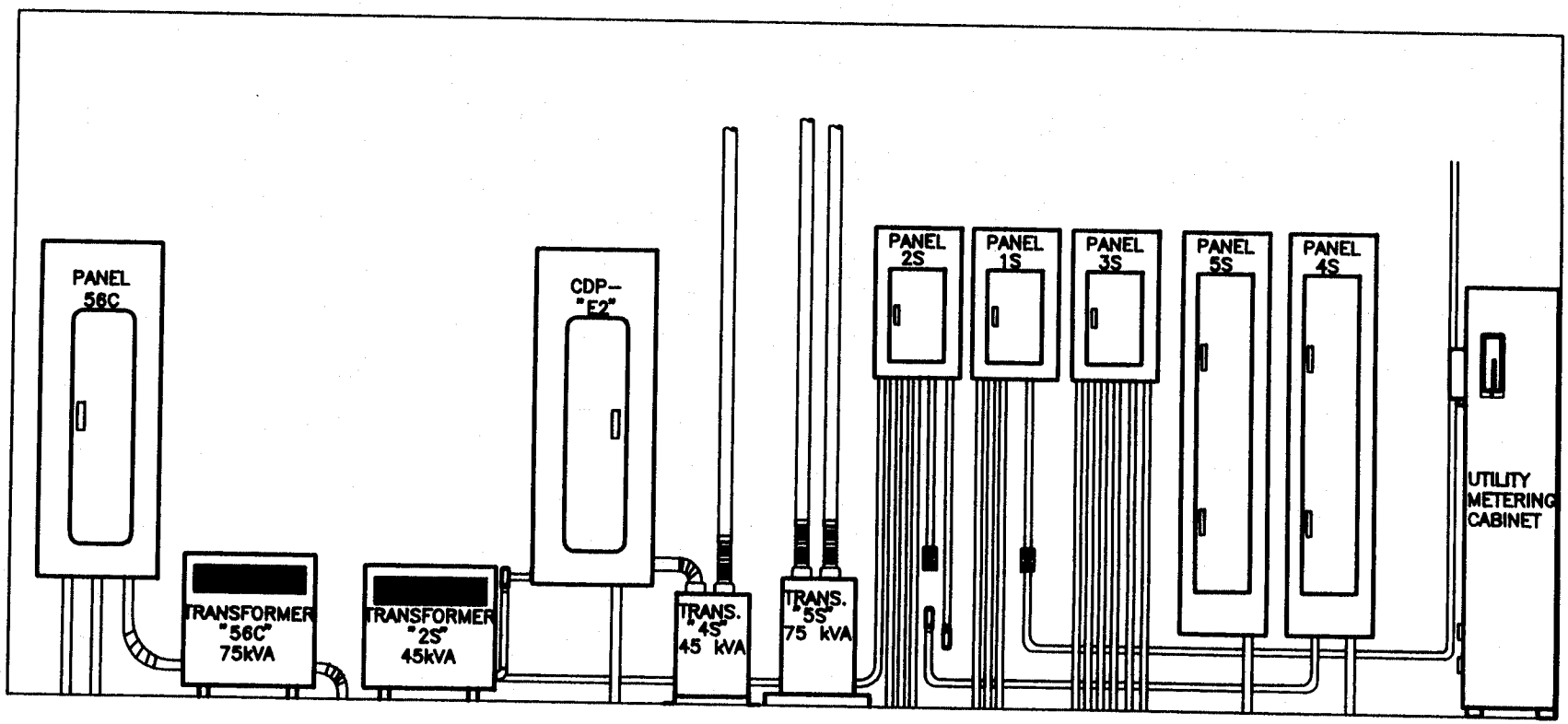
19.3.1 347/600 V Distribution Equipment

19.3.1.1 Non-Essential Service

The 600 V main distribution panel feeds all eleven MCCs in the plant area. These MCCs provide all the plant area non-essential 600 V service. A layout of the distribution panel is shown in Figure 19-6.

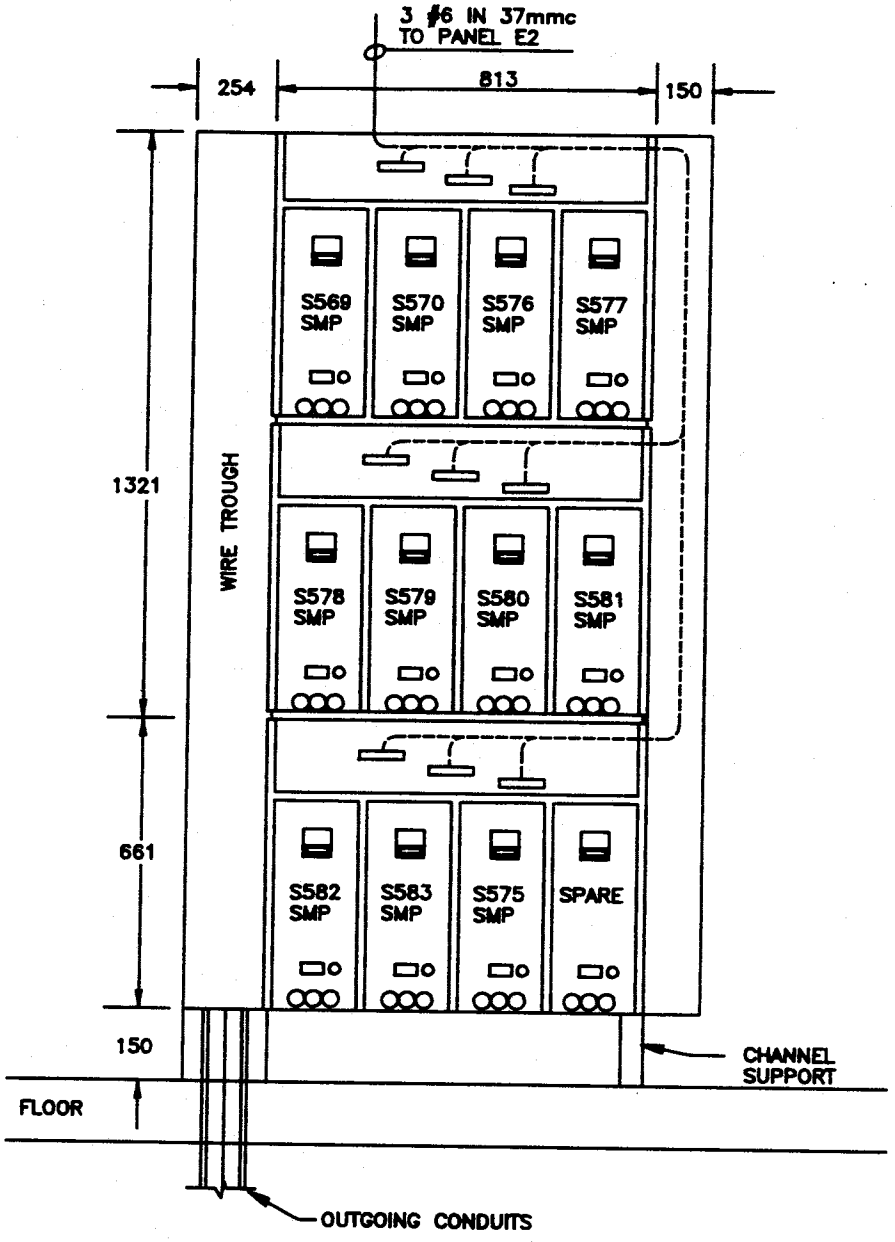
600 V power from MCCs 1S and 2S supply most of the pumps, motors, and HVAC equipment in the Secondary Clarifier area. The locations of the MCCs are shown in Figure 19-4 and layouts provided in Figures 19-7, 19-8, and 19-9.

Transformer "5S" draws 600 V power from MCC-1S and provides 347/600 V to panel "5S". All of the area's non-essential 347 V service is taken from this panel. The locations of this transformer and panel are shown in Figure 19-4 while a description of the equipment supplied by panel "5S" is provided in Panel Function Summary Table 19-1.



ELECTRICAL ROOM NORTH WALL
EQUIPMENT LAYOUT

Date : January 1994
Figure 19-10



GROUPED SUMP PUMP MOTOR STARTER PANEL

Date : January 1994
Figure 19-11

19.4 MCC DISCONNECT PROCEDURES

19.4.1 Procedure for Locking Off Equipment

Each group (Operations, Electrical Maintenance, and Mechanical Maintenance) has their own locks for locking off equipment:

1. The equipment should be locked off with the locks provided;
2. The switch should be tagged, the reason for locking off stated on the tag, and the tag should be signed and dated;
3. A request for maintenance should be made.

19.4.2 Procedure for Unlocking Equipment

Only the person who locked off and tagged the equipment shall unlock it.

19.5 SYSTEM MONITORING

The INFI 90 monitors the following electrical system parameters:

1. MCC-1S and MCC-2S voltage;
2. Hydro feeders No. 1 & 2 voltage;
3. Hydro feeders No. 1 & 2 current;
4. Hydro feeders No. 1 & 2 power factor.

Cross references between this equipment and the INFI 90 can be found in Bridging Table 19-2. Equipment/Instrument Summary Table 19-3 gives a detailed listing of all the monitoring devices associated with this equipment. Further monitoring information is available in the Process and Instrumentation Diagram shown in Figure 19-12.

TABLE 19-2

ELECTRICAL POWER SYSTEM/INFI 90 BRIDGING TABLE

EQUIPMENT ID NUMBER	GRAPHIC DISPLAYS		GROUP DISPLAYS			
	DISPLAY NUMBER	REMOTE CONTROL INDEX NUMBER	TREND	CONTROL STATION	REMOTE CONTROL SWITCH	SINGLE POINT
S511-EI	5-U, OVERVIEW		5-U			5-U
S512-EI	5-U, OVERVIEW		5-U			5-U
S525-EI	5-U, OVERVIEW		5-U			5-U
S526-EI	5-U, OVERVIEW		5-U			5-U
S527-EI	5-U, OVERVIEW		5-U			5-U
S528-EI	5-U, OVERVIEW		5-U			5-U
S533-XI	5-U, OVERVIEW		5-U			5-U
S534-XI	5-U, OVERVIEW		5-U			5-U

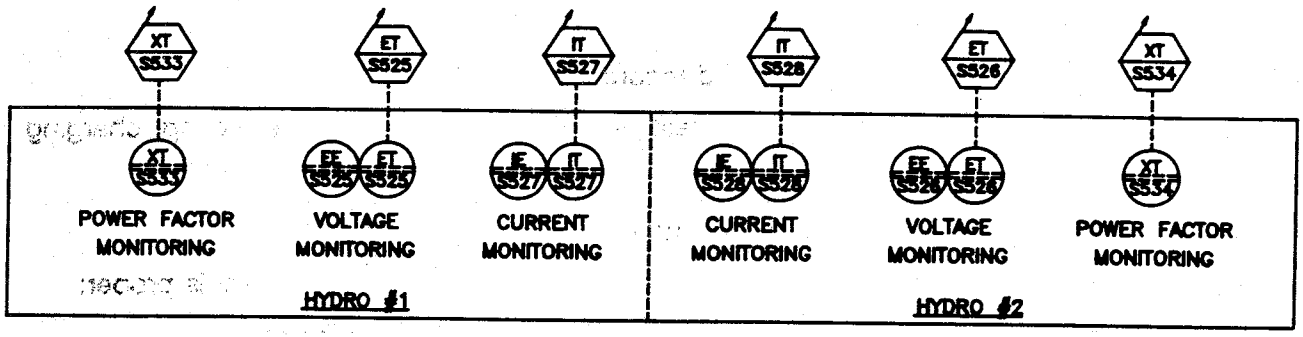
TABLE 19-3

ELECTRICAL POWER SYSTEM EQUIPMENT/INSTRUMENT SUMMARY

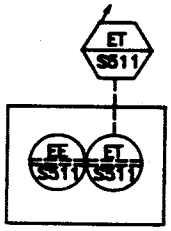
INSTRUMENT TAG NO.	SERVICE	LOCAL	LOCAL PANEL	FDP-S	INFI 90	REMARKS NORMAL RANGE SET POINT
S511-EI	MCC 1S VOLTAGE INDICATION		I		I	0 to 750 V
S512-EI	MCC 2S VOLTAGE INDICATION		I		I	0 to 750 V
S525-EI	HYDRO FEEDER #1 VOLTAGE IND.		I		I	0 to 750 V
S526-EI	HYDRO FEEDER #2 VOLTAGE IND.		I		I	0 to 750 V
S527-II	HYDRO FEEDER #1 CURRENT IND.		I		I	0 to 4000 A
S528-II	HYDRO FEEDER #2 CURRENT IND.		I		I	0 to 4000 A
S533-XI	HYDRO FEEDER #1 POWER FACTOR		I		I	0.5 to 1.0
S534-XI	HYDRO FEEDER #2 POWER FACTOR		I		I	0.5 to 1.0

S - SAFETY STOP A - ALARM C - CONTROL I - INDICATION R - RESET Q - COMMON ALARM

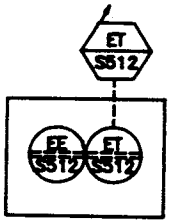
All instruments on this page found in Figure 19-12



MAIN SWITCHBOARD MONITORING



VOLTAGE INDICATION AT MCC 1S



VOLTAGE INDICATION AT MCC 2S

ELECTRICAL POWER SYSTEM
PROCESS & INSTR. DIAGRAM

Date : January 1994
Figure 19-12

19.6 ROUTINE CHECKS

19.6.1 600 Volt Transformers and Breakers

1. Check all meter readings and record same;
2. Roll the breaker into the "test" position and operate the spring charging mechanism;
3. Check the contact alignment and clean the contacts;
4. Roll the breaker back into position, and ensure that the alignment is proper;
5. Check the transformer high-voltage and low-voltage terminals;
6. Visually check the transformer core for any signs of deterioration;
7. Check for overheating of the transformer.

19.6.2 Motor Control Centers

1. Check the indicating lights and replace if necessary;
2. Check the terminals on each starter;
3. Operator the reset button to ensure that the operation is free;
4. Check the main terminal to the MCC;
5. Clean each starter compartment of any foreign materials;
6. Operate each starter manually;
7. Check the overload relay heater control sizing.

19.7 EQUIPMENT DATA

1. **<u>600V Main Distribution Panel:</u>**

Location:	Electrical Room
Purpose:	Subfeed 600V power to plant area MCCs
Manufacturer:	Westinghouse Type DS Switchgear Unit
	600V, 4000A, 3ph, 3wire, 60Hz