HEADLINE 72-116
VOLUME 1

FACILITY DESIGN DESCRIPTION
of
THE PROTOTYPE APPLICATIONS LOOP

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1.0 INTRODUCTION

The Sodium Technology program in support of Fast Flux Test Facility is to provide FFTF design input, conduct design verification tests, develop operational procedures for sodium and gas purity monitoring and control systems, and develop the technical base to characterize and control the chemical behavior of large sodium systems. Included in the program are an integrated development program encompassing sodium purification, in-line impurity monitoring instruments, sodium sampling and analysis methods, and cover gas systems. In order to develop procedures, train personnel and initiate the development of tests, a general purpose sodium facility was required in mid-1972. The Prototype Applications Loop is to fulfill this need with initial emphasis on the development of in-line chemistry monitoring instruments.

The Prototype Applications Loop will also be used as a general development facility for Materials Technology programs, so that important materials tests can be conducted in well characterized sodium.

2.0 FUNCTIONAL REQUIREMENTS PROTOTYPE APPLICATIONS LOOP

The Prototype Applications Loop (PAL) is a forced convection, isothermal, controlled chemistry sodium loop to fulfill the following functions:

- 2.1 Provide sodium for testing and development of prototype sampling, analysis, purification, and cover gas control equipment for the forthcoming engineering facilities and for the FFTF.
- 2.2 Provide a training base for personnel and to develop procedures for later adaptation to the FFTF.
- 2.3 Demonstrate operational capability of in-line instruments.
- 2.4 Provide for the development and testing of design features, including procurement and fabrication records, and quality assurance procedures to be used on FFTF.

In order to fulfill these functions the loop was designed to operate isothermally up to 1200 °F and to provide a large reservoir of homogeneous sodium for supply to test assemblies. The design criteria used to meet the above functions are attached as Appendix F. The design parameters are summarized in the following table:

Component	Design Parameters			
	Flow, GPM	Temp., °F	Pressure PSIG	Volume, in ³
Reservoir	25	1200	25	*23,340
Jet Mixing Assembly	10.5 max.			
Crystallizer	1.0	1200	40	1,360
Economizer	1.0	1200	40	
Loop Piping	25	1200	40	665
NaK Piping	2.0	800	50	* 277
NaK Pump	2.0	8800	50	
Sodium Pump	25	1500	25	

**Sodium poundage at fill: 765 pounds

*Liquid volume at operating level.

**Includes 34 pounds for SCS fill.

3.0 DESIGN DESCRIPTION

3.1 General Arrangement

The Prototype Applications Loop (PAL) located in the 335 Bldg., is a forced convection, isothermal, controlled chemistry sodium loop. The PAL was designed and fabricated for sodium technology studies described in the functional requirements, Section 2.

The PAL is a versatile, experimental sodium system capable of operation to 1200°F and 40 psig, and is designed for experimental flexibility without modifying the basic components. The center of PAL is the 150-gallon mixing tank to which personnel access is provided by the work platform - confinement arrangement shown in Print No. H-3-32181. A view port is provided to study the surface of sodium at elevated temperature and for verifying that mixing is adequate. The main piping is located below the work platform (see Figure 1); however, the decking of the work platform can be readily removed for access to make minor repairs such as replacement of trace heaters. The mezzanine about 8 feet above the work platform provides access to the top of the mixing tank for the addition or removal of experimental devices through the nozzles.

The PAL vessel's are designed and fabricated in accordance with the ASME Boiler and Pressure Vessel Code Section III (Class C 1967) Nuclear Vessels RDT Standards. The piping is designed to the extent of ANSI-B-31 - 7 Class II 1967. The appropriate Hanford Standards for electrical, instrumentation, and structural (Appendix G) were also used as design guidelines. The material of construction of the sodium boundary is 304 stainless steel with a 0.04% minimum carbon content, except for minor amounts of stellite in the valve seats.

3.2 Enclosure Cooling

Piping and vessel heat losses through the insulation to the environment within the enclosure are to be about 30,000 BTu/hr at the maximum operating temperature of 1200°F. A 1500 scfm induced draft is provided to flow air from the building through the enclosure to maintain temperatures at 120°F or less. Inlet air flow enters the enclosure from 3 separate locations through three each 5" x 10" openings, two openings on the east side of the loop enclosure and one on the north side of the enclosure.

The air flows over the piping system then into the suction side of the exhaust fan which discharges to the atmosphere outside of 33 Bldg., through the duct work.

Piston operated damper controllers are installed at each of the inlets, and one at the suction of the blower. These are connected to the smoke detector system and will be actuated to close dampers upon a signal from the smoke detector alarm.

3.3 Reservoir

The reservoir is a pressure vessel 48" high and 32" in diameter with an ellipsoidal head on each end. The reservoir walls are 3/8" thick. The reservoir is designed, fabricated and stamped in accordance with ASME Boiler and Pressure Vessel Code Section III, Class C for Nuclear Vessels, 1967 and RDT E 10-3T Tank, Liquid Metal Service.

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Figure 3.1 Prototype Applications Loop

A cutaway view of the tank is shown in Print H-3-32156. The side of the tank has four penetrations: the view port, the line to feed the sodium pump and two sodium return lines. The view port is a 4" sch 40 pipe, which is equipped with a damper, a valve and a sight glass for viewing the sodium/gas interface. The sodium lines are 1" sch 40 pipe and each is equipped with a siphon break. The siphon breaks serve two purposes: 1) only 5 to 10 gallons of sodium can siphon from the tank should a major break in the piping occur, and (2) they act as vent holes or points for gas de-entrainment.

The pumping power of the driver loop provides the mixing in the tank via the double jet-deflector plate arrangement shown in Print H-3-32156. The double jet assembly is located midway between the bottom of the tank and the deflector plate. The openings in the jet nozzles are 0.35" in diameter. The outlet line to feed the EM pump has two suction ports on the same horizontal plane as the midpoint of the jet nozzle. The inside diameter of the suction ports is about 1".

On the top of the tank, shown on Print H-3-32157, there are four large (2") access nozzles for:

- Inserting the double jet-deflector plate and liquid level probes
- A materials surveillance stringer
- Materials addition and light port for illumination during viewing
- A spare nozzle for future experiments.

The nozzle for illumination is equipped with a butterfly valve near the tank and an isolation valve at the top of the nozzle. The butterfly type valve is to reduce the rate of sodium deposition in the nozzle. The other two nozzles are equipped with diffusion baffle plates that fit almost flush with the top of the tank to reduce sodium vapor transport into the nozzle and to provide supports for the liquid level probes and deflector plate support. Entry through the four 2" nozzles on the top of the tank can be through a portable "glovebox" or portable chamber. The chamber will be designed to couple with the nozzle flanges and will be purgable, so it can be back-filled with argon gas.

In addition to the access nozzles on the top of the tank there are also two nozzles for the gas inlet and outlet vapor traps and five thermowell nozzles for temperature measuring devices. These are located in four quadrants as shown in Print H-3-32157, and at two different levels. The temperature of the sodium in the vessel can be measured at four locations: the center, near the wall, near the bottom of the vessel, and near the liquid-gas interface. The fifth thermowell is for measuring the temperature of the gas phase. There are four thermocouples attached to the vessel to measure the skin temperature at selected locations.

The liquid-gas interface in the reservoir is the highest point of sodium in PAL. Therefore, the reservoir also acts as an expansion tank. The gas space above the sodium is about 30% of the tank volume.

3.4 Cold Trap

The service cold trap has a five gallon volume, and is designed to handle flow rates of 0.5 to 1.5 gpm with a residence time in the economizer of 0.2 min at 1 gpm. The service cold trap is packed with wire mesh to provide crystallization surfaces as shown on Print H-3-32154. There are four thermocouples in the cold trap; two in the annulus and two in the center. The temperature in the service cold trap can be controlled between 215 and 500° F $\pm$ 10° F. NaK is used to cool the service cold trap. Heat in the NaK system is dissipated using a NaK to air forced convection heat exchanger. The cold trap was fabricated in accordance with ASME Boiler and Pressure Vessel Code Section III, Class C, Nuclear Vessels, 1968, RDT E 4-5T, Forced Circulation Cold Trap Assembly for removal of sodium impurities and RDT E 10-3T, Tank, Liquid Metal Service.

3.4.1 Cold Trap Air Cooling System

Air flow to the cold trap cooler is controlled by a damper system consisting of a panel mounted proportioning controller, and a proportioning damper drive motor installed on the cooler housing.

The control signal is from a thermocouple installed in the cold trap thermowell. The input signal to the controller is summed with an internally-generated set point reference voltage to form an input error signal at summing point No. 1. The error signal then feeds through an attenuating resistor to summing point No. 2 to be summed with the position feedback signal, opposite in polarity from the motor, to thus form the output error signal. The output signal is amplified and, depending on the polarity, energizes one of the two relays to drive the motor in the proper direction. The motor, in turn, drives both the damper and the wiper of the rebalancing potentiometer. As the wiper moves, the position feedback signal changes. The motor continues to turn until the output error signal decreases to zero. The system is then balanced at the null point determined by the controller.

3.5 Loop Piping

The loop piping system is made up of approximately 70% $\frac{1}{2}$ " sch 40 and 30% 1" sch 40 304 stainless steel pipe with a 0.04% minimum carbon content. The pipe was purchased in accordance with ANSI B 31.7, Class I, Code for Nuclear Piping specification, then upgraded by the HEDL nondestructive testing laboratory to RDT F 3-8T, "ultrasonic examination of metal pipe and tubing for longitudinal discontinuities, February, 1969, level S-2.

The entire piping system was fabricated in accordance with ANSI B 31.7, Class II, Code for Nuclear Piping, and the following tests performed:

- 100% Radiography of all butt welds in accordance with RDT F 3-6T, March, 1969.
- 100% Liquid Penetrant Examination at all welds in accordance with RDT F 3-6T, March, 1969.
- 100% Liquid Penetrant Examination at all attachment welds support legs, anchors and guides in accordance with ANSI B 31.7 paragraph 1-736.5.5.

- The entire piping system was pneumatic tested with ultrapure nitrogen to 170 psig in accordance with ANSI B 31.7 paragraph 1-737.1.2.
- The entire system was leak tested to less than 1×10^{-7} atmospheres/cc/sec. with a helium mass spectrometer in accordance with RDT F 3-6T, March, 1969.

3.6 Valves

The PAL piping valves are all welded bellows seal bar stock type valves rated at 250 psi at 1200 F. Thirteen $\frac{1}{2}$ " valves, three 1" straight pattern valves are used in the sodium piping system and two $\frac{3}{8}$ " tubing valves are used in the NaK system.

3.7 Flowmeters

The PAL flowmeters are the permanent magnet type with a high gauss magnet purchased to RDT Standard C 4-5T, November, 1970.

3.8 Electromagnetic Pumps

Main Loop

The main loop pump is a conduction type electromagnetic pump, rated at 25 gpm at 25 psig and has a 40 psig shut off head. The pump has a 1" outside diameter by 0.049 wall throat fabricated from 304 austenitic stainless steel tubing, purchased to ASTM A-213 tubing specifications and (upgraded to RDT F 3-8T, February, 1969, level S-2 by the HEDL NDT laboratory).

The pump is a single phase 60 HZ 270 VAC maximum unit. Power is supplied from a motor driven 30 amp 0-270 VAC autotransformer mounted adjacent to the pump. A 7.5 KVAR capacitor located near the autotransformer is wired in parallel with the pump to provide power factor correction.

The pump is provided with thermocouples on the throat for temperature monitoring during normal heat up and operation, and for overtemperature protection.

Cold Trap Cooler Pump

The cold trap coolant pump is a DC Faraday type pump, rated at approximately 2 gpm at 7 psig. The pump has approximately a 10 psig shut off head. The pump throat is fabricated from 0.75 outside diameter by 0.065 wall 304 austenitic stainless steel tubing purchased to ASTM A-213 specifications and upgraded to RDT F 3-8T level S-2 by HEDL NDT laboratory, and then fabricated into a pump throat as per Print No. H-3-32180. Power to the pump is supplied from a panel-mounted 0-1000 ampere, 0-8 volt variable power supply.

A thermocouple is installed near the pump throat to monitor the temperature during operation and provide overtemperature control.

3.9 Vapor Traps

The Prototype Applications Loop vapor traps are controlled temperature profile refluxing units. The traps are fabricated from 2- $\frac{1}{2}$ " sch 40 pipe with a pipe cap on each end. The trap is fitted with a 1" connector on the inlet and a 3/8" connector on the outlet. The trap is filled with $\frac{1}{4}$ " stainless steel Raschig rings for packing. External heating of the traps is accomplished by the use of a wrapped heater using controlled spacings along the wall for zone heat control. A heater is provided on the inlet connector for preheat control of the outlet vapor trap, each of the heaters has its own temperature controller. Four internal thermocouples at different elevations on the trap measure the temperature profile. One thermocouple on the external surface of the trap is used for temperature control. The vapor traps are designed to reduce the sodium concentration in the argon sample gas stream to 5 ppm.

3.10 Thermal Insulation

Calcium silicate type insulation with a low chloride content was installed on the loop piping system in a two layer configuration in order to minimize heat losses through the joints. The insulation is of sufficient thickness to provide a maximum insulation surface temperature of 135° F under natural convection cooling conditions and with an ambient temperature of 90° F and with the sodium temperature of 1200° F. The cold trap is insulated with 3 inches of Kaowool type blanket insulation.

4.0 ELECTRICAL & INSTRUMENTATION

4.1 Electrical Power Supply

The Prototype Applications Loop requires two separate power supplies for operation. A 50 KVA, 480/240/120 60 HZ, 1 phase transformer for the loop's trace heating and instrumentation system, and a 15 KVA 480/208/120 60 HZ, 3 phase transformer for the NaK coolant pump.

The power is supplied from the 335 Building motor control center, through multi-conductor cable in the service wire tray, to fused disconnects located on the west wall of the 335 Building. The two transformers are installed under the work platform on the loop, and are wired into the fused disconnects. A 200 ampere magnetic contactor K-1 is installed on the secondary side of the loop transformer and is connected into the loop's safety circuit for emergency shut down. Three distribution panels are provided for the loop's operation. Panel-A supplies power to the reservoir heater, the loop's electromagnetic pump, the ventilation blowers, and the cover gas system. This panel is deactivated by K-1 contactor in the event of a fire. Panel-B is for instrumentation and will not be shut down by the safety system. Panel-C supplies power for the loop's trace heater circuit, and can be deactivated by either the trace heater magnetic contactor K-6 or the main contactor K-1. A 15 KVA 480/208/120 60 HZ 3 transformer is provided for power to the DC electromagnetic pump. It is activated by the K-3 magnetic contactor.

4.2 Loop Monitoring and Recording System

The five variables of the Prototype Applications Loop are displayed at all times in bar graph form on a 20 inch cathode ray television tube (metrascop). Fifty channels are provided for the loop's variables. Each of the 50 channels is provided with an alarm function as shown in tabulated form on Print No. H-3-32162, sheet #2.

Channels No. 1 through channel 43 display the loop's temperature profile which has a temperature range of 0-1250°F. Channel 44 monitors the cover gas pressure. Channel 45 monitors the NaK cover gas pressure, channel 46 monitors the liquid level in the reservoir.

An edge lit engraved overlay is provided over the cathode ray tube which shows the numerical values of the grid calibration and indicates channel identity of the data bar display. The metrascop, including all its alarm functions can be bypassed for maintenance purposes at the PAL control panel. Signals from magnetic flowmeters FM 1 - FM 4 are recorded on two dual pen recorders which are located in the PAL control panel. This bypass is to be used only for maintenance operations of short duration.

Digital Readout

The system is provided with a precise digital readout of the variable for any selected channel, or of the high and low alarm levels on that particular channel, as well as the usual bargraph display. The readout is on nixie tubes mounted adjacent to the CRT. The channel being indicated on the nixie tubes is shown by a cursor below the bargraph grid. The cursor is set by the operator by a front panel knob, thus the operator can select a digital readout of any one of the channels, or of the high or low alarm levels on any one of those channels. An additional readout tube shows whether the presentation is of the transducer variable or of the alarm level setting. The letter "H" is used to indicate high

alarm and "L" for low alarm. The letter "F" for instance, is used to indicate a temperature reading in degrees Fahrenheit.

Printer Model P-16

The Metrascope Printer Model P-16 is designed to function with the Metrascope Model M/S20D, for the purpose of maintaining a permanent record of data displayed on the bargraph such as temperature, millivolts, etc., during normal operation and especially during an abnormal condition such as an alarm condition. Printing will occur under the following conditions:

1. Print Frame
 - a. Single Prints all channels displayed one time when push button is depressed or timer is actuated.
 - b. Continuous Prints all channels displayed and continues to repeat printing all channels
2. Alarm
 - a. Alarm Normal Prints all channels displayed automatically if any channel is in an alarm condition. Channels in alarm printed in red.
 - b. Alarm Channels Only Prints only the channels which are in alarm automatically when one or more channels are in alarm.

The printer will print 16 columns each of which has 16 characters. A sample print word is given as an example:

285 12.34. 35 1234

Day	Hour	Minute	Channel Number	Alarm (high or low)	Signal Level
-----	------	--------	----------------	---------------------	--------------

The groupings are as the configuration show below on the characters as indicated:

014	01	01	50	0506
014	01	01	49	0506
014	01	01	48	0506
014	01	01	47	0506
014	01	01	46	0253
014	01	01	45	0000
014	01	01	44	0000
014	01	01	43	0024
014	01	01	42	0026
014	01	01	41	0025
014	01	01	40	0026
014	01	01	39	0026
014	01	01	38	0028
014	01	01	37	0020
014	01	01	36	0027
014	01	01	35	0025
014	01	01	34	0026

Paper Type

Three and one-half inch wide fanfold, five inches long with ribbon printing.

4.3 Electric Valve Operator System

All of the valves in the PAL sodium system are equipped with electric controlled motor operators. This system provides the means to open or close selected valves from a remote valve control station. Two sizes of valve operators are used on PAL valves. Thirty-five inch/pound units are installed on the $\frac{1}{2}$ " valves, and 100 inch/pound units are installed on the 1" valves. Valve No. 's 1 through 6 are also equipped with low temperature relays that prevent the valve from being operated until the temperature reaches a desired point. (This is adjustable on the metrascope.)

The valve operator control panel is located just below the metrascope on the main control console. This permits viewing the loop's sodium flows while adjusting the valve settings. The valve control panel consists of 20 switches; 16 for the loop's valves, and 4 spares; an on/off power switch; a valve position meter, calibrated in 0-100% open; and an open/close switch. In operation the valve to be operated is selected by depressing switch #1 for V-1, switch #2 for V-3, etc. Turn on the power switch, while observing the meter, either open or close the valve. After the desired setting is reached (the open/close switch is a self centering switch, and should have returned to the center position), the valve selector switches are the lock-in type and require that they be depressed a second time to allow them to be turned off.

4.4 Fire Detection System

An air duct ionization smoke detector installed in the loop's exhaust duct provides a continuous sample of the loop's atmosphere. The smoke detector control system is interconnected with the loop's control circuit so as to provide emergency shutdown of all of the loop's processes in the event of a fire. In addition, the signal is tied into building Zone 5 fire alarm panel which alarms at fire station. A panel mounted key-operated by-pass switch is provided to by-pass the smoke detector circuit during startup. Argon flood of the piping bay is nonoperative until scrubbers are installed in the 335 Building.

4.5 Trace Heater Controllers

The temperature/power controller employs closed-loop operating principles in controlling the temperature of a loop piping system.

In setpoint operation, a thermocouple affixed to the surface of the piping generates a feedback signal which represents workpiece temperature. This signal is compared with a temperature command signal established by the setting of the setpoint dial. If the temperature of the piping is not at the command level, the command and feedback signals are unbalanced. This imbalance causes a control signal to be generated at a magnitude proportional to the temperature deviation, and with a polarity which reflects the direction of error. If the piping temperature exceeds the command level, the control signal is termed negative; if it is less than the command level, the control signal is termed positive.

The power controller responds to the magnitude of a positive control signal by applying the proportional voltage to the heating element. A negative control signal completely inhibits the output of the controller, allowing the piping to cool to the command level. The extent to which the piping temperature may deviate below the command level before maximum corrective power is applied to the heating element is defined as the band of proportional control. As the piping temperature rises to command level within this band, the control signal to the power controller reduces proportionally which, in turn, causes power to the heating element to be also reduced proportionally. The width of the band of proportional control is adjustable to provide stable system operation under various conditions of heater and piping thermal response.

Reset action is provided which is adjustable from the front panel of each controller with a range of 0.067 to 0.333 repeats per minute. The reset circuitry is an integrating type which is enabled only when the controller is operating with the proportional band (anti-reset wind up).

Voltage limiting is provided with adjustment on the front panel of the controllers which can be set to limit the output voltage from 0 to full line voltage (120 VAC).

In the manual mode of operation, closed-loop control is not utilized; the temperature-command and feedback signals exercise no authority over the magnitude of the control signal, and the control signal becomes solely a proportional function of the zero-to-maximum setting of the manual control dial.

4.6 Liquid Level System

Direct current resistance probes are used in the reservoir tank for liquid level indication and control. Two top entry "J" probes 12 inches long, by 0.250 outside diameter are inserted into the top of reservoir through nozzle. The probes are assembled into the jet deflection assembly as shown on H-3-32156, Sheet 2, which are readily replaceable. Construction of each probe is similar to that of metal sheathed grounded thermocouples with the conductors insulated from the outer sheath along its length. The probe conductors and the sheath are fabricated from 304 stainless steel. The end of the wires and the tip of the sheath are fusion-welded to form a junction. Both the wires and the sheath comprise a circuit of electrical resistances interconnected as shown in Print No. H-3-32171.

4.7 Alarm System

All of the loop's off-standard operating conditions are indicated on a 24 channel alarm panel as indicated on Print H-3-32162, Sheet 2. The alarm panel is located in the upper central part of the loop's control console. The unit is designed to provide flashing lamps and audible output for the alert condition, and flashing lamps for a return to normal condition. The unit is also equipped with a first out indication that will permit the operator to determine which of the systems that went into alarm first.

4.8 Thermocouples

Inconel sheathed, MgO-insulated Chromel-P-Alumel (Type K) premium grade thermocouples with ungrounded junctions purchased to RDT Standard C 7-6T (HWS-9211), Spe-

cification for Thermocouples for Sodium Service, are used throughout the Prototype Applications Loop. The thermocouple reference is sealed with high temperature epoxy (900°F) and connected to glass-over-asbestos, stainless overbraid insulated lead wire. The thermocouples are installed on the one-inch piping via welding directly to pipe using welding pads, in the vessels by the use of thermowells, and to the $\frac{1}{2}$ -inch piping using stainless steel banding material.

4.9 Trace Heaters

The trace heaters that are used in PAL are of standardized design and are readily interchanged from one part of the loop to another, to reduce the spare parts inventory and to facilitate maintenance when it is required. The heaters are a clam shell type with a ceramic shell and nichrome wire for radiant heating which provides uniform distribution of heat. The outside diameter of these heaters are a standard 2-3/4" and the inside diameter are a standard 1-3/4". These standard sizes are used for all $\frac{1}{2}$ and 1 inch piping. The diameter of supports between the pipe wall and heater are varied in size to accommodate varying pipe sizes. These piping supports also support the thermocouples that are connected to the piping section.

The trace heaters are made in standard length of 6, 12 or 24" for the straight sections. Tees and all of the ells will have a 6" radii. The $\frac{1}{2}$ -inch valves also have clam shell heaters of sufficient size to ensure the sodium in the bellows is melted.

The three 1" valves are equipped with two each rectangular shaped, ceramic insulated 50 watt heaters, one heater is installed on each side of the valve body. The heaters are wired in parallel as shown on Print No. H-3-32160.

The clam shell heaters are rated at 100 watts/ft. each. This is slightly over twice the power required to melt the sodium in the piping. The two halves are wired in series parallel.

4.10 Reservoir Heater

The reservoir heater is a radiant type resistance furnace purchased from a commercial vendor as per specification No. HWS-9214. The furnace is fabricated in multiple sections in order for the unit to be installed around the tank nozzles.

The individual sections are internal wired to external connections boxes where the connections can be made for series or parallel wiring whichever the case may be. The furnace has a total power capability of 21.5 kW at 240 VAC 60 HZ 1.

The furnace is divided into 2 controlled heater sections. The bottom heater unit which is the reservoir tank surface below the liquid level has four sections, the base and three side sections which has a maximum power output of 18 kW. The units are all wired in parallel and produce a maximum watt density on the vessel surface of approximately 7.1 watts per inch². The top heater section (the area above the liquid level) is constructed from four horizontal and two vertical heater sections, all interconnected to produce a maximum power of 3.5 kW. The four horizontal units are wired in series, then parallel wired with the top vertical units. The furnace is insulated with sufficient fire brick to re-

duce the surface temperature to less than 140°F while the furnace is operating at 1200°F. The furnace's exterior surface is fabricated from 1/8 inch thick sheet steel.

4.11 Reservoir Heater Control

Two temperature controllers and two SCR solid state power phasers provide the power for the top and bottom heater sections of the PAL reservoir furnace.

The temperature controllers are a solid state high response instrument with proportional, rate, reset and current limiting controls. The output is connected to the input of a solid-state power phaser. The phaser provides proportionally controlled single phase power in response to the output from the controller.

The reservoir's bottom heater temperature controller is installed in the loop control panel board, and the power phaser, which is a 70 ampere 240 VAC unit, is mounted on the south end of the loop, along with the remaining electrical switchgear.

The reservoir top heater temperature controller is installed in the loop's control panel just above the bottom heater controller. It is connected to the power phaser which is a 30 ampere 240 VAC unit that is installed inside of the loop's control panel board.

Push button, and magnetic contactors are provided in each of the heater circuits to shut down the individual heater circuit in the event of a high temperature signal.

The input signal to the bottom heater temperature controller is from a Type K 1/8 inch dia. sheathed thermocouple installed in a thermowell (RTC-1) in the reservoir. A Type K 1/8" dia. sheathed pad thermocouple TDR-41 that is welded externally on the side of the reservoir provides the overtemperature shut down of the system.

The input signal to the top heater temperature controller is from a Type K 1/8" dia. sheathed thermocouple RTC-2, installed in a thermowell which protrudes into the reservoir's vapor space.

A Type K 1/8" dia. sheathed, pad thermocouple (TDR-42) that is welded externally on the top of the reservoir provides the overtemperature shutdown function of the top heater system.

5.0 PAL COVER GAS SYSTEM

5.1 General

The PAL Cover Gas System is designed to provide high purity argon and experimental gas mixes to the sodium/gas interface and to analyze them in a gas chromatograph. Gas can be added at a maximum rate of $1\frac{1}{2}$ liters per minute and bled at the same rate. The cover gas can be circulated at a maximum rate of $1\frac{1}{2}$ lpm, simultaneously with the feed-bleed provision while the system maintains a set pressure of 0 to 20 inches H_2O . The cover gas schematic is shown on H-3-32178.

The cover gas system is located on the mezzanine level of the PAL structure. The control panel, gas chromatograph, and mechanical assemblies are mounted inside of an air conditioned enclosure. The filter assemblies and gas bottle manifolds are located outside of the enclosure on the mezzanine level.

5.2 Pressure Control

The system pressure is sensed with a pressure transmitter with a range of 0 - 20 inches H_2O . The pressure is monitored at a position between the inlet filters and the inlet vapor trap and is recorded on a recorder. The pressure signal is also transmitted to a flow controller, where the signal level is compared with the set point. The output signal from the controller is fed to a current to pressure converter which in turn supplies 3 - 15 psig air pressure to a diaphragm-operated control valve, which opens to increase pressure in the system. The flow of gas into the system is monitored with a Mathison 600 series mass flow meter. Provision is made for addition of custom gas mixtures through a header and flow meter that are located on the PAL mezzanine. Gas can be added to the system through this fixture during operation without interference to normal cover gas system operation.

System pressure is indicated on the Metrascope, as received from the pressure transmitter.

5.3 Bleed Control

Gas can be fed to and bled from the system at a rate of up to $1\frac{1}{2}$ lpm. A 3000 cc/min mass flow meter monitors the bleed flow through a diaphragm-operated control valve which allows gas to escape from the cover gas system. The flow meter signal is fed to a millivolt to current transformer and on to a recorder and to a controller where the bleed rate is compared with the setpoint value. The controller output is fed to a current to pressure transmitter, which provides a proportional 3 - 15 psig air pressure output to the diaphragm-operated control valve.

5.4 Flow Control

Gas flow through the mixing vessel gas plenum is provided with a metal $1\frac{1}{2}$ lpm pump, installed downstream of the outlet filter bank. This pump operates at one speed and flow control is achieved by throttling of the suction line of the pump with a proportionally controlled valve. A 0-3000 cc/min mass flow meter monitors the flow rate, whose output

is fed to a millivolt to current converter. The output of the converter is transmitted to (a) an alarm unit which provides a low flow alarm to annunciator drop #24, and to (b) a recorder, and to (c) a controller where the flow signal is compared to a set point value. The controller output is fed to a current to pressure converter which in turn provides a proportional 3 - 15 psig air pressure to the diaphragm-actuated flow control valve.

5.5 Filter System

5.5.1 Two inlet filters with 10 micron pore size are provided upstream of the inlet vapor trap. These filters are arranged in parallel and are equipped with hand operated isolation valves so that one filter can be replaced while the second is in operation.

5.5.2 Two 10 micron pore-size outlet filters are provided downstream of the outlet vapor trap. These filters are arranged in a manner similar to the inlet filters described in 5.5.1, except that the filter isolation valves are air operated. The flow is automatically diverted from the first filter to the second when the low flow alarm is tripped. This provision is necessary since the outlet filters can be easily fouled with sodium vapor. Flow must be initiated in filter No. 1 for proper filter cycling to proceed. After flow has been automatically diverted to filter No. 2, filter No. 1 can be replaced and the flow can be redirected through No. 1 by depressing the reset button which is located on the cover gas panel. Dead-ended valves are provided at each filter location to facilitate leak checking after maintenance.

5.6 Pressure Relief

A pressure relief valve is provided between the inlet filters and the inlet vapor trap. This valve is set at 5 psig to protect the delicate cover gas instrumentation, even though the design pressure of the PAL reservoir is 25 psig.

5.7 Gas Chromatograph

A gas chromatograph is installed immediately downstream from the circulation pump. Gas is drawn from the system through a 5 micron filter and into the sample coil. Gas may be either returned to the system or can be vented to atmosphere. Manifolds are provided for introducing of standardizing gases and ultra pure argon.

6.0 SODIUM CHARACTERIZATION SYSTEM

6.1 Introduction

The Sodium Characterization System (SCS) consists of (1) a sodium sampling loop required to circulate sodium to and from the main PAL to the SCS; (2) an in-line instrument package (ILIP) which includes oxygen, carbon, and plugging meters for continuous monitoring of sodium impurities; and (3) a sodium sampling package for direct sampling of sodium for chemical analysis. The latter may include one or more of the following components at various times during the program; flow-through sampler, multipurpose sampler, and vanadium-wire calibrator (or equal).

The PAL SCS was designed for the following functional requirements:

- A. Circulate sodium to be monitored and sampled to and from the main loop sampling point under prescribed conditions of flow rate temperature.
- B. Obtain, identify, and prepare sodium samples for analysis at HEDL or other designated facilities, in accordance with methods and accuracy being developed by the Standards Committee at Argonne National Laboratory under an AEC contract.
- C. Monitor impurity levels in PAL sodium with an In-Line Instrument Package which consists of oxygen meter, carbon meter, and plugging meter and which is identical to the greatest extent possible with the FFTF ILIP being developed at HEDL and ANL.
- D. Provide capability of sampling sodium as required by individual sampling devices and in accordance with nationally acceptable methods and procedures.
- E. Provide a means of calibrating individual instruments in the ILIP or the SSP.
- F. Minimum possible impurities shall be introduced or removed in sampled sodium so that sodium chemistry is not significantly changed.
- G. Gas vent lines shall be provided to facilitate draining and filling the SCS.
- H. Sampling pump flow control will be provided to accommodate varying flow or differential pressure requirements within the SCS.

The operational standard and design parameter for the loop and individual components are provided in Tables VI-1 and VI-2.

6.1.2 Basic Design Requirements

6.1.2.1 Process Requirements

- A. The PAL SCS is designed to meet PAL process and impurity monitoring requirements listed in Table VI-1 and VI-2 below.
- B. Receive sodium from the PAL under variable conditions to temperature, pressure, and flow rate, and return the sodium to the designated collection point under conditions specified. The acceptable range for these conditions is given in Table VI-1.

- C. Provide continuous and reliable indication of oxygen, hydrogen, and carbon activity within the PAL sodium coolant in the range specified in Table VI-2.
- D. Provide capability of sampling sodium as required by individual sampling devices and in accordance with nationally acceptable methods and procedures.
- E. Provide a means of calibrating individual instruments in the ILIP or the SSP.
- F. Minimum possible impurities shall be introduced or removed in sampled sodium so that sodium chemistry is not significantly changed.
- G. Gas vent lines shall be provided to facilitate draining and filling the SCS.
- H. Sampling pump flow control shall be provided to accommodate varying flow or differential pressure requirements within the SCS.

TABLE VI-1
SCS OPERATIONAL AND DESIGN PROCESS REQUIREMENTS

<u>Parameter</u>	<u>SCS Operational</u>	<u>Design</u>
Load, KVA	35	50
Maximum Sodium Temperature (Main Loop), F	1200	1200
Flowrate, gpm	10	10
Pressure, psig	50	50
Na, Pounds	33.9	33.9

6.1.2.2 System Configuration and Essential Features

The SCS consists of a sodium sampling loop, in-line instrument package and sodium sampling package.

The sodium sampling loop is arranged for connection to the PAL with: (1) pump for forced circulation of the sodium; (2) flowmeter; (3) automatic safety shutoff valves to isolate the loop from PAL in case of malfunction; and (4) isolation valves for the ILIP and sodium sampling package.

The ILIP consists of a distribution loop which connects to the sodium sampling loop for sodium circulation to the meters, and carbon, oxygen, and plugging meters connected in parallel across the distribution loop. The geometry is compatible with the FFTF In-Instrument Cell⁽¹⁾ and typical of the FFTF ILIP conceptual design.

The sodium sampling package consists of a distribution loop connected with the Sodium Sampling Loop in a configuration compatible with the FFTF By-Pass

TABLE VI-2

Operating and Design Process Conditions for In-Line
Instruments, Calibrators and Sampling Devices

Process Parameter Requirement	Oxygen Meter Module	Carbon Meter Module	Plugging Meter Module	Vacuum Dist. Sampler	Flow-Thru Sampler	In-Line Calibrator Module
1. Temperature Range, °F						
a. Operating	700-900	1200-1400	(a)	(c)	(c)	1200-1400
b. Inlet	400-1200	700-1200	400-1200	400-1200	400-1200	400-1200
c. Outlet (Approx.)	Inlet $\pm$ 50	Inlet $\pm$ 50	Inlet $\pm$ 50	Inlet	Inlet	Inlet $\pm$ 50
2. Nominal Flow gpm	0.25	0.25	0.25	1-3	1-5	0.1
3. Concentration range capabilities	0.1 to 50 ppm	0.1 to 25 ppm		variable		
4. Design pressure, psig (piping system)	50	50	50	50	50	50
5. Design pressure, meter or sampler components, psig(b)	50	50	50	50	50	50
6. Temperature accuracy and control requirements	$\pm$ 5°C	$\pm$ 5°C	$\pm$ 5°C	$\pm$ 5°C	$\pm$ 5°C	$\pm$ 5°C

(a) at plugging temp. $\pm$ 25°F

(b) all or part of SCS to be valved out at higher pressures.

(c) at inlet temperature or distillation temperature.

Sampling Cell⁽¹⁾ and typical of the FFTF sodium sampling package. Sampling components shall be provided to meet requirements of the PAL experimental test program.

6.1.2.3 Design Life and Availability

All PAL SCS equipment is designed where possible for a service life of 5 years for consistency with PAL requirements. Where 5 years life is not reasonable due to the experimental nature of the component or limitations of state-of-the-art technology, equipment is designed and installed with redundancy and/or convenience of replaceability.

6.1.2.4 Designed Safety Features

- A. Safety circuits, controls, and isolation valves are provided so that normal or abnormal operation of the SCS will not compromise the operation of the PAL, i.e., if the SCS is inoperable, operation of the PAL will not be affected except that sodium purity monitoring provided by SCS will not be available to the PAL.
- B. The SCS is designed for unattended operation to assure that automatic controls required for safe functional operation are included in the system. When loop is being operated in the "unattended mode" any one of the following conditions will shut it down and energize an alarm at Bldg 325, wherein an operator will respond to the alarm condition:
 - Power failure
 - Cold trap high temperature
 - Low Na level
 - Low flow FM-1-2 & 3
 - Smoke in Containment
- C. Enclosures, automatic ventilation system controls, and smoke detection devices are provided to assure that smoke resulting from sodium fire will be confined to the enclosure and/or smoke exhaust system and that sodium fires can be promptly suppressed. Smoke detection causes blower shutdown, damper closure and loop scram.

6.1.2.5 Maintenance

The SCS is designed for contact maintenance and checkout as well as failure replacement of components. Some features are:

- A. Modular design is employed where possible to minimize field maintenance and to maximize system availability.
- B. Module arrangement provides ready access to sodium utility, electric, and instrument connections to minimize the time required for removing and replacing a module.

6.1.2.6 Surveillance and In-Service Inspection

The SCS is located inside an enclosure and specific components such as sampling devices are separately enclosed to minimize personnel exposure to the sodium system. There is no capability for surveillance and in-service inspection except as provided by the various automatic safety controls and instrumentation required for unattended operation.

6.1.2.7 SCS Instrumentation and Controls

Instrumentation for the SCS provides the following minimum functions:

- A. Continuous measurement and automatic control of variables essential to the successful performance of the facility.
- B. Continuous and permanent record of process variables which are necessary for the determination of test conditions within the facility.
- C. Automatic shutdown for emergency offstandard conditions (shutdown signals include low flow, high temperature, smoke and power failure).
- D. Operation of the SCS (except for specific sampling functions) from the SCS control panel.
- E. Control console using "high density" instrumentation and graphic panel layout consistent with SCS's required for other non-FFTF facilities and the FFTF SCS, to (1) simplify the design effort and reduce design costs; (2) minimize operator retraining as new facilities are started up and operated; and (3) facilitate procurement.
- F. Control console using modular panel layouts for subsystems, to permit addition of or modification of subsystem control panels without significantly affecting the remainder of the panel.

6.1.2.8 Quality Assurance

The SCS quality assurance plan is based on applicable sections of RDT Standard F 2-2T and includes QA elements specified for a non-FFTF Type I facility as defined in WHAN-M-2, "HEDL Quality Assurance Manual. (7)

6.1.2.9 Codes and Standards

The SCS has been designed and built in accordance with the technical requirements for a Class II nuclear system. Therefore, design, materials, fabrication, construction installation, inspection and testing conformed to applicable sections of the appropriate codes and standards provided in Appendix.

- A. ANSI Piping Code B31.7, Class II - 1967.
- B. RDT Material, Process and Equipment Standards including the following:

C 4-5T	Flow Meters
E 4-19T	Plugging Meter
F 3-8T	UT Examination of Pipe & Tubing
F 3-6T	Non-Destructive Testing
F 5-1T	Cleaning
F 6-1T	Welding (Part 1)

C. Hanford Engineering Standards, HWS-10,000 as applicable.

6.2 System Description

The SCS provides the capability to continuously monitor impurities in PAL sodium in the low ppm range and to sample the sodium for analysis of these impurities. Three major subsystems are included as represented on drawings located in Appendix B and tabulated on drawing list, H-3-32220.

- Sodium Sampling Loop (SSL)
- In-Line Instrument Package (ILIP)
- Sodium Sampling Package (SSP)

6.2.1 Sodium Sampling Loop

Sodium is circulated to and from PAL by way of two auxiliary taps on the PAL system side loop to in-line instruments and sampling devices in the SCS through the Sodium Sampling Loop. Diagrammatic and physical arrangement of the SSL are shown on the Engineering Flow Diagram and arrangement drawings, Appendix B.

The loop consists of a stainless steel trace heated and insulated piping system, with main flow (nominally 5 gpm) passing through a one-inch pipe system and branch flow through $\frac{1}{2}$ inch or $\frac{1}{4}$ inch piping to the SSP and ILIP, respectively. Both ILIP modules and sampling devices are connected in parallel across supply and return legs of the SSL.

An AC electromagnetic pump with permanent-magnet flowmeter provides forced circulated and flow monitoring of sodium in the loop. Pneumatically or motor operated, paired isolation valves connect the loop to ILIP and SSP. Safety circuits operated by high temperature or other selected process variables energize these valves to isolate the packages from the loop or the loop from PAL.

After entering the system from PAL and passing through the inlet isolation valve, main pump, and flowmeter in turn, sample sodium flow splits, passes through either ILIP or SSP supply headers, and then upward through bypass flow legs to recombine in the upper return header. The return header includes, (1) a freeze vent connected to the high point in the system; and (2) isolation valve located near the return connection to the PAL system. ILIP and SSP bypass flow legs also include one inch flow throttling valves and the SSP bypass leg includes a flowmeter.

As shown in the arrangement drawings, the SCS is housed in a metal enclosure measuring 3 ft in width, 9 ft. in height, and 9 ft. in length. The pump and flowmeters

are located in the 2- $\frac{1}{2}$ ft. high lower base section. SSL piping external to the enclosure connects the PAL and SCS systems. Connecting pipes are in a separate enclosure.

6.2.2 In-Line Instrument Package

The ILIP consists of oxygen, hydrogen, carbon and plugging meters for continuous monitoring of the activity of impurities which may be present in the sodium in elemental form or as chemical species or for monitoring the plugging temperature which is indicative of impurity content. Individual meters are packaged in modules which include, in addition to the meter(s), the sodium piping, flow control valve, flowmeter, heaters, coolers, and economizers as required for the operation of the meters. Meters and components are assembled in integral rectangular frameworks with dimensions as follows:

	<u>Depth (length)</u>	<u>Dimensions in</u>	
		<u>Height</u>	<u>Width</u>
Oxygen-Hydrogen Meter Module	32	30	22
Carbon Meter Module	32	30	11
Plugging Meter Module	32	30	11

Modules in turn are assembled in an open centered framework measuring 32 inches in depth, 60 inches in length, and 46 inches in height with a 32 x 30 x 44 long internal opening to receive the meter modules which are placed side by side in the opening.

That portion of the SSL which provides sodium to the ILIP modules is housed in the framework along with isolation valves and bypass flow regulating valve as shown in the Equipment Arrangement Drawing H-3-32222. At assembly the ILIP framework bolts to and becomes an integral part of the SCS enclosure framework. The $\frac{1}{4}$ inch sodium piping is field-welded to connect to the SSL.

(2) The oxygen-hydrogen meter module includes two electrochemical oxygen meters. Oxygen meters consist of a thoria yttria electrolyte tube inserted into the stream of flowing sodium. A signal electrode inserted down the center of the tube contacts the bottom of the tube through a "reference electrode" (air-platinum). A coax cable connects the signal electrode to an electronic system which indicates or records the electropotential across the cell. The electropotential signal is proportional to the oxygen chemical activity in the sodium.

The hydrogen meter consists of a nickel membrane probe inserted into the sodium and connected to a high vacuum system. Hydrogen selectively diffuses through the membrane, until the hydrogen partial pressures equilibrate; thus, the hydrogen content of the sodium is directly related to the pressure within the vacuum system which is measured by vacuum gauge.

(3) The carbon meter module has a single diffusion-type carbon meter which consists of a probe and probe housing. Flowing sodium is heated to 1400 F before entering the housing where it flows past the alpha iron probe tip. Carbon in the sodium selectively diffuses through the iron membrane which forms the tip of the probe and is picked up by argon-hydrogen sweep gas supplied from the carbon meter control console. Upon return, the gas mixture is chemically converted and processed in a flame ionization detector, the signal output of which indicates the extent of carbon activity in the sodium.

The plugging temperature indicator module has an orifice-type plugging temperature indicator⁽⁴⁾ consisting of three concentric tubes, with maximum outside diameter of 2-3/8 inch (2 inch pipe size) and length of 40 inches. Sodium flows down the center tube through a four hole orifice plate (0.052 in. diameter holes) at the bottom of the tube and exits upward through the annulus formed by the inner tube. Cooling air between the outer and inner tube cools the 1200°F incoming sodium until impurity precipitates form on the orifice, partially blocking flow. The indicator is operated in the oscillating mode, i.e., in an alternate heating and cooling cycle to produce a flow-temperature trace which indicate the extent of impurities in the sodium.

Alternately, a sintered-metal tube or disc may be used instead of the orifice ("frit" plugging temperature indicator).

6.2.3 Sodium Sampling Package (SSP)

The SSP is contained in a 4 ft wide by 6-1/2 ft high section of the SCS enclosure except for two flowmeters and valves located in the "base section" of the enclosure. A flow through tube sampler and multipurpose sampler are currently provided in the SSP; however, design allows for replacement of these devices with other inline calibrators or special sampling devices.

Sodium flows to the flow through tube sampler through a 1/2 inch branch line connection on the SSL, passing in turn through a flowmeter, piston-operated isolation valve, motor-operated flowcontrol valve, U-shaped sample tube, and double piston operated outlet valves to return to the SSL.

At the predetermined sampling time, sodium in the 30 inch long, 1/2 diameter U tube is solidified by air cooling. Flow valve closure is carefully timed and cycled to prevent formation of voids within the U tube. Tube ends are crimped to first seal off the sodium in the tube and then sever the tube from the system. The U tube with its sodium inside is then removed for laboratory analysis of sodium impurities.

U tubes are mechanically connected to the system so that old tubing stub ends can be readily removed and the new tube vacuum leak tested to start the next sampling cycle.

The Multipurpose Sampler (MPS), shown pictorially on Figure A1, is capable of performing any of the following operations: (1) sodium sampling including taking protected samples, (2) equilibration of metal specimens for analyses of oxygen, carbon, hydrogen, and possibly other impurities in sodium; and (3) sampling for particulates in sodium. The MPS consists of an isothermal sampling zone and a heater and economizer (heat exchanger) for temperature control (Fig. A1). Inlet sodium temperatures from 400 to 1200°F can be maintained for overflow cup or filtration sampling, or, if desired, the sodium can be heated to 1382°F (750°C) for specimen equilibration. The MPS can be operated in a high level radioactive environment with all mechanical operations conducted with the aid of master-slave manipulators. The design data and criteria are given the ordering data. The MPS has been designed to meet the requirements of RDT C 8-8T and conforms with Class 1 of Section III of the ASME Code as supplemented by RDT E 15-2T and code case 1331-7.

MULTIPURPOSE SAMPLER

FOR APPLICATIONS ON FFTF SYSTEM 85
SODIUM CHARACTERIZATION

Figure A1. Multipurpose Sampler For Applications on FFTF System 85 Sodium Characterization

6.3

Subsystems and Components

6.3.1 Sodium Sampling Loop

6.3.1.1 Piping

The SSL piping system has been designed and was fabricated as a Class II system in accordance with ANSI Piping Code B31.7 - 1969. Features of the system include:

- Stress analysis⁽⁶⁾ using the MEL-21 computer code for piping stress analysis.
- All-welded system except for the flow through tube sampler and multipurpose sampler mechanical connectors, specifying full-penetration butt-welds.
- Type 304 stainless steel material with 0.04% minimum carbon content ordered to ASTM material standards but ultrasonically checked to upgrade to RDT standards.
- Fabrication procedures and testing in accordance with H-3-32220, Appendix D.

6.3.1.2 Valves

Valves are ANSI B31.7 Class II welded-bellows-sealed valves. Valves are listed in Appendix E. One inch valves have the following features:

- Configuration is plug-valve with in-line pipe connections and right angle bonnet/body arrangement.
- Valve seats are Stellite[®].
- Body is welded barstock arrangement of 316 SS.
- Spring-loaded piston operators fail-close on all piston operated valves.
- Valves are approximately 18 in. in height and are provided with stroke limit switches for position readout.
- SCS main isolation valves are equipped with manual override features.

One half inch motor valves are provided with: (1) motor operators for torque-limited control of rotary stem plug (globe pattern) valves; and (2) potentiometers as well as limit switches for continuous indication of valve position. One half inch piston valves are the same as the 1 inch piston valves except for size.

6.3.1.3 SSL Pump

Sodium is pumped in the SSL using a conventional variable-flow AC electromagnetic pump rated for nominal 10 gpm flow at 30 psig discharge pressure and 1500 F maximum operating temperature. Pump flow duct is a one-inch 304 SS tube with 0.049 inch thick walls.

A motor operated autotransformer located on the west wall of 335 Building is provided for pump power control, to facilitate remote control.

6.3.1.4 SSL Flowmeter

Permanent magnet flowmeters in SCS are listed in Appendix E. They are constructed of 304 SS to specification HWS-9102.

6.3.1.5 Freeze Vent

The SCS freeze vent consists of a 14 inch long section of one inch 304 SS pipe connected to the SCS loop high point and mounted at an angle of 40° with the horizontal to reduce head room requirement. An internal heater well is provided with a heater to melt out frozen sodium when required to reactivate the vent.

A piston-operated isolation valve is located on the outlet side of the vent. Temperature interlocks operate to close the valve if the upper temperature exceeds 190°F, or to prevent opening if system temperature exceeds 400°F.

6.3.1.6 Enclosure

The carbon steel structure which forms the SCS enclosure is comprised of four base sections assembled into a unit measuring 3 ft. in depth, 9 ft. in length, and 9 ft. in height. Individual sections which may be welded or bolted together to form the enclosure are:

	<u>Depth</u>	<u>Length</u>	<u>Height</u>
Base Section	3'	9'	2'- $\frac{1}{2}$ '
ILIP Section	2'8"	5'	3'10"
SSP Section	3'	4'	6'6"

Special design features include:

- Unitized structural design for shop assembly followed by shipping and handling in field installation as an integral unit.
- Bottom pan 4 inch deep, 3 ft. wide and 9 ft. long formed from 3/16" plate to provide the structural base and liquid retention capability of about 60 gallons of sodium.
- Side panels cut from 11 ga sheet stock and fastened by self-tapping screws to complete the enclosure envelope and still permit access to internal components for operation and maintenance.

6.3.1.7 Enclosure Cooling

Piping insulation losses and process cooling requirements are expected to produce a total heat load within the enclosure of about 30,000 BTU/hr. A 1200 cfm induced draft is provided to circulate ambient air through the enclosure to maintain internal temperature at 120°F with external ambient at 90°F. Air flows into the enclosure at the base section at the SSL pump end, flowing through the enclosure to exhaust from an opening near the top of the SSP section. Piston operated multi-vane dampers are used on the inlet and outlet to isolate the enclosure in the event of fire or smoke signal. The inlet and outlet damper will close automatically on smoke signal to prevent discharge of smoke to the 335 Building.

6.3.2 In-Line Instrument Package

Service requirements for the In-Line Instrument Package are given in Table VI-3.

6.3.2.1 Oxygen-Hydrogen Meter Module

Meters for in-line measurement of oxygen activity and hydrogen concentration in sodium are arranged in a common module.

The oxygen-hydrogen meter module is a rectangular box 30 inches high, 22 inches wide and 32 inches long containing two oxygen meters, hydrogen meter, flow regulating valve, flowmeter, economizer, cooler, and sodium piping. Sodium enters the lower section of the box and flows through the valve, flowmeter, economizer, oxygen meters and hydrogen meter in turn, discharging from the top of the box to the distribution loop. The $\frac{1}{4}$ inch pipe system is designed for nominal 0.25 gpm flow at 1200°F inlet temperature and outlet $\pm 50^\circ\text{F}$ of inlet temperature.

A. Oxygen Meters. Oxygen meters are electrochemical cells which provide an electropotential output signal proportional to chemical activity due to the presence of oxygen in sodium. Major components are:

- Cross-shaped probe housing with side ports for inlet and outlet sodium flow, bottom port for thermocouple, and top port for probe insertion. An additional connection for purge gas is also provided.
- Oxygen meter probe with a solid thoria yttria electrolyte tube, reference electrode, and signal electrode assembled in a cap which is mechanically connected to the probe housing. Connections to the cap are inlet and outlet reference gas and coaxial signal cable (Table 3-1).

B. Flow-Control Valve. Motor-operated, rotary-stem globe valves similar to small valves described in paragraph 6.3.1.2 are used for flow control.

- C. Flowmeter. Flowmeters are permanent-magnet type with approximately 3000 Gauss magnet and $\frac{1}{2}$ or 1 inch pipe flow duct. Calibrated output is approximately 4.45 mv/gpm.
- D. Economizer. The economizer is a tube-in single-pass heat exchanger with an active length of about 17 inches, an outer shell of 1 inch pipe and inner tube of 5/8 inch diameter tubing. The economizer is designed for a terminal temperature difference of 50 F and total heat load of 15000 to 20,000 BTU/hr.

TABLE VI-3
ILIP SERVICE REQUIREMENTS

A. Oxygen Meter Module

Service	Run	Requirements
1. Sensor output	Coaxial cable	a. Record
2. Reference Gas for Electrode	1/8 tubing (2 runs)	a. Supply standard gas mixture. b. Gas bottle supply with gas manifold, in operating gallery. c. Flowmeter, flow control valves panel-mounted on oxygen module panel. d. Flow assurance meter on return line.
3. Purge gas	1/8 tubing	a. Supply argon from gallery bottle; panel-mounted flowmeter, control valves.
4. Oxygen probe thermocouple	Thermocouple leads	a. Record
5. Cooler-economizer cooling gas	Power leads to blower	a. Supply 35-50 cooling gas at ambient temperature, @ 5 - 10 psig. b. Discharge in-cell.
6. Flowmeter readout	Shielded cable	a. Record
7. Heater power	Electric power leads	a. 220 VAC 2-4 KW.
8. Trace heater	Electric power leads	a. Estimated 10-12 2-wire circuits, 110 VAC
9. Thermocouples	Thermocouple lead wire	a. Estimated 10-12 2-wire T/C circuits; connect to trace heat controllers or record.

TABLE VI-3 (Cont'd)

B. Carbon Meter Module

1. Carbon meter sensor gas 1/8 tubing

a. Supply decarburizing gas from gallery, supply bottles through panel mounted flow regulators and switching valves. Gas bottles to include air, and fuel and calibrating gas for flame ionization detector.

2. Carbon meter gas return 1/8 tubing

Return to gas manifold, control console.

Repeat services (6), (7), (8), and (9) under Par. A.

C. Hydrogen Meter

To be added

D. Plugging Temperature Indicator (PTI)

Service	Run	Requirements
1. Cooling gas	Power leads to blower	a. Supply 35-50 cfm cooling gas at ambient temperature 5-10 psig. b. Gas discharge to cell.
2. Thermocouple	Thermocouple	a. Connect to recorder controller in gallery control console for oscillating mode operation.
4. Solenoid	Low-power leads	2-wire system to match solenoid power.
5. Damper Motor	Low-power leads	3-wire system
Repeat services (7), (8), (9), under Par. A.		

E. Distribution Loop

1. Valve signal leads Low-power leads a. Power to motors
b. Position feed-back

1. Services (7), (8), (9) under Par. A.

E. Cooler. A gas cooler is provided to cool sodium to a temperature about 25°F below the oxygen meter operating temperature, to permit trim heating of the sodium before entering the meter housing.

- F. Oxygen Meter Trip Heater. A low capacity, fast response trim heater will be provided to accurately control the sodium temperature at the oxygen meter. Trim heater is controlled by an automatic controller on the control panel.
- G. Hydrogen meter. The diffusion hydrogen meter consists of a probe inserted into the stream of flowing sodium and connected to a high vacuum system with ion pump and high vacuum gauge. The pump is normally valved out of the system. The diffusion probe is a corrugated seamless nickel bellows through which hydrogen diffuses from the sodium to the high vacuum system. Hydrogen content in the sodium is directly related to the pressure measured in the high vacuum chamber.
- H. Other Components. Other module components and details are:
- One inch angle-iron frame for the module structure with bottom pan to catch sodium spills.
 - Motor operated welded-bellows sealed plug valves for flow control.

Electrical power and instrument leads within the module are connected to separate common plugs accessible from the front face of the SCS enclosure. Some instrument leads (such as flowmeter signal leads) are run direct to control console to avoid noise problems.

6.3.2.2 Carbon Meter Module

Carbon activity in the flowing sodium is monitored with a diffusion type carbon meter mounted with flow control valve, flowmeter, heat exchanger (economizer), heater, and carbon meter in a module measuring 30 inches high, 11 inches wide, and 32 inches long. Sodium flowing at rates up to 0.25 gpm and temperatures between 400 and 1200°F is heated to 1400°F before contacting the carbon meter and then cooled to within 50°F of the module inlet temperature before return to the ILIP distribution loop. The economizer, heater, and probe chamber are all 5/8 inch ID and are assembled by welding on a common axis to form a single unit. Other module components are identical with those described previously.

- A. Economizer. The center tube of the heat exchanger is 5/8" ID x 0.020" wall with an active length of 15". At 0.3 gpm and sodium inlet temperature of 700 F, it transfers 6.7 kW of heat with the heater running at 1.5 kW (full power). At 0.1 gpm it carries approximately 90% of the heat load, heater power is down to 200 watts, and the exit stream temperature is less than 50°F above the inlet. If the sodium temperature at the inlet is reduced to 400°F, the maximum flow rate drops to approximately 0.25 gpm. A sliding joint is provided at the cold end to allow differential thermal expansion between the tube and shell.

- B. Heater. The heater design is a modification of that used on the UNC carbon meter side loop⁽⁵⁾. The heater length is reduced from 10" to 4". The OD is increased slightly to 2", and the number of cartridge heaters is increased from 4 to 6. The maximum heat flux to the sodium is 95,000 BTU/hr.ft² vs. 13,000 BTU/hr.ft² for the original UNC design, due mainly to a larger ID in the present design.
- C. Carbon Meter. Sodium which has been heated to 1400°F flows upwards into the carbon meter probe housing past the probe and returns to the economizer leaving the module. The probe consists of an outer tube with a cylindrical iron membrane which forms the tip of the tube, and an inner tube through which an argon/wet hydrogen carrier gas enters the probe. Carbon in the sodium selectively diffuses through the probe membrane, and combines chemically with the carrier gas.

Subsequently, the carrier gas with combined carbon returns to the meter control console (Section 2.6) which contains a chemical converted unit and a flame ionization detector. The output of the flame ionization detector is proportional to carbon activity of the system. A detailed description of the operation of the system is given in Reference 3.

6.3.2.3 Plugging Temperature Indicator (PTI)

The PTI module includes the flow control valve, flowmeter, and plugging meter mounted in an 11 inch wide, 32 inch deep, and 30 inch high frame. Service requirements are listed in Table 3.1. Components are identical with the other modules, except for the PTI itself.

The basic features of the orifice-type plugging temperature indicator are described in Section 6.2.2. Other features include:

- A 160 cfm blower which forces cooling air up the outer PTI annulus to initiate the meter cooling cycle. The blower is operated at variable speed with a solid-state power control device.
- A 400 watt metal-sheathhead electric resistance heater proportionately power-controlled to initiate the meter heating cycle.
- Motor operated damper to control air flow.
- The PTI thermocouple mounted in the bottom of the meter to obtain fast response measurement of sodium temperature at the orifice plate.
- A solenoid mounted at the top of the PTI to operate the orifice plunger and re-establish sodium flow in case of orifice plugging.

6.3.2.4 Multipurpose Sampler

- A. Pressure Boundary. The pressure boundary (H-4-33032) of the sampler body is made of 2 in. schedule 40 pipe, with the bottom enclosed by a 2-in. schedule 40 pipe cap that accommodates the outlet pipe. Two Grayloc connectors spaced about 5 in. apart are used at the upper end of the sampler. The lower connector is a quick disconnect throughbolt type Grayloc and is attached to the 2-in. pipe barrel. The upper connector (H-4-33035) is a remotized Grayloc for the routine insertion and removal of samples in the FFTF Primary Sodium Sampling Package and in the Secondary Sodium Sampling Package. Attached to the spool piece between the Grayloc connectors is a branch line of 1-in. schedule 40 pipe with a freeze vent (H-4-33034). This line permits a vacuum or inert atmosphere to be obtained in the sampler, and provides for pressure balancing during operation if required. The freeze vent has external fins, is blower cooled, and has a removable cartridge heater inserted in a thimble. The sodium inlet and outlet lines are 1/4-in. schedule 40 pipe. Support of the sampler is from rings at the lower and upper end of the 2-in. pipe. The lower support ring also supports and guides the lower furnace while the upper furnace is supported by a hinge arrangement that is attached to the support rings.
- B. Economizer. The economizer (heat exchanger, H-4-33033) is a tube (coil) in-shell type. Inlet flow is over the coils in the shell side and the return flow is through the inside of the 3/8-in. O.D. 0.035-in. wall tube which is coiled around a center spacer (1 1/8-in. O.D.) to form 23 coils on a 1/2-in. pitch. The economizer is welded to the bottom end of the 2-in. SCH 40 pipe barrel. The economizer is not part of the pressure boundary. Above the economizer there is a 1 7/8-in. O.D., 0.049-in. wall shroud tube that is used to conduct the sodium flow to the sample cup region. Three 1/8 in. diameter holes, which are 2 1/2 in. from the top of the shroud tube, admit three sodium streams to the cone of the sample cup holder. The economizer has a design capacity of about 11 Kw which provides a sodium inlet to outlet ΔT equal to 40 F at a maximum sodium flow rate of 0.3 gpm.
- C. Sample Insert Holder and Resistance Bulb Well. The sample insert holder (H-4-33035) is attached to the thermowell. The insert holder is a cone near the end of the thermowell with three protruding pins for attachment to the bayonet slots in the insert. The cone serves to direct the sodium into the sample cups. The thermowell extends into an immersion chamber below the cone, which is maintained flooded with Na to provide good temperature monitoring capabilities.
- D. Freeze Vent. A freeze vent (H-4-33034) has been provided to prevent the transport of sodium into the gas system of the MDS.

The freeze vent design was based on data in AI-AEC-13022 (Jan. 31, 1972), and has been sized to stop 1200°F sodium at a velocity of ~0.5 ft/sec. It consists of a 1-in. schedule 40 pipe enclosing a heater well. A gap of 0.050 in. is provided between the O.D. of the well and the I.D. of the pipe for gas flow. When required, this annulus provides adequate surface for the sodium freeze plug formation. Cooling fins are spaced on the periphery of the 1-in. pipe with an air shroud tube around the fins. Air is blown past these fins by a 100 cfm blower. A cartridge type heater is placed in the heater well to permit remelting of the freeze plug when desired.

- E. Sampler Inserts. The MDS may be operated with any of three inserts for, depending on the insert chosen, (1) taking single archive (protected) samples of sodium (H-4-33036), (2) equilibrating metal specimens for O, H & C, (H-4-33037) and (3) taking particulate samples. All of the inserts fit interchangeably on the sample insert holder.

6.3.2.5 Flow Through Tube Sampler (FTTS)

Section 6.2.3.

General features and operation of the FTTS are described in

- A. Sample Tube. The U shaped sample tube is a $\frac{1}{2}$ inch diameter x 0.035 inch thick wall 304L stainless steel tube with a total length of about 36 inches coupled to the Flow Through Tube Sampler system with Swagelok® tubing connectors. A mechanical stop swaged to the sample tube ends provides positive separation of tube ends from the system connections when replacement of the tube is required. A vacuum leak tests sample tube branch connection is provided to allow leak test of a new assembly after tube replacement.
- B. Flow Through Tube Sampler Housing. An 11 ga (0.125 in.) stainless steel box measuring 21 in. (length) x 14 in (height) x 6 in (depth) houses the sample tube. Access for tube removal is gained through front opening drop down door. Three 370 watt flat radiant heaters are mounted on the door to maintain internal temperature and pre-heat a new sample tube. The bottom of the housing is formed as a 2 inch deep pan which is filled with vermiculite for sodium leak collection and fire suppression.

A U-shaped $\frac{1}{2}$ inch pipe formed to match sample tube configuration is mounted inside the housing to provide the air-blast manifold required for sample tube cooling. Cooling air discharges through a series of 1/16 diameter holes to impinge on the sample tube.

6.3.2.6 In-Line Calibrators

In-line calibrators are used in sodium systems to "calibrate" the impurity level in the sodium with wire or foil gettering technique inserted into the sodium and then removed for laboratory analysis. A vanadium-wire calibrator is provided initially on PAL-SCS and consists of a group of wires mounted in a holder. The holder is designed for installation in a carbon meter module described above. The valve and flowmeter normally in a carbon meter module are omitted. The module is connected to the sample loop with mechanical connectors (Consoeals [®]). Drawings of the calibrator are in Appendix B.

6.3.3 Electrical and Instrumentation Systems

6.3.3.1 General

Instrumentation for the SCS performs the following minimum functions:

- Provides continuous measurement and automatic control of variables essential to the successful performance of the facility.
- Provides a continuous and permanent record of process variables which are necessary for the determination of test conditions within the facility.
- Provides automatic shutdown for emergency off-standard conditions. Shutdown signals include low flow, high temperature, etc.

Major components and subsystems within the system include:

- Main control console (located in the 335 Building near the main PAL).
- Subsystem control panels including recorders, controllers, and switches (in the main console) panel (in the main console).
- Panel alarm/trace heat graphics panel (in the main console).
- Transmitter rack (located next to sodium loop).
- Trace heat controller panels (in main console).
- Power Controller Console (located near west wall at 335 Building).
- Instrument Power supply (in the main console).

Design drawings for these elements are included in Appendix B. Process instrumentation and electrical components are listed in Appendix C.

In general, the SCS instrumentation system provides a main control console containing subsystem control panels, one for each in-line instrument, sampling device, or other subsystem for which space is available. Each panel consists of a modularized pullout "drawer" to facilitate removal for maintenance or addition of subsystems.

Thus, the main console constitutes a "storage" cabinet in bare form. Subsystem panels are designated as follows:

- S 10 Sodium Sampling Loop
- S 20 Plugging Temperature Indicator
- S 40 Oxygen Meter
- S 50 Carbon Meter
- S60B Multipurpose Sampler
- S 70 Flow Through Tube Sampler
- S 80 Hydrogen Meter

Instruments and controls within each panel are "high density" type and include all functions except for trace heat control required to operate any one of the subsystems. In "high density" instrumentation, process signals (temperature, pressure, flow, etc.) are fed to the transmitter rack and converted or amplified uniformly to 1-5 VDC signals for transmittal to the subsystem panels within the main control console.

Descriptions of the electrical and instrumentation components and subsystems follow.

6.3.3.2 Instrument and Electrical Equipment Description

- A. Main Control Console. The main control console is a structural framework 6 ft 8 in. wide, 7 ft 6 in. high and nominally 2 ft 8 in. deep with front face cutouts (drawer openings) for the subsystem control panels and trace heat controllers (bottom section) described below. A 24 volt power supply, relay panel, and panel lighting control module are included to service the subsystem panels.
- B. Subsystem Control Panels. The typical arrangement for these panels is indicated on H-3-33117. As shown, panels are variable in length and nominally 13- $\frac{1}{2}$ in. high. On the front panel face, the lower half is used for graphic panel layout representing the particular system, while miniaturized electronic instrumentation is installed in the upper section. Such instrumentation as indicators, controllers, recorders, valve control switch may be included in the panel (see Appendix D for list) and is provided in submodules with front face width from one inch to 6 inches in even integer increments to facilitate panel layout. Thus, individual control modules may be readily removed from the panel, or the panel may be removed from the console for maintenance. Graphic panels are translucent and are back-lighted for operator convenience. Miniaturized alarm or indicating lights are mounted at appropriate points in the graphic layout for such functions as valve position indication.
- C. Panel Alarm/Trace Heat Graphics Panel. As inclined panel is provided to mount on top of the main control console. Typical panel alarm sections are mounted along the top edge of panel with the trace heat graphics below.

- D. Transmitter Rack. Signal transmitters will be mounted in a standard rack. The rack will be mounted on the 335 Building floor near PAL-SCS.
- E. Trace Heat Controller Panels and Power Controller Console. Solid-state stepless proportioning controllers using phase angle firing and separate power controller devices (such as SCR's) are provided for heating the SCS system. Multiple controllers are arranged in panel modules which include a 4 in. wide set-point controller cor common set-point control mode for all the controls within the panel. Panel space for each controller is nominally one inch wide by 7 inches high. Thus, use of the common set-point controller system minimizes the amount of console space required for the trace heat controller system.

Other features of the system include:

- Manual or relay switching to permit either manual or automatic control of system heatup sequence. Simultaneous heatup is also provided.
- Manually adjustable reset, proportional band, or automatic sequence switching band for each controller.
- Null balance indication.
- Common temperature indicator with pushbutton for readout on each controller.
- Multi-turn potentiometer with digital turn knob for manually adjusted set-point control.
- Output power control device (PCD) mounted in separate cabinet.
- Rate of temperature rise limiting circuit ($100^{\circ}\text{F}/\text{HR}$).
The separate PCD option was selected to minimize the number of high power devices located within the main control console.
- Heating of the MPS is provided by two clamshell furnaces that enclose the pressure boundary. The furnaces are 10 in. diameter by 12 1/4-in. long and come in two symmetrical halves. Each furnace is capable of about 1800 watts at 120 volts that are divided into three separately controllable zones. The furnaces are insulated with built-in ceramic fiber insulation. Trace heating of connecting lines is compatible with trace heating in the distribution loops; either the PSSP or the SSSP. The heaters in all cases are the tubular resistance type, with magnesium oxide insulation. The heaters are banded to the pipe with stainless steel straps and then covered with 0.003 in. thick stainless steel shim stock. Exact heater zones and installation details

are shown in the drawings of Appendix E. Redundant (spare) heaters are supplied in all locations.

- The instrumentation that is used for the MPS in FFTF is shown on Drawing H-4-33033, Process and Instrument Diagram Multipurpose Sampler. Other options for the instrument package are as follows. The temperature of the sampler insert is monitored by a platinum resistance bulb (RB). The resistance of the RB can be monitored directly and converted to temperature with the calibration charts of the particular bulb being used. Temperature is read directly with a recorder of the proper type and range. Readout is obtained on a potentiometric recorder with an overall accuracy of $\pm 5^{\circ}\text{F}$. Other temperatures are measured by thermocouples and recorded or indicated by multipoint instruments as follows:

- 1) Freeze Vent
- 2) Gas-Vacuum Line
- 3) Inlet Sodium Line
- 4) Outlet Sodium Line
- 5) Thermal Baffle Zone of Top Furnace

The furnace temperatures are controlled from thermocouples in each of the three axial zones per furnace. Normally the bottom zone of the top furnace is the main heat input zone (preheat zone). Furnace temperatures are controlled with two-mode temperature controllers (proportional band plus reset).

The top two heater zones of the top furnace act as guard heaters and are controlled by a two-mode controller to maintain the sampler insert in an isothermal condition by offsetting heat losses.

All zones of the bottom furnace are controlled by a two-mode controller. The heat input for the bottom furnace is adjusted to maintain the sodium inlet temperature. Trace heaters for the inlet and outlet sodium lines, for the gas-vacuum line, as well as the freeze vent, are controlled by two-mode controllers. The heater will be used to melt sodium that inadvertently enters the freeze vent.

High temperature alarm thermocouples and alarm circuits are provided for the two furnaces and for all trace heating zones. Any high temperature alarm is visually and audibly annunciated and causes automatic shut down of both furnaces and, if needed, automatic valve isolation of the MPS.

6.3.3.3 Alarms, Interlocks and Bypass Circuits

A generalized list of safety alarms in SCS is given in Table IV-1. An expanded detailed list will be added.

A bypass circuit for starting the pump and opening isolation valves under no flow conditions is provided. The circuit will reset itself as soon as flow starts and the flowmeter indicator rises above the low flow set point.

6.3.4 Trace Heating System

6.3.4.1 Trace Heaters

All piping and components containing sodium are traced with electrical heating elements to melt and maintain the liquid state of sodium. The tracing is of sufficient capacity to heat the pipe and components from 220°F to 1200°F at a rate of 100°F per hour when the system is filled with sodium and is capable of maintaining an isothermal system temperature 1200°F in an ambient temperature of 70°F. The heating elements are derated and so designed, fabricated and attached that they will be capable of meeting the loop system cycle and life requirements.

The system is arranged to permit manual control of heating from free surfaces when melting the sodium to compensate for thermal expansion.

The heater system has variable power and has a uniform heat rate (watts/lb of mass) in all parts of the system. A watt-density of about 10 watts/sq. in. is employed. The system has protective temperature detectors and readout controls to indicate high or low localized temperatures which may cause damage from excessive thermal or fluid expansion stresses.

Trace heaters are required for the sodium sampling loop piping and valves, and meter module systems. Sample loop piping and valve heaters consist of semi-rigid sheathed electric resistance heaters selected for maximum reliability at the 1200°F maximum operating temperature. Single heaters are fastened along each designated length of pipe by continuous helical wraps of stainless steel foil. Heater installation assures that the heated length is firmly fastened to the heated object.

6.3.4.2 Thermocouples

Stainless steel sheathed, MgO-insulated Chromel-Alumel (Type K) thermocouples with ungrounded junctions will be used in the SCS. Thermocouples will be fitted with a high temperature junction (900°F minimum rating) and connected to the thermocouple connector with high temperature (glass-over-glass or glass-over-asbestos) insulated lead wire. Thermocouples will be installed by spring-loading.

6.3.5 Thermal Insulation

Insulation provides a maximum insulation surface temperature of 135°F under natural convection cooling conditions and with ambient temperature of 90°F and with sodium at 1200°F. Insulation optimized to minimize the space envelope and conserve space in the ILIP package. Insulation is low in halogens and other harmful materials.

TABLE VI-4
SCS SAFETY SYSTEMS AND INTERLOCKS

No.	System Parameter	O-H Meter Module	Carbon Meter Module	Plugging Meter Module	Distr. Loop	System Response
1.	High Temperature	X	X	X	X	Alarm, pump shutdown
2.	Oxygen Probe Freeze Seal	X				Alarm-High Temp, 2 meters
3.	High Na Flow	X	X	X	X	Alarm, Close Isolation Valves, Shutdown pump
4.	Low Na Flow			X	X	Alarm, Close Isolation Valves, Shutdown pump
5.	Ion Pump, High Press	X				Alarm
6.	Freeze Vent Hi-Temp				X	Alarm, close Freeze Vent Valve
7.	Heat Sequence Complete	X	X	X	X	Panel Light
8.	Isolation Valve Position				X	Alarm and Interlock with Trace Heating System to prevent heating post closed valve.
9.	Smoke Detection				X	Alarm, Close Isolation Valves, and shutdown traceheaters and ventilation fans, close ventilation dampers.
10.	Loss of power to pump (CB Trip)				X	Alarm
11.	Smoke detector bypassed				X	Alarm

6.3.6 Auxiliary Services and Services Provided by Others

6.3.6.1 Power Supply

Power is supplied from the 335 Building motor control center to a 50 KVA Transformer. Power distribution is shown on drawings H-3-35150, 151 and 152.

6.3.6.2 Instrument Gas Supply

The following gases are supplied for operation of the oxygen and carbon meters in SCS:

- Oxygen meter reference gas-dry air.
- Oxygen meter purge gas - high purity argon.
- Carbon meter carrier gas - argon-5% hydrogen.
- Carbon meter flame ionization unit - high purity hydrogen.
- Carbon meter calibrating gas - argon/hydrogen/methane.

Purity requirements on gases may vary with experimental program.

Two bottle racks, one for each type gas, are provided at the existing 335 Building gas bottle station. One-eighth inch diameter stainless steel tubing is run from the bottle station to the SCS. Twelve tubing lines are provided for gas supply, for gas return, and for future chromatograph connections.

6.3.6.3 Process Gas Supply

Building compressed air or nitrogen from a back-up bottle rack is used for actuation of piston-operated valves and dampers. Commercial grade argon is provided for a manually operated fire-suppression system.

6.4 Safety

The SCS is designed to minimize hazards or accident conditions and to be compatible with PAL safety requirements. Emergency systems provide safe, orderly shutdown in the event of an emergency without adversely affecting PAL operability except for the loss of sodium characterization capability. Further, the SCS is designed to prevent personnel exposure to high-temperature piping and to electrical equipment and to prevent the release of sodium combustion products to the environs in the event of fire.

6.4.1 Hazards

The following potential hazards are considered in design:

- Sodium leakage
- Fire and chemical reactions due to sodium leakage or high temperature.

Design features of the SCS provided to minimize these hazards are described briefly below.

6.4.2 Design Features to Reduce Potential Hazards

6.4.2.1 Sodium Leakage

SCS features to prevent or minimize sodium leakage include:

- A. A high integrity stainless steel piping system built to rigid quality standards and thoroughly stress analyzed to prevent rupture of the sodium boundary.
- B. Monitoring of temperatures at all critical points in the system with appropriate alarms for off-standard conditions.
- C. Automatically operated isolation valves to isolate the SCS from the PAL, or to isolate SCS subsystems in the event of system malfunction.

6.2.2.2 Fire and Chemical Reactions

- A. The SCS is housed in a steel enclosure with capability of providing inert gas blanket to minimize fire hazards in event of leak.
- B. The enclosure is monitored by smoke detection device which actuates alarm and shutdown systems.
- C. Thermal insulation used in the system is chemically inert to sodium and construction materials.

6.4.3 Fire Protection

Fire protection is provided in accordance with the National Fire Protection Association Codes and the Hanford Standards as applied to the PAL design. A product-of-combustion ionization detector is located in the SCS enclosure and in the ventilation system exhaust.

Fire extinguishment is by automatic isolation and manual argon flooding.

6.5 Operations

6.5.1 Operation Philosophy

The SCS is designed to provide maximum system availability consistent with PAL operating requirements and philosophy. The basic SCS operating philosophy is as follows:

- The SCS will be operated as a test bed for sodium characterization devices and typical FFTF equipment.
- The SCS will be operated to provide sodium characterization data to interpret the meaning of SCS data in terms of long term effects on the main loop facility.

This will form the technical basis for coolant purity standards for the operation of other HEDL facilities and FFTF.

- Members of Sodium Technology will conduct tests on the SCS and will provide technical assistance in operator and maintenance training, sodium sampling and processing for analysis, and in-line instrument data analysis and interpretation.
- Operating procedures will be in accordance with the PAL SCS Quality Assurance Plan (Appendix H).

Operation of the SCS is from a control panel except for sodium sampling which requires operator contact. Control and/or measurement of system variables are provided as described in Section 6.2.

6.5.2 Initial Fill and Startup

Initial fill and startup procedures will be added. The procedures will be based on recommendations by Sodium Technology personnel and will be consistent with PAL fill, startup and operating procedures.

6.5.3 Normal Operation

To be added.

6.5.4 Off Standard or Special Operation

To be added.

6.5.5 Shutdown

To be added.

6.6 Maintenance

6.6.1 SCS Maintenance Philosophy

Maintenance philosophy will parallel that for PAL, including the following:

- A. Maintenance will be performed only during PAL outage or after SCS shutdown and isolation from PAL.
- B. SCS design considers maintenance activities in the following order of preference:
 - Adjust in place.
 - Replace components and/or subassemblies such as instrument module with spare or repair and requalify the disabled unit.
 - Repair components in place to the maximum extent possible.

Such items of equipment as motors, valve actuators, sensors, or other components are designed to readily permit inspections and adjustments. Design for feasibility and accessibility for use of special tooling needed for infrequent or accident recovery types of maintenance are not anticipated and will not be built until time of need.

The SCS will be valved off and cooled to solidify the sodium, after which in-place or shop maintenance will be performed. Sodium will be flushed from components removed from the system for maintenance unless otherwise approved in accordance with procedures detailed in the PAL SCS QA plan.

General maintenance procedures for specific SCS components are given below. Detailed procedures will be provided at a later date for preparation and performance of maintenance. These will include those procedures currently being developed for cleaning and requalification of sodium system components.

6.6.2 SCS Component Maintenance

To be added.

6.6.3 Preventive Maintenance

The design provides conventional and special monitoring instrumentation to aid in preventive maintenance, including data recording equipment such as: instrumentation for monitoring operational trends and off normal conditions, sodium leak detection, temperature, pressure, flow, liquid level, valve position indication, electric power input variables and off-normal alarms.

Component service data from design verification testing at HEDL, ANL, and EBR-II will be compiled as the data become available to aid in establishing a firm philosophy and detailed procedures for preventive maintenance.

6.6.4 In Service Inspection

To be added.

APPENDIX A

REFERENCES

References

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2. "Development of a Continuous Electrochemical Meter for Oxygen in Sodium", B. Minushkin and M. Kolodney, UNC-5131, December 15, 1967.
3. W. H. Caplinger, "Carbon Meter for Sodium", UNC-5226, March 1969.
4. "A Comparison of the Valve and Orifice Plugging Meters for Monitoring Sodium Purity", G. E. Meadows, WADCO (to be published).
5. "In-Line Vacuum Distillation Sodium Sampler", W. H. Olsen, Trans. of ANS, Sup. Vol. 13, September 1970.
6. "Stress Analysis Report for the PAL Sodium Characterization System", D. H. Lester, WADCO, (unpublished).
7. Quality Assurance Program Plan for the Prototype Applications Loop and the PAL Sodium Characterization System, Rev. 1.
8. Honeywell Manual for PAL-SCS Control Panel.

APPENDIX B

DRAWINGS

See Companion Volume.

APPENDIX C

PROCESS INSTRUMENTATION

Item	Req'd	Input	Output	Specs. and Remarks
A. <u>Sodium Sampling Loop</u>				
1. Master Breaker	1	220 VAC	220 VAC	De-energizes SCS on trip.
2. Power Distribution Panel	1	220 VAC	220 V	Power supply to ILIP and SSP modules.
3. Trace Heater Controllers	4-8	110 VAC Type T/C's	0-10 amps to trace heaters	
4. Flowmeter recorder	1	0-5 mv	Flow read-out	
5. Main Pump Power Indicators	1			Voltmeter and ammeter for 8 KW, 200 V, pump power supply
6. Pump Power Control	1	8 KW, 220 V	0-8 KW	Motor operated power transformer for MSA Style VI pump (or equal)
7. Smoke detector control	1	110 VAC	Trip Alarm Functions	Power supply and trip relays for ionization smoke detector for SCS enclosure, Pyralarm Mode #FLU-2 or equal
8. Isolation Valve Control Components	1	110 VAC	Trip alarm remote operation	Piston operated by air. Air controlled by solenoid valve.
B. <u>Oxygen-Hydrogen Meter Module</u>				
1. Master Breaker	1	220 V from Item 1-A	220 VAC	2 Pole w/thermal trip.
2. Power Distribution Panel	1	220 V	110 & 220 V	Power supply to module circuits.
3. Voltage supply for	1	110 VAC	Stabilized ref. vol- tage to VDC	
4. Voltage divider	2	From (3)	-	Ref. (3)
5. Electrometer	2	From (4)		Para (to be added)

Item	Req'd	Input	Output	Specs. and Remarks
B. (Cont'd)				
6. Recorder, 2 pen	2			Record oxygen meter output hydrogen activity meter output, ion pump pressure.
7. Recorder, 24 pt	1	T/C, Type K	Temp. readout	Record trace heating, of thermocouples.
8. Ion Pump Power Supply	1	110 VAC	150 ma. to pump, 0-200 AV to recorder	Perkin-Elmer, Ultek 150 ion pump power supply.
9. Oxygen reference and purge gas components	Unit			Adjustable flowmeters with gas supply and pressure relief valves (gas type and flow to be defined)
10. Temp. controllers	10	100 VAC T/C, Type K	0-100 amps	Trace Heater control
C. <u>Carbon Meter Module</u>				
1. Master Breaker	1	220 V from Item 1	220 VAC	2 Pole w/thermal trip
2. Power Distribution Panel	1	220 V from		Reference 4
3. Flame ionization Detector	1	CH ₄	0-10 mv	"
4. Catalytic converter	1	CO	CH ₄	"
5. Humidifier	1	Ar-5% H ₂	Ar-5% H ₂ +H ₂ O	"
6. Dew Probe	1		Readout moisture content	"
7. Gas flow and control				"
8. Probe heater controller	1	220 V	0-220 V	4 KW SCR Controller, (Temp. controller + power controller).
9. Recorder	1	0-10 mv from (3)	FID readout	
10. Recorder (24 pt)	1	Type K, T/C's	T/C readout	
11. Temperature Controllers	8	110 VAC Type K, T/C's	0-10 amp power	

Item	Req'd	Input	Output	Specs and Remarks
<u>D. Plugging Meter Module</u>				
1. Master Breaker	1	220 V from Item A-1	220 VAC	2 Pole w/thermal trips
2. Power Distribution	1	220 VAC from Item D-1	110 & 220 VAC	Power supply to module circuits
3. Recorder, 24 pt.	1	Type K, T/C's 110 VAC	T/C readout	Thermocouple recorder
4. Recorder, flowmeter	1	PM flow-meter	Flowrate	(4 channel)
5. Fan Speed Control	1	110 VAC 0-10 mv from Item B-6	Variable Speed Fan Control	
6. Temperature controllers	8	110 VAC Type K, T/C's	0-10 amp to heaters	Trace heat controllers
<u>E. Multi-Purpose Sampler</u>				
1. Master Breaker	1	220 V from Item A-1	220 VAC	2 Pole w/thermal trip
2. Power Distribution Panel	1	220 VAC from Item D-1	110 & 220	Power supply to module circuits
3. Recorder, flowmeter	1	Pm flow-meter	Flowrate readout	(4 channel)
4. Temperature controllers	8	110 VAC Type K, T/C's	0-10 amp to heaters	Trace heat controllers
5. Indicating	1	Type K, T/C	Indicating readout	Plugging meter temperature indicator, API Model 451 or equal.

APPENDIX D

EQUIPMENT LIST

<u>Item</u>	<u>No. Req.</u>	<u>Input</u>	<u>Output</u>	<u>Spec's and Remarks</u>
<u>A. PROTOTYPE APPLICATION LOOP</u>				
1. Transformer 50 KVA	1	440 VAC 60 HZ 1Q	120/240/VAC	Loop Power
2. Master Breaker (K-1)	1	120/240 VAC	120/240/VAC	Loop Power
3. Fuse Disconnect	1	440 VAC	440 VAC	Loop Power
4. Distribution Panel - (A)	1	240 VAC	120/240 VAC	Loop Power
5. Transformer 15 KVA	1	440 VAC 60 HZ 3Q	208 VAC	Electromagnetic Pump #2 Power Su
6. Circuit Breaker (K-3)	1	208 VAC	208 VAC	" " " "
7. Fused Disconnect	1	440 VAC	440 VAC	" " " "
8. Distribution Panel - (B)	1	240 VAC 60 HZ 1Q	120/240	Loop Instrument Power Panel
9. Fused Disconnect	1	240 VAC 60 HZ 1Q	240 VAC	" " " "
10. Circuit Breaker - (K-6)	1	240 VAC 60 HZ 1Q	240 VAC	Loop Trace Heater Power
11. Distribution Panel - (C)	1	240 VAC 60 HZ 1Q	120/240 VAC	" " " "
12. Power Supply Dic	1	208 VAC 60 HZ 3Q	0-1000 AMP, 0-10Volt	Paragraph 3.8
13. Power Stat Motor Driver	1	240 VAC	0-270 VAC	Paragraph 3.8
14. Capaciator	1	30 Amp	65 AMP	Paragraph 3.8
15. Pressure Transmitter	1	0-50 PSIG	10-50 MA	NaK Pressure Sensor
16. Pressure Transmitter	1	0-20 inch H ₂ O	10-50 MA	Cover Gas Pressure Sensor
17. Damper Controller Motor	1	120 VAC	90° Rotation	Paragraph 3.4.1
18. Blower	1	120 VAC	200 SCFM	NaK Cooler
19. Electromagnetic Pump - AC -	1	0-270 VAC	0-25 gpm	Paragraph 3.8
20. Electromagnetic Pump - DC -	1	0-1000 AMP at 0-8 VDC	0-5 gpm	Paragraph 3.8
21. Valve Actuators	16	120 VAC	2 1/2 turns Rotation	Paragraph 4.3
22. Display Unit (Metra Scope)	1	Loop Parameters	Loop's Data	Paragraph 4.2
23. Scanner Unit (Metra Scope)	1	Loop Parameters	Loop's Data	Paragraph 4.2
24. Digital Recorder (Metra Scope)	1	Loop Parameters	Loop's Data	Paragraph 4.2
25. Valve Control Panel	1	120 VAC	Valve Position	Paragraph 4.3
26. Alarm Panel	1	Operating Variables	Off-Standard Alarm	Paragraph 4.7
27. Temperature Controllers (master)	17	Loop Temperatures	0-10 AMPS to heaters	Paragraph 4.5
28. Temperature Controllers (slaves)	17	Loop Temperatures	0-10 AMPS to heaters	Paragraph 4.5
29. Temperature Controller	2	Reservoir Temperature	0-5 VDC to phasers	Paragraph 4.11
30. Smoke Detector	1	220 VAC	Trip Alarm Functions	Paragraph 4.4
31. Damper Controller	1	110 VAC	Power to Damper Motors	Paragraph 3.4.1
32. Flow Recorder	1	0-2 MV	Flow Data	Standby Flow Recorder
33. Am meter	1	240 VAC	0-30 Amperes	AC Em pump power
34. Volt meter	1	240 VAC	0-300 Volts	AC Em Pump Power
35. Watt meter	1	240 VAC	0-20 kW	Paragraph 4.10
36. Watt meter	1	240 VAC	0-3 kW	Paragraph 4.10
37. Power Phaser	1	240 VAC	0-20 kW	Paragraph 4.11

<u>Item</u>	<u>No. Req.</u>	<u>Input</u>	<u>Output</u>	<u>Spec's and Remarks</u>
A. Prototype Application Loop (Continued)				
38. Power Phaser	1	240 VAC	0-3 kW	Paragraph 4.11
39. Valves	18			Paragraph 3.6
40. Valve Operators	16	120 VAC	2-1/2 turns	Paragraph 4.3
41. Blower	1	240 VAC	1500 SCFM	Paragraph 3.2.1
42. Reservoir Heater	1			Paragraph 4.10
B. <u>PAL COVER GAS</u>				
1. Anemometer	2	0-3000 cc	0-6 VDC	Paragraph 5.4
2. Power Supply & Linerizer	2	120 VAC	0-10 VDC	Paragraph 5.4
3. Recorder 12 pt.	1	Thermocouple Type K	Temperature	Vapor Trap Temperature
4. Recorder	2	10-50 MA	Flow & Pressure	Paragraph 5.2
5. Temperature Controller	3	Thermocouple Type K	0-10 AMPS to heaters	Paragraph 4.5
6. Controller	3	10-50 MA	10-50 MA	Paragraph 5.3
7. Power Supply	1	10-50 MA	10-50 MA	Paragraph 5.2
8. Alarm	1	10-50 MA	Filter Switch	Paragraph 5.5.2
9. Convertor	2	0-10 MV	10-50 MA	Paragraph 5.3
10. Convertor	3	10-50 MA	3-15 PSIG	Paragraph 5.4
C. <u>SODIUM CHARACTERIZATION SYSTEM</u>				

See Panel drawings in Appendix B, Table in Appendix C, and Honeywell Manual for control panel.

APPENDIX E
OPERATIONAL SAFETY ANALYSIS

JANUARY 1972

PROTOTYPE APPLICATIONS LOOP
OPERATIONAL SAFETY ANALYSIS

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PROTOTYPE APPLICATIONS LOOP

OPERATIONAL SAFETY ANALYSIS

I. INTRODUCTION

Discussed in this section are the safety features of the Prototype Applications Loop (PAL) and the Prototype Applications Loop-Sodium Characterization System (PAL-SCS) and controls of the operation to assure that the facility is safe to operate under normal conditions and certain hypothesized off-standard conditions. In general, the safeguard objectives which will control the operations and the experiments proposed to be run in the PAL facility can be stated as follows:

- (1) That no operation or credible failure will result in an uncontrolled release of sodium or its compounds to an area that may endanger personnel, cause extensive damage to test equipment and buildings, or adversely influence the environment.
- (2) That property damage, loss of use of the PAL facility and/or other facilities located in the 335 Building shall be minimal in the event of a credible failure and in no case, exceed \$95,000.
- (3) That the design of experiments and methods of operation will minimize the potential for chemical reactions involving sodium.

II. SYSTEM RESPONSE TO EQUIPMENT FAILURE

The codes, standards, and practices followed for the procurement, fabrication and nondestructive testing of the PAL facility have produced a sodium containment system having a minimal probability for failure. (Re-PAL-SDD and QA Plan) However, there are components of the containment system which have a relatively higher potential for failure than others.

The most likely failure of the PAL facility sodium containment is at mechanical connectors, valve bellows seals, metallic membranes of the carbon and hydrogen meters, or the ceramic electrolytes of the oxygen meters. A sudden large release of sodium from failures of these devices will be an event of low probability. More probable is a small leak occurring at a mechanical connector or valve bellows seal which gradually increases in magnitude. PAL design features which will give early detection of leaks at valve bellows are the radiant heaters used for heating the bellows region of the valve. An open circuit in a valve heater and/or a high temperature indication on the record thermocouples attached to the valves will accompany a sodium leak and also indicate the location of the leak. Sodium leaks creating significant smoke will be detected by the PAL enclosure smoke detectors.

A. Sodium and NaK Spills

1.0 PAL Reservoir

The PAL reservoir is a 150 gallon vessel which will be filled with 100 gallons of sodium. The vessel inlet and outlet lines are near the operating level of the sodium in the reservoir and syphon breaks are employed to minimize sodium spillage in case of failure of the sodium piping exterior to the reservoir. The mechanical connectors used on the vessel are located on the top head and will contact only cover gas and sodium vapor. An excessive high level of sodium in the reservoir cannot occur as the quantity of sodium will be limited to the original filling. A rupture failure of the vessel is not considered to be a credible event due to the design, materials used in construction of the vessel, the extensive qualification of the vessel and the conservative operation of the vessel during the conductance of the PAL test programs. Thermal stresses have been discounted as a potential mechanism for rupture of the vessel because: Normal operation of the vessel, syphon breaks and sodium delivery piping will be at or near isothermal conditions. Temperature transients will be limited to a maximum of 100°F/hour by operating procedures. Failure by over-pressurization is safeguarded through design by:

- The argon gas is regulated between 5-25 psi by a reducing valve in the argon supply manifold.

- The cover gas pressure is automatically controlled at a nominal pressure of + 10 inches of water.
- A pressure transducer located in cover gas system of the PAL actuates a valve isolating the PAL cover gas system from the argon supply system in the event excessive pressure is developed in the PAL cover gas plenum.
- A 5 psi pressure relief valve is located in the PAL cover gas system.
- The design pressure for the PAL vessel is 25 psi at 1200°F.

Dropping of heavy loads on the PAL vessel is not a credible accident as there is no overhead crane in the 335 Building. A small crane mounted on the PAL facility at the 12 foot level has a maximum load limit of 500 lbs. The crane will be used for lifting and transferring small items required for the maintenance of the PAL cover gas system and gas chromatograph. All sodium and cover gas piping is protected by steel decking or guard rails from accidental bumping or dropping of loads from the PAL crane. In addition, inspections, controls and procedures are in place which further reduce the probability of equipment handling failures. These include:

- An annual inspection of the crane, including a lift test.
- Inspection of chokers and lifting harness prior to each use for damage and broken strands.
- Operating procedure (IX-A-24 Jib Crane Operation) and administrative controls which require:
 - Operators of the crane to be qualified according to a training program established by the HEDL maintenance organization for this purpose.
 - That a minimum of two operators will be present to perform the equipment move.

2.0 PAL Piping

The PAL piping is contained within a metal enclosure measuring approximately 10 feet by approximately 8 feet by 4 feet high. When the PAL vent system is closed - as in a scram situation - any openings or gaps between pieces of the sheet metal are less than 1/16 inches. Small openings < 1/16" are expected to fill with sodium combustion products in the event of a sodium fire and offer further resistance to escaping combustion products. Steel trays partially filled with vermiculite, 10 feet by 20 feet and 6 inches high are under the piping, cold trap vessel, NaK system and the reservoir. The trays will serve as a catch basin in the event of a sodium spill.

A sodium spill from the PAL piping may range in volume from a small seepage leak to the volume of sodium available to the leak. If a significant leak occurs at the low point of the piping the maximum volume of sodium available for leakage is about 10 gallons. Small leaks will probably occur at valve bellows and may be detected by an unexplained temperature rise at a thermocouple or a valve heater failure. Leaks of sufficient quantity (~ 250 grams of sodium) are expected to produce enough smoke to actuate the smoke alarm, automatically terminating all the PAL facility operating functions with the exception of instrument power. The PAL vessel liquid level probes have sufficient sensitivity to detect a loss of 1.5 gallons of sodium. The low liquid level trip and alarm will terminate operation of the PAL driver pump (EM pump 1).

3.0 Maximum Credible Accident

The component of the PAL piping having the highest potential for failure is the pump tube of EM pump No. 1. Factors contributing to the vulnerability of the tube are: less wall thickness than other PAL piping and the potential for generation of excessive temperature within the tube if a sustained loss of sodium through the tube occurs. Failure of the pump tube is postulated as the maximum credible accident for the PAL facility and a substantial failure of the tube could result in a sodium spill of about 10 gallons. Design features and operating procedures which safeguard against the accident are:

- A low flow trip alarm which terminates the power to EM pump #1.
- The pump tube temperature is monitored continuously and a high temperature trip alarm will automatically terminate pump operation when the trip is actuated.
- Nominal flow rate for the system will be less than 50% of the design output of the pump.

4.0 PAL-SCS Distribution Piping System

The PAL Sodium Characterization System (SCS) distribution piping system and instrument modules are contained in a separate enclosure near the PAL. The PAL will supply sodium to the SCS. The codes, standards and practice for procurement fabrication and qualification of the SCS plumbing were identical to the PAL. Therefore, the integrity of the system will assure a minimum probability of leakage. The SCS enclosure has the following design features which minimize the effects of sodium spills if they should occur. Sodium spills within the enclosure which are sufficient to actuate the fire alarm trip will automatically terminate all operation of the SCS including the SCS EM pump and will close the SCS inlet-outlet sodium valves isolating the SCS from the PAL limiting the supply of sodium available for the spill. The SCS enclosure vent system will automatically shut down and close the vent dampers. The event will be accompanied by visual and audio alarm at the SCS control panel. The capability for flooding of the SCS enclosure with argon is provided. The inert gas flood is controlled by manual operation. A procedure (IX-B-2) for operation of the argon fire control system is incorporated in the manual of operating procedures for the PAL facility.

5.0 Hydrogen Meter Module

A rupture or leak in the diffusion membrane of the hydrogen meter would allow sodium to enter the vacuum side of the hydrogen meter. This will not be a complete breach of confinement of the sodium containment as the vacuum system is an all metal self-contained system capable of containing sodium. The vacuum system is pumped with a vac-ion pump and does not exhaust to the

atmosphere. Upon entering the vacuum system, the first few milligrams of sodium would be flash distilled and deposited throughout the vacuum system. The event will be detected by a large increase in the current flow in the ion pump. A high and erratic signal will be obtained from the ionization gauge used to read the pressure of the system when sodium vapor is deposited on the filaments of the gauge.

Upon receiving a high pressure in the vacuum system of the hydrogen meter module the vac-ion pump will be terminated automatically. It would not be necessary to terminate sodium flow in the in-line instrument package (ILIP) section of the SCS. Necessary action items are written into the hydrogen meter module operating procedure IX-A-10.

The hydrogen meter module was designed and developed by Argonne National Laboratories. The diffusion membrane is protected from rupture by over-pressurization by an internal restraining structure. The design has undergone destructive testing up to 3000 psi. The membrane was observed to collapse inwardly around the internal restrainer without developing hydraulic fluid leakage through the membrane.⁽¹⁾

6.0 Oxygen Meter Module (SCS)

Two gas lines are required for operation of each oxygen meter housing. They are: the reference gas which serves as the reference electrode, and the purge gas which is used to purge the housing when the sensor is replaced. The reference gas is separated from the molten sodium flowing through the meter by the ceramic electrolyte. Breakage of the electrolyte will allow sodium at $\sim 750^{\circ}\text{F}$ to contact the reference gas which is chemically reactive with sodium. The gas pressure in the 1/8 inch OD reference gas line will be approximately atmospheric and the sodium being under several psi will be forced toward the reference gas supply rather than the reference gas bubbling into the sodium. The reference gas line will be at ambient temperature and a sodium freeze seal will be formed in the 1/8 inch stainless steel tube. The exothermic reaction between the sodium and the reference gas will be insignificant because of the limited surface area for reaction. Recent experiences at EBR-II and ANL-Chicago have not indicated any unusual or specific hazards

associated with fracturing of the oxygen meter electrolyte.⁽²⁾ The housing purge line will not be open while sodium is flowing in the meter and during normal operations the purge line will be closed with an isolation valve. Loss of the electrolyte will render an oxygen probe inoperative; however, the other oxygen probe will remain functional and it will not be necessary to terminate sodium flow in the ILIP section of the SCS.

7.0 Carbon Meter Module

Rupture of the iron membrane of the carbon meter probe would allow sodium to enter the decarburizing gas stream. The event will render the carbon meter inoperable; however, no special hazards are foreseen. Past experience has indicated rupture of the iron membrane to be an uncommon event.⁽³⁾ However, rupture of the carbon meter membrane can be brought about by two mechanisms: over-pressurization, and corrosion by improper use of the decarburizing gas. The pressures developed in PAL and the PAL-SCS will not exceed 25 psi. The carbon meter diffusion membrane is an Argonne National Laboratory design and has been designed to a pressure requirement of 150 psig at 1400°F.⁽⁴⁾ The decarburizing gas presents a reducing atmosphere when the gas is flowing; however, under certain zero flow conditions the gas can become an oxidizing atmosphere which will be corrosive to the iron membrane, thus weakening the membrane. Operating procedures will limit the operation of the carbon meter when the decarburizing gas flow is zero. In the event the carbon meter iron membrane did rupture, no sodium would be expected to reach the atmosphere. The operating pressure in the 1/8 inch stainless steel decarburizing gas line is slightly above atmospheric pressure (a few inches of water) and the sodium in the meter being under a greater pressure, will flow into the decarburizing gas lines. A freeze plug would be developed in both gas lines a few inches after entering the gas lines as the lines will be ambient temperature. Detection of the event will be detected by a rapid change in the output signal of the flame ionization detector and a loss of decarburizing gas flow. Standard operating procedure will be to terminate sodium flow in the carbon meter module if the combined events happen.

8.0 Plugging Temperature Indicator Module

The bellows of the throttle valve (MOV-S21) is the most probable site for sodium leakage in the PTI module. The valve heater and thermocouple will provide for early detection of sodium leakage from the valve bellows. The PAL-SCS smoke detector will detect any significant smoke produced in the PTI module and automatically terminate SCS functions with the exception of instrument power, including closing the SCS sodium valves isolating the SCS from the PAL.

9.0 Flow Through Sampler and Multi-purpose Sampler

The flow through sampler sample tube and multi-purpose sampler are connected to the sampling manifolds with mechanical connectors. The connectors are broken and made up for each sampling operation. The mechanical connectors are the site of highest probability for sodium leakage in the sampler modules. The following design features and operating procedures will minimize sodium leakage from these samplers.

- Every new sample tube, after attaching to the manifold, will be evacuated and leak checked prior to taking a sample.
- When the samplers have been preheated to $\sim 300^{\circ}\text{F}$, the mechanical connectors will be retorqued prior to starting sodium flow in the sampler.

10.0 NaK System

The PAL cold trap is cooled by a forced convection NaK system. The NaK is cooled by a NaK to air heat exchanger. The volume of the NaK in the system is 1.3 gallons. The following design features and operating philosophy will minimize NaK leakage from the cold trap cooling system.

- The NaK reservoir is fabricated to ASME Section III, Class C.
- The piping is fabricated in accordance with ANSI B 31.7, Class II.
- Maximum operating temperature is limited to 800°F by operating procedure. (Re-PAL operating procedure IX-A-8).

- Maximum operating pressure is 30 psig.
- Maximum design pressure is 50 psig at 800°F.
- A 50 psi rupture disc located in the gas phase of the NaK reservoir will relieve excessive pressure.
- The NaK reservoir pressure will be monitored continuously and has a high pressure trip alarm.
- Maximum operating NaK flow rate will be 0.2 gpm (Re-PAL operating procedure IX-A-8). The pump power requirements < 300 watts will not produce overheating if a sustained flow loss should occur.
- Valve 17, the only valve in the NaK system below the liquid level, is closed after the filling step, removing the valve bellows from the active NaK system.

The total volume of NaK which would spill from the NaK system in the event of a breach of the NaK system would be less than the total volume of 1.3 gallons as the cold trap annulus will retain some of the NaK and the inlet and outlet lines of the annulus will serve as syphon breaks. The maximum volume of NaK available to a breach at the high point of the system is approximately .3 gallons and a breach at the low point of the system is approximately .8 gallons. The PAL piping catch pan also serves as a catch basin for the NaK system. Damage to the PAL piping is expected to be insignificant in the event of a NaK spill. A NaK leak which creates sufficient smoke to activate the PAL smoke detector alarm will automatically terminate all the PAL facilities operations with the exception of instrument power, and isolate the enclosures from the vent systems.

B. Impact of PAL Sodium and/or NaK Spills

The PAL and the PAL-SCS enclosures are expected to contain all potential sodium spills associated with the operation of the PAL facility. Even though the enclosures and catch pans will contain the spilled sodium and/or NaK pool, the enclosures are not hermetically sealed and some of the reaction products which become airborne and which are not condensed on the inside of the enclosures can escape the enclosures and spread into the 335 Building. The

hazard will be inhalation of airborne combustion products. However, no sodium or NaK combustion products are expected to escape from the 335 Building. Damage to equipment and instrumentation from combustion products will be minimal as the PAL & PAL-SCS instrumentation is enclosed in cabinets. Other instrumentation in the 335 Building which is not enclosed is some distance from the PAL facility and is not expected to be affected by a spill at the PAL facility.

The Plant Improvement Program for the 335/336 Building includes an addition of a scrubber system for oxide control for potential fires in the 335/336 Building. The PAL & the PAL-SCS enclosures will exhaust to the scrubber system when it is available. During the modification, an argon fire suppression system will be added to the PAL enclosure.

A spill of sufficient volume to produce enough combustion products to breach the PAL facility enclosure would produce the following events:

- The PAL facility smoke detector alarms will automatically terminate all operations, with the exception of instrument power of the PAL and the PAL-SCS and activate visual and audio alarms at the PAL control panel.
- The fire alarm will be activated by TFO personnel and the building evacuation and emergency procedures will be enforced.
- In case of a malfunction of the PAL smoke alarm and nondetection of the smoke emitted from the closures, the 335 Building smoke detection system will be tripped sounding a fire gong which is audible throughout 335 and 336 Buildings. Simultaneously, an alarm at the 300 Area Fire Department will be sounded summoning the Fire Department to the 335 Building.
- Building emergency procedures and evacuation plans will be enforced. The emergency procedures include shutdown of operating facilities and closure of all building vent systems and doors to confine the smoke to the 335 Building.

III. SYSTEM RESPONSE TO UTILITY AND STRUCTURAL FAILURE

A. Inert Gas System Failure

A cryogenic system furnishes argon gas to the sodium facilities which will operate in the 335/336 building complex. The most likely cause of failure of the argon is exhausting the supply. Remote reading of the gas storage tank pressure is not provided but a low pressure alarm (1300 psi) will sound in the CSDF control room alerting the operations staff to a problem. In addition, administrative controls require reading and recording the gas storage tank pressure and the liquid level of the cryogenic tank each shift. Depletion of the argon supply to a minimum requires two failures: an exhaustion of the liquid argon supply and a steady leak. Potential mechanisms for a steady leak to occur are:

- Safety relief valve on the high pressure side of the argon supply to trip and fail to reseal.
- Safety relief valve on the low pressure side of the argon supply to trip and fail to reseal.
- Excessive and uncontrolled leakage at one or more of the facilities using the argon supply (i.e. seal failure at top of CSDF TK-1 or TK-2).

Off-standard situations in the argon system will be detected by:

- An audible alarm signalling a low pressure in the gas storage tank.
- Routine reading of the gas pressure in the storage tank and comparison with previous readings.

Failure or loss of the 335/336 building cryogenic supply system will only interrupt or force a change in work activity for the PAL facility. A back-up supply of argon will be available for the PAL cover gas system. The backup supply will be a smaller volume (2000-4000 cubic ft) and may curtail experiments requiring large usage of argon.

B. Failure of Electrical Supply System

1.0 Causes for Failure

Causes for failure of the electrical supply to the 335 Building are the same as for any power system; electrical storms being the most common. Emergency power is not available to the facility and is not necessary for the safe shutdown of the PAL facility. Adequate emergency lighting has been provided to enact the building emergency procedure and for evacuation needs.

2.0 Results of Power Failure

With a lost of electrical power, all PAL facility functions will be terminated. A resumption of power will return the instrument function to normal operation. All other PAL facility functions will remain in the tripped mode. Startup will require a manual reset before these operating functions can be resumed. The manual of operating procedures for the PAL includes a startup procedure for the facility when the operation has been terminated by a building power failure.

C. Failure of Compressed Air System

1.0 Potential Mechanism

Compressed air to the 335 Building is supplied by the 300 area power house through underground lines. Air failure could be a result of compressor failure, but is unlikely since more than one compressor would have to fail; other failure mechanisms are rupture by excavation and by over-pressurization of the distribution header in the 335 Building. Over-pressurization is very unlikely since the supply pressure in the distribution system is only 100 psig. Rupture by excavation is safeguarded against by requiring the use of excavation permits before work is undertaken. This permit identifies the location of underground lines which may be endangered by excavation activities.

2.0 Results of Failure of Compressed Air System

The PAL and the PAL-SCS valves which are pneumatically operated will close with a loss of the air supply. The SCS isolation valves have interlocks which terminate all other SCS functions as they close. All dampers which are air operated will close with a failure of the air supply.

IV. HAZARDS ASSOCIATED WITH TESTING

The general nature of the tests to be run with the PAL facility are: study of the startup chemistry, testing of prototypic sodium sampling devices, in-line impurity monitoring instruments and cover gas handling equipment including gas purity analyses.

The PAL cover gas system, including the gas chromatograph, is located on the PAL mezzanine in a separate enclosure. The enclosure has a recirculating air system which is cooled by a refrigerated unit. A leak in the argon gas system in the enclosure is a potential hazard to personnel working in the enclosure. An oxygen indicating and alarm system is employed to monitor and notify personnel of unsafe working conditions in the enclosure.

The NaK reservoir rupture disc vents into a down tube directing any escaping NaK into the vermiculite filled catch pan under the NaK and PAL piping. The down tube is continuously purged with argon to minimize the potential NaK air reaction in the event the rupture disc blows. The argon purge exiting from the down tube will exhaust into the PAL enclosure and represents a potential hazard to personnel performing maintenance functions inside the enclosure. The following work practices and procedures are followed: All entrances to the PAL enclosure will be locked and posted with signs identifying the hazard and the necessary requirements for gaining entry to the PAL enclosure. Personnel will not enter the enclosure until a side panel of the enclosure has been removed, the argon purge gas has been terminated and/or an analysis of the enclosure atmosphere has been determined safe for entry. Personnel entering the enclosure are required to carry a portable oxygen analyzer-alarm instrument.

All tests will be subjected to a safety review. This is to be done in accordance with the document, "Facility Management Plan for Sodium Engineering Operations," HEDL-TME 71-14. These individual analyses will be directed at the specific test activities planned.

- To assure the test conditions are within the operating limits of the facility. (Limits set forth in PAL SDD and QA Plan.)
- To identify any special training requirements for either operating or maintenance personnel involved with the test.
- To identify specific safety aspects associated with the test such as thermal burns, chemical burns and the use of equipment or specialized instruments.
- To assure that the approved operating procedures are satisfactory for the test proposed.

If the safety review conducted by Sodium Technology and Test Facilities Operations representatives for a planned experiment indicates that hazards of a type not covered in the approved operational safety analyses, or if the expected or postulated hazards are more severe than those previously analyzed, a new safety analysis will be required before performance of the experiment. The results of such a new safety analyses will be documented, reviewed by the HEDL Safeguards Council, and added to the OSA as an appendix.

Job Hazard Breakdowns will be provided for the PAL facility startup and testing program. The J.H.B. will be prepared by Sodium Technology and/or Test Facilities Operations and will be submitted to HEDL Industrial Safety for review and approval.

V. ADMINISTRATIVE CONTROL

This section presents the administrative and procedural controls used in the operation of the PAL facility, the general approach to conducting various phases of normal operation, the general approach to control performance of experiments, and the emergency plans and procedures to be followed in the event of an accident.

A. Quality Assurance

The method of operation for the PAL and its contained test equipment is formalized by a Quality Assurance Plan which was prepared as described by RDT Standard F 2-2T, Quality Assurance Program Requirements. An action matrix is to be completed for each study or series of studies which clearly assigns performance responsibilities to organizations and individuals.

B. Basic Operating Principles

The basic operating principles for the PAL include the following:

- (1) Special procedures will be prepared for the pre-sodium check and the sodium filling of the facility and includes safety items.
- (2) Before sodium is charged to the system, all the engineered components will be subjected to a thorough performance check. Pieces will be checked individually and as a system. The performance of all equipment will be recorded. Alarm systems will be tested to assure they are audible in all portions of the 335 Building.
- (3) As sodium is charged to the system, performance checks will be made on those equipment pieces which could not be checked without sodium (i.e. level detectors, EM pumps and EM flowmeters).
- (4) Startup, repetitive operations, and normal shutdowns will be performed in accordance with procedures and recorded check lists approved by Sodium Technology and Test Facilities Operations designated representatives.

- (5) Tests and routine maintenance of the PAL facilities protective devices and operating equipment will be done in accordance with a written schedule.
- (6) All unexpected incidents or unsafe acts will be promptly investigated, documented and reported in accordance to AEC and HEDL requirements to effect remedial procedures to prevent recurrence.
- (7) In the event of any situation where continued operation of the PAL facilities may compromise safety, a shutdown of the facility will be required as quickly as the situation warrants and planned emergency action will be taken to protect persons and property.

PAL Safety and Operational Alarm System

Drop Number	Function	Results
1.	Power Failure	All functions terminated. Power restoration-instruments operate only - other operating functions require manual reset. A+V
2.	Reservoir Cover Gas, Temperature, High	A+V
3.	Reservoir Liquid Level, High	A+V
4.	Reservoir Liquid Level, Low	EM Pump #1 operation terminated A+V
5.	Reservoir Gas Pressure High	A+V
6.	Reservoir Gas Pressure Low	A+V
7.	Flow FM-1 High	A+V
8.	Flow FM-1 Low	EM Pump #1 operation terminated A+V
9.	Flow FM-2 High	A+V
10.	Flow FM-2 Low	A+V
11.	Flow FM-3 High	A+V
12.	Flow FM-3 Low	A+V
14.	Cold Trap Economizer Temperature, High	A+V
15.	Cold Trap Temperature, High	A+V
16.	Temperature EM Pump #1	EM Pump operation terminated. A+V
17.	Reservoir Bottom Temperature, High	Reservoir bottom heater power terminated. A+V
18.	Reservoir Top Temperature, High	Reservoir top heater power terminated. A+V

PAL Safety and Operational Alarm System (Continued)

Drop Number	Function	Results
19.	Loop Trace Heaters Over Temperature	1-31 trace heaters have individual trip. Termination of power to all heaters with the over temperature. A+V
	Low Temperature Valves 1, 2, 3, 4, 5 & 6	A+V Valve operators are interlocked with low temperature alarm.
20.	Loop Temperature, High	A+V
21.	Smoke Detector	Terminates all PAL functions except instrument power - closes all vent dampers. A+V
23.	NaK System, High Pressure	A+V
24.	Cover Gas Low Flow	A+V
A+V	Audio and Visual Alarm at the PAL Control Panel	

REFERENCES

1. Private communication with P. Nelson, ANL, 1/17/72. Details appear in ANL Quarterly, Oct.-Dec. 1971.
2. Private communication G. R. Haroldson, ANL-ERB-II, 12/3/71.
3. Private communication W. H. Caplinger, HEDL, 10/15/71.
4. Letter to W. R. Wykoff, HEDL from L. Burris, ANL, "Module Development and Design", CEN-1600/PROG.-1:14, 8/20/71.

APPENDIX F

DESIGN CRITERIA

1. General Layout. All components except an auxiliary vacuum distillation sampler are to be located below the sodium level in this tank. A portable glovebox is to be located on top of the tank for access to two ports and for sampling. The layout is to allow sufficient space around all components for access and maintenance. The working pressure for the entire system is to be 0 to 25 psig.
2. Operational and Safety Requirements. The PAL shall be designed for automatic, safe, unattended operation at constant flow and shall be capable of operating for extended periods of time without attention of operating personnel. Controls shall be located on a central control panel and shall be capable of controlling the system at equilibrium conditions after preheat and loop startup have been accomplished. Trace heating and loop startup and normal shutdown shall be activated manually from the control panel. Provisions shall be made for containment of sodium spills, smoke from fires, and monitoring for malfunctions and loop safety for unattended operation.
3. Mixing Tank. The mixing tank shall be designed to heat about 100 gallons of sodium to 1200F in 12 hours or less, maintain any selected temperature isothermal $\pm 5F$ and completely stir the contents of the tank and refresh the gas sodium-interface. 30% void volume shall be provided for cover gas. Access to the tank shall be provided for the following functions:
 - a. Addition and sampling port 2" ID to allow addition or removal of materials during operation - provisions to be made for attaching portable glovebox to port.
 - b. Materials surveillance stringer port 2" ID with provisions to insert or remove material tabs during operation. Stringer length will be 12" below sodium surface.
 - c. Parasitic loop access port 2" ID (not in glovebox).
 - d. Level measurement port to allow insertion of level measuring devices (not in glovebox).
 - e. Viewing port to allow viewing during operation.
 - f. Light port for illumination during viewing.
 - g. Gas inlet and outlet with refluxing vapor traps to allow continuous circulation or argon at 1.5 liter/min at 1200F sodium temperatures.

- h. Four thermowells - (1 in each quadrant) the complete length of the vessel to allow measurement of temperature distribution,
4. Pumping. It shall be possible to independently control the flow through the mixing tank jets and to the experiments such that a change in flow in an attached experiment will not affect the mixing flow. Flow requirements are:
- a. Mixing tank - sufficient to achieve optimum mixing and surface renewal.
 - b. Cold trap - 0.5 to 1.5 gpm.
5. Cold Trap. A cold trap shall be provided of about 5 gallon capacity and flow capabilities of 0.5 to 1.5 gpm (variable) with a variable inlet temperature of 250 to 1200F. The outlet flow shall be reheated to the inlet temperature $\pm$ 50F before mixing with another stream. Provisions shall be provided for measuring temperature distributions in the trap. It shall be possible to operate the trap to adjust trap minimum temperatures over the range 225 to 800F $\pm$ 10F independent of inlet temperature or flow. The trap shall be liquid cooled. Valving shall be provided to insert experimental traps in series before or after, or in parallel with this service cold trap.
6. Experimental Provisions. The PAL is to provide the following provisions for experiments and tests.
- a. Cover access ports as detailed in Item 1.
 - b. A glovebox on the top of the tank for handling materials to be put into or withdrawn from the tank.
 - c. A sodium manifold to provide sodium to external experiments including:
 - 1) outlet and return from sampler system
 - 2) outlet and return from in-line instrument package
 - 3) outlet and return - spare
 - d. Valving for experimental traps as indicated in 5 above.
7. Heaters and Controls. The heaters for the main tank shall be adjustable to compensate for end heat losses. The rest of the system shall be trace heated to melt the sodium sequentially from the mixing tank and shall have sufficient capacity to make up for heat losses to maintain the loop at test temperature $\pm$ 5F in an ambient temperature of 70F. When heat is extracted, the heat shall be replaced before mixing with another stream.

Each heater shall be operable independently and it shall be possible to measure the power input and resulting temperature change for each heater independently.

The instrumentation shall provide (a) continuous measurement and automatic control of variables essential to the successful performance of the facility, (b) continuous and permanent records of process variables necessary for the determination of test conditions and (c) automatic shutdown for emergency off-standard conditions. The following variables shall be measured:

- . Sodium trap temperature in mixing vessel and temperature distribution
- . Gas plenum pressure and temperature
- . Sodium reservoir liquid level
- . Loop total flow through mixing tank
- . Cold trap flow
- . Cold trap temperature
- . Pump voltage and amperage
- . Trace heater temperature
- . Trace heater amperage

Alarms shall be provided for out-of-limit or danger conditions as follows:

- . High and low cover gas pressure
- . High and low sodium flow
- . High and low sodium reservoir temperature
- . High trace heater temperature
- . High and low sodium level in reservoir tank
- . High pump flow-duct temperature
- . Pump discharge valve(s) closed, pump permissive switch
- . Sodium leakage

8. Materials. The loop shall be constructed of austenitic stainless steels except where other materials are needed for special applications such as stellite for valve seats. Where materials other than austenitic stainless steels are specified they shall be compatible with sodium, austenitic stainless steel and other materials to assure a mutually compatible system.

APPENDIX G

CODES AND STANDARDS

A. Components and Materials:

1. Piping - ANSI B 31.7 Nuclear Power Piping Class I including applicable nuclear cases and supplementary criteria.
Ultrasonic inspection to RDT F 3-8, Level S-2.
2. Reservoir - ASME Section III Class C. RDT E 10-3.
3. Cold Trap - RDT E 4-5T
4. Fittings - ASTM A 403 - 67.
5. Tubing - ASTM A-213 - ANSI B 31.7 Para. 1-724.1.1.
6. Welding Rod - Mil-19933D 1967.
7. Plate - ASTM A 240 plus NDT Reqs. of RDT M 5-1T.
8. Flowmeters - RDT C 4-5T.
9. Thermocouples - RDT C 7-6T.
10. Liquid Level Probes - RDT C 5-2T.

B. NDT and Processes:

1. Radiography - RDT F 3-6T.
2. Ultrasonic Examination - RDT F 3-6T, F 3-8T, F 3-4T and F 3-5T.
3. Dye Penetrant - RDT F 3-6T.
4. Marking - RDT F 7-3T.
5. Packaging - RDT F 7-2T.
6. Welding - RDT F 6-1T.
7. Cleaning - RDT F 5-1.

APPENDIX H

QUALITY ASSURANCE PROGRAM PLAN FOR THE
PROTOTYPE APPLICATIONS LOOP (PAL) AND THE
PAL SODIUM CHARACTERIZATION SYSTEM (SCS)

REV. 1

QUALITY ASSURANCE PROGRAM PLAN
FOR THE
PROTOTYPE APPLICATIONS LOOP (PAL) AND THE
PAL SODIUM CHARACTERIZATION SYSTEM (SCS)

Revision 1

PREPARED BY:	V. P. KELLY	January, 1970
REVISION 1 BY:	P. R. CORBETT	October, 1971

HANFORD ENGINEERING DEVELOPMENT LABORATORY
RICHLAND, WASHINGTON
(99352)

OPERATED BY:
WADCO, A Subsidiary of Westinghouse Electric Corporation,

For The
U. S. ATOMIC ENERGY COMMISSION
Under Contract No. AT(45-1) 2170

QUALITY ASSURANCE PROGRAM PLAN
FOR THE
PROTOTYPE APPLICATIONS LOOP (PAL) AND THE
PAL SODIUM CHARACTERIZATION SYSTEM (SCS)

REVISION I

APPROVAL SHEET

Approved By: John W. Flory 11/15/71
Quality Assurance
Program Manager - Projects Date

Approved By: Paul W. Bennett 11/23/71
Project Engineer (PAL) Date

Approved By: David H. Lester 11/23/71
Project Engineer (PAL SCS) Date

Approved By: David H. Lester _____
Manager, Sodium System Engineering Date

Approved By: John W. Flory 11/30/71
Manager, Quality Assurance Date

QUALITY ASSURANCE PROGRAM PLAN
FOR THE
PROTOTYPE APPLICATIONS LOOP
and
SODIUM CHARACTERIZATION SYSTEM

1.0 SCOPE

This revision of the Quality Assurance Program Plan for the Prototype Applications Loop (PAL) supersedes the original program plan, dated 30 January, 1970. Changes covered by this revision include those made necessary by change in management of the PAL from BNW to WADCO, changes due to WADCO organizational structure and operating philosophy, and the addition of PAL Sodium Characterization System (SCS) to the QA Plan.

The PAL is a general-purpose, isothermal, forced-convection evaluation loop for sodium chemistry and a test bed for checking and calibrating sodium characterization instruments.

The initial use of the PAL will be in support of Task ST-F, the evaluation and selection of sodium on-line impurity monitoring devices. These devices are required for impurity level control and for detection of off-normal sodium conditions that, if not detected and corrected, could lead to a sodium-based malfunction. The PAL is also for the near-term support of Tasks ST-B, ST-D, and ST-E.

The PAL provides a means of connecting sodium instruments to be calibrated into a sodium stream that has controlled flow, pressure, and purity for checking or calibrating the instruments. The PAL consists of a 100-gallon reservoir, piping system, pumps, sodium purification system, temperature control, and control panel in a unitized structural framework 10 by 25 feet by 11 feet high. The PAL is designed to operate at sodium temperatures up to 1200F, flow to 20 gpm, and a reservoir pressure of up to 20 inches of H₂O.

The PAL SCS will be located adjacent to the PAL and will be used to measure the quality of Na that is circulated through the PAL.

2.0 QUALITY ASSURANCE PROGRAM ELEMENTS

This Quality Assurance Program Plan is based on meeting requirements of RDT Std. F2-2T, as applicable to a non-nuclear, low-volume, low-pressure sodium test facility. General guidelines given by WHAN M-2 (WADCO Quality Assurance Manual) and BNWL-MA-64 (WADCO Manual for Design and Construction of Systems and Equipment Containing Alkali Metals) were followed in formulating this program plan. The program elements of RDT Standard F2-2T, as they apply to WADCO and other participating agencies, are shown in Table I.

3.0 ORGANIZATIONS AND THEIR RESPONSIBILITIES

3.1 WADCO

3.1.2 General - The WADCO and contractor organizations responsible for enacting the PAL QA Program are shown by Figure 1.

3.1.3 Sodium Technology - The primary responsibility for the quality of the completed PAL and PAL SCS rests with WADCO Sodium Technology. Sodium Technology is also responsible to WADCO Management for assuring that design, development, procurement, construction, and installation are consistent with project goals, technical criteria, approved cost, work scope, and schedule.

3.1.4 Quality Assurance and Standards - WADCO Quality Assurance and Standards has the primary responsibility for managing, monitoring, and auditing the Quality Assurance Program for the PAL. They are also responsible for assuring that controls are established and implemented to meet all requirements of a quality program as defined by RDT Standard F2-2T.

3.2 Services from Other WADCO Groups and From Contractors

Services from other WADCO groups and from contractors who have responsibilities for phases of the PAL effort will include, but will not be limited to, those listed in Table II. Where contractors have a part in the PAL program that could significantly affect the PAL QA effort, those contractors will be required to prepare a QA Program Plan of their own, to be approved by WADCO Quality Assurance.

4.0 MAJOR EQUIPMENT DESIGN AND QA REQUIREMENTS

The principal components of the PAL and PAL SCS are defined and described by the following documents. Major components of the PAL and PAL SCS are also listed in Table III, along with applicable quality control and verification elements for each major component. The QA "Type" classification of items in Table III is in accordance with WADCO Quality Assurance Manual, WHAN M-2, QAR-1.

- . Functional Requirements for PAL, describing the design criteria and experimental requirements.
- . Preliminary Design Description, Prototype Applications Loop, describing the conceptual design and the codes and standards to be employed. The primary purpose of this document is to provide the personnel who will be performing experiments in PAL an early opportunity to review the design, in light of the experimental requirements.
- . CPM diagram, describing the design, procurement and fabrication plans and identifying critical items, interfaces and establishing schedules.

5.0 PROGRAM DOCUMENTATION AND QUALITY RECORDS

The quality assurance functions outlined in this program plan will be performed in accordance with procedures given in the WADCO Quality Assurance Manual, WHAN M-2, and supplemental quality assurance plans and procedures developed specifically for the PAL and PAL SCS.

Records, reports, drawings, specifications, and other documents generated during the life of the project, will be filed and maintained by the design manager. Files will be made and maintained in accordance with the requirements of WHAN M-2, QAR-14, and the index shown by Table IV.

The document release and change control system shall be such that no design will be released for use on PAL or PAL SCS without approval of HEDL. All designs released through the Hanford Engineering Files will be released by HEDL. Changes to released designs will not be made without prior approval by HEDL and will be released only through a change control system that meets the requirements of WHAN M-2, QAI 2-4.

QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR THE PAL & PAL-SCS

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Legend: Level of Quality Effort

R = Required

0 = Optional

Responsibility

A = Approve

P = Perform

V = Verify

R = REVIEW

S = SUPPORT

TABLE I

PAGE I

QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR THE PAL & PAL-SCS

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Legend: Level of Quality Effort

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Responsibility

A = Approve
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P = Perform
V = Verify
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TABLE I

PAGE II

QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR THE PAL & PAL-SCS

Program Requirement		Applicability			Responsibility for Action															Implementation by Project Phases																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Program Requirements From RDT Std. F2-2T Sect. 2 thru 8		Level of Quality Effort			WADCO										Supporting Contractors					Planning	Design	Procurement	Fabrication	Installation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
					Document(s) Pertaining To This Requirement (WHAN M-2)	Project Engineer	Quality Assurance	Facilities Program Management	Procurement	Sodium Technology					Component Fab. J. A. Jones	Receiving & Insp. ARCO/FSS	Component Suppliers Installation JA JONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Legend: Level of Quality Effort

R = Required

O = Optional

Responsibility

A = Approve

P = Perform

V = Verify

R = REVIEW

S = SUPPORT

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QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR THE PAL & PAL SCS

Program Requirement		Applicability			Responsibility for Action														Implementation by Project Phases					
Program Requirements From RDT Std. F2-2T Sect.2 thru 8		Level of Quality Effort			WADCO										Supporting Contractors				Planning	Design	Procurement	Fabrication	Installation	
					Document(s) Pertaining To This Requirement (WHAN M-2)	Project Engineer	Quality Assurance	Facilities Program Management	Procurement	Sodium Technology					Component Fab. J.A. Jones	Receiving & Insp. ARHCO/FSS	Component Suppliers Installation JA JONES							
		I	II	III																				
SECTION 5 Continued (Mfg., Fab., & Ass'y.)	5.11 Corrective Action		R		QAR 12	R,A	V				P					P		P	P					
	5.12 Handling, Preservation & Shipping		R		QAR 10		V	V			A					P	S,V	P	P					
	5.13 Quality Records		R		QAR 14		P	V			P					P	P	P	P					
	5.14 Quality Audits		R		QAR 15		R		P									P	P					
SECTION 6 Construction & Installation	6.2 Organization		R		QAR 1		V	A	A		R,A								P					
	6.3 Contract Review		R		QAR 17		P	P	P		A								P					
	6.4 Construction Planning		R		QAR 17		R,A		A		R,A								P					
	6.5 Config. Control		R		QAR 17		R,A		A		P								P					
	6.6 Construction Procurement		R		QAR 4		R,A	V	S	P	S								P					
	6.7 Constr. Install. Control		R		QAR 17		P	V			P								P					
	6.8 Inspection		R		QAI 8-8			V			R,A								P					

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QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR THE PAL & PAL SCS

Program Requirement		Applicability			Responsibility for Action														Implementation by Project Phases						
Program Requirements From RDT Std. F2-2T Sect. 2 thru 8		Level of Quality Effort			WADCO										Supporting Contractors				Planning	Design	Procurement	Fabrication	Installation		
					Document(s) Pertaining To This Requirement	Project Engineer	Quality Assurance	Facilities Program Management	Procurement	Sodium Technology					Component FAB. JA Jones	Receiving & Insp. ABHCO/ESS	Component Suppliers	Installation JA JONES							
		I	II	III																					
SECTION 6 Constr. & Install.	6.9 Acceptance Testing		R		QAI 8-9	A	A			RA					P	P	P	P							
	6.10 Quality Records		R	R	QAR 14	P	P,V								P		P	P							
	6.11 Quality Audits		R	R	QAR 15		P																		
-SECTION 7																									
Operation, Maintenance Modification	NOT APPLICABLE																								
SECTION 8 Quality Assurance Audits	Audits		R	R	QAR 15		P																		

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TABLE II

SPECIFIC RESPONSIBILITIES FOR PAL AND PAL SCS TASKS

Task	Organization or Individual
Design Criteria	HEDL Sodium Technology
Facility Design and Checking	HEDL Sodium Technology & Drafting
Equipment Specifications or Design & Checking	HEDL Sodium Technology
Installation Design and Checking	HEDL Sodium Technology & Drafting
Development Performance (as required for design)	HEDL Sodium Technology
<u>Engineering Studies:</u>	
Stress Analysis	HEDL Sodium Technology
M & O Studies	HEDL Sodium Systems Operations
System Design Descriptions	HEDL Sodium Technology
Purchasing	HEDL Procurement & Material Control J.A. Jones
Supplier Qualifications	HEDL Quality Assurance
<u>Procurements:</u>	
<u>Procured Item</u>	<u>Supplier (where known)</u>
Reservoir Furnace	Electro Applications
Trace Heaters	Electro Applications (PAL) G.E. (PAL SCS)
Piping Thermocouples	Semco
Reservoir/Cold Trap TC's	Semco
Reservoir Liquid Level Probes	Tem tex
Magnetic Flow Meters	Tem tex
Trace Heater Controllers	RI Controls
Valve Operators	RI Controls (Motor) NUPRO (Pneumatic)
Data Acquisition System	Metra Instruments (PAL) Honeywell (SCS)
SCS Instrumentation	Honeywell

TABLE II
(Sheet 2 of 3)

Task	Organization or Individual
Source Inspection	HEDL Quality Assurance HEDL Sodium Technology
Receiving	ARHCO J.A. Jones (on J.A. Jones procurements)
Receiving Inspection	ARHCO HEDL Standards Laboratory (as-needed basis) J.A. Jones (on J.A. Jones procurements)
Warehousing and Material Protection & Control	ARHCO J.A. Jones HEDL Sodium Technology
Fabrication/Manufacturing	J.A. Jones
Chemical, Physical, and Spectrographic Analyses	Suppliers of Materials & Equipment
Non-destructive Testing	ARHCO J.A. Jones HEDL NDT Applications (as needed)
Inspection of Manufacturing & Fabrication	HEDL Quality Assurance
Third-Party Inspection for Code Compliance (for PAL only)	Lumberman's Mutual Ins. Co.
Construction/Installation Administration	HEDL Facilities Project Management HEDL Sodium Technology
Inspection of Construction and Installation	HEDL Quality Assurance (Primary) HEDL Facilities Project Management HEDL Sodium Technology
Acceptance Test Procedures	HEDL Project Engineer
Acceptance Test Performance	Operating Organization (with assistance from Construction Contractor and Project Engineer.)

TABLE II
(Sheet 3 of 3)

Task	Organization or Individual
Technical Review Board Members	(PAL) V. F. Fitzpatrick D. W. Bennett T. J. Owen J. D. Floyd (PAL SCS) V. F. Fitzpatrick D. H. Lester J. D. Floyd W. O. Goslin
Operating Organization	HEDL Sodium Engineering Operations
QA Audits	HEDL Quality Assurance

TABLE III
PAL-SCS QA PLAN

SHEET 1 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	COMPLETE ASSEMBLY	VALVES, Na (EXISTING)	VALVES, GAS	
DRAWING NUMBER	H-3-32220	NA	NA	
M&E NUMBER	See M & E List	See M & E List	See M & E List	
QA CATEGORY OR TYPE	II (WHAN-M-2)	II	III	
DESIGN COGNIZANCE	WADCO	NA	Supplier	
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	To be assembled on site by J.A. Jones	Existing on-site as AEC Property	See Dwgs.	
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	ANSI B31.7, Class II	ANSI B31.7, Class II	ANSI B31.1	
RDT STANDARDS	See Individual Components	NA	NA	
TRACEABILITY (MATERIAL OR PARTS)	NA	No	No	
DESIGN REVIEW LEVEL	I	I	I	
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No	No	
PROPRIETARY DESIGN OR PROCESS?	No	No	No	
SUPPLIER EVAL. REQUIRED?	NA	No	No	
SOURCE SURVEILLANCE?	NA	No	No	
TYPE OF CERTIFICATIONS REQUIRED	Conformance of con- struction with ANSI B31.7 and Dwgs.	NA	Conformance with ANSI B31.1	
SAMPLING PLAN?	NA	NA	100%	
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	Clean Na- exposed parts to RDT STD. F5-1T	Clean to RDT STD. F5-1T. Protect after cleaning.	None	
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	Welders & NDT Person- nel to RDT STD F6-1T	No	No	
CONSTRUCTION OR ASSEMBLY DOCUMENT	ANSI B31.7, CL II **	ANSI B31.7, CL II	ANSI B31.7, CL II	
IS TRAVELER REQUIRED?	Yes (include inspection)	No	No	
ATP OR TEST PLAN?	ATP	ATP	No	
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	Inspection Plan	Inspection Plan	Procedure	
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	Yes - As required by ANSI B31.7	No	No	
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	No	No	
THIRD-PARTY INSPECTION?	No	No	No	
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	
RECEIVING INSPECTION?	NA	Yes	Yes	
SUPPLIER QA PLAN REQ'D?	Contractor QA Plan	No	No	
TYPES OF NDT REQUIRED AND WHERE REQUIRED	*Per ANSI B31.7, CL II Helium Leak Test	Pressure Test and Leak Test	Pressure Test and Leak Test	
QUAL. RECORD FILE NO.				
REMARKS	<ul style="list-style-type: none"> 100% Radiograph welds, Pressure Test per B31.7, Class II. Dye penetrant weld preparation and last pass. ** Welding shall be to RDT F6-1T 			

TABLE III
PAL-SCS QA PLAN

SHEET 2 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	STAINLESS STEEL PIPING & TUBING	STAINLESS STEEL FITTINGS		
DRAWING NUMBER	NA	NA		
M&E NUMBER	See M & E List	See M & E List		
QA CATEGORY OR TYPE	II	II		
DESIGN COGNIZANCE	WADCO	WADCO		
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	Separate	Separate		
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	*Pipe ASTM A312, TP 304	*ASTM A182 and ASTM A403		
RDT STANDARDS	NA	NA		
TRACEABILITY (MATERIAL OR PARTS)	To mill heat of material	To mill heat of material		
DESIGN REVIEW LEVEL	I	I		
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No		
PROPRIETARY DESIGN OR PROCESS?	No	No		
SUPPLIER EVAL. REQUIRED?	No	No		
SOURCE SURVEILLANCE?	No	No		
TYPE OF CERTIFICATIONS REQUIRED	Conformance to material require- ments	Conformance to material require- ments		
SAMPLING PLAN?	No	No		
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	RDT STD F5-1T	RDT STD F5-1T		
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	Qualification for weld- ing into system. Qual per RDT STD F6-1T	Qualification per RDT STD F6-1T for welds in system		
CONSTRUCTION OR ASSEMBLY DOCUMENT	ANSI B31.7, CL II	ANSI B31.7, CL II		
IS TRAVELER REQUIRED?	Only on Assembly	Only on Assembly		
ATP OR TEST PLAN?	No	No		
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	Procedure	Procedure		
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	Check analysis & physi- cal properties test results from mill	Check analysis & physi- cal properties test results from mill		
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	No	No		
THIRD-PARTY INSPECTION?	No	No		
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site		
RECEIVING INSPECTION?	Yes	Yes		
SUPPLIER QA PLAN REQ'D?	No	No		
TYPES OF NDT REQUIRED AND WHERE REQUIRED	Ultrasonic Test and Dye Pen	Dye Pen per F3-6		
QUAL. RECORD FILE NO.				
REMARKS	*Tube per ASTM A213, TP 304, upgraded by Dye Pen per ANSI B31.7 and Ultrasonic Test per RDT STD F3-8	*All disconnects in SST Sodium-wetted pipe shall be Marman "Conseal" joints except tubing shall be Swagelok		

TABLE III
PAL-SCS QA PLAN

SHEET 3 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	PIPING INSULATION	ELECTRICAL	ELECTRO-MAGNETIC PUMP	FLOWMETER (SODIUM)
DRAWING NUMBER	NA	NA	NA	H-3-32221
M&E NUMBER	NA	See M & E List	See M & E List	See Dwg. H-3-32221
QA CATEGORY OR TYPE	III	III	II	II
DESIGN COGNIZANCE	WADCO	WADCO	Existing Equip.	WADCO/Supplier
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	Separate	To be assembled on-site	Existing eqpt. owned by Commission **	Separate
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	Specs in Purchase Req.	National Elect. Code - NFPA 70	NA	HWS-9021, "MSA" Type
RDT STANDARDS	M12-1, M12-2T	NA	NA	C4-5T
TRACEABILITY (MATERIAL OR PARTS)	No	No	Pump Duct to mill heat of material	On all mat'ls used to heat or batch from ma- terials supplier
DESIGN REVIEW LEVEL	I	I	I	I
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No	No	No
PROPRIETARY DESIGN OR PROCESS?	No	No	No	No
SUPPLIER EVAL. REQUIRED?	No	No	No	Yes
SOURCE SURVEILLANCE?	No	No	No	Yes
TYPE OF CERTIFICATIONS REQUIRED	Leachable Halide con- tent range, & "K" Factor *	Conformance with NEMA Stds. where applica- ble. Listed by UL or FM. Conform with dwgs	Material certs on flow tube	Compliance with HWS- 9021 & on analysis & physical tests on all materials used
SAMPLING PLAN?	See Remarks *	No	No	No
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	None - Ship in sealed moisture-proof con- tainers	None	RDT STD F5-1T	RDT STD F7-2 and Spec HWS-9021
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	No	No	No	Welders & weld pro- cedures per RDT F6-1T
CONSTRUCTION OR ASSEMBLY DOCUMENT	None	NFPA 70	ANSI B31.7, CL II for assy. into system	HWS-9021
IS TRAVELER REQUIRED?	No	No	No	No
ATP OR TEST PLAN?	No	ATP	ATP	ATP
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	None	Procedure	Receiving Inspection Procedure	Receiving Inspection Procedure
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	No	NEMA Standards or UL or FM listed parts	No	Yes - mill analysis certs. on metals. Phys. tests on non-metals.
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	No	WADCO Use Site	WADCO Use Site	WADCO Use Site
THIRD-PARTY INSPECTION?	No	No	No	No
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	WADCO Use Site
RECEIVING INSPECTION?	Yes	Yes	Yes	Yes
SUPPLIER QA PLAN REQ'D?	No	No	No	Yes
TYPES OF NOT REQUIRED AND WHERE REQUIRED	None	As required by NEMA Stds. or NFPA 70	*Leak Test and Pressure Test	Per HWS-9021
QUAL. RECORD FILE NO.				
REMARKS	*Supplier to furnish typical test results for leachable halide.		*Radiograph accessible welds in pressure- containing parts. **New pump duct of certified, dye- penetrant and ultrasonically- tested stainless steel tubing.	

TABLE III
PAL-SCS QA PLAN

SHEET 4 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	FREEZE VENT	TRACE HEATERS		
DRAWING NUMBER	H-3-32229	H-3-35155		
M&E NUMBER	See M & E List			
QA CATEGORY OR TYPE	II	III		
DESIGN COGNIZANCE	WADCO	WADCO		
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	Assembled by JA Jones on-site	Separate		
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	NA	HWS-1894		
RDT STANDARDS	RTD STD used as Design Basis	NA		
TRACEABILITY (MATERIAL OR PARTS)	Steel traceable to mill heat of material	NA		
DESIGN REVIEW LEVEL	I	I		
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No		
PROPRIETARY DESIGN OR PROCESS?	No	No		
SUPPLIER EVAL. REQUIRED?	No	No		
SOURCE SURVEILLANCE?	No	No		
TYPE OF CERTIFICATIONS REQUIRED	Certifications on analysis & physical tests of steel used	Compliance with HWS-1894		
SAMPLING PLAN?	No	See HWS-1894		
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	RDT STD F5-1T	No		
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	Welders & weld pro- cedures per RDT STD F6-1T	No		
CONSTRUCTION OR ASSEMBLY DOCUMENT	B31.7, CL II for assy. into system	NFPA 70		
IS TRAVELER REQUIRED?	Yes	No		
ATP OR TEST PLAN?	ATP	ATP		
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	Inspection Plan **	Receiving Inspection Procedure		
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	Mill analysis & physical tests on steel	No		
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site		
THIRD-PARTY INSPECTION?	No	No		
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site		
RECEIVING INSPECTION?	NA	Yes		
SUPPLIER QA PLAN REQ'D?	Contractor QA Plan	No		
TYPES OF NDT REQUIRED AND WHERE REQUIRED	*Leak Test and Pressure Test	See HWS-1894		
QUAL. RECORD FILE NO.				
REMARKS	*Radiograph welds 100% ; Dye Pen welds after Leak Test. **Part of Plan for com- pleted SCS assembly.			

TABLE III
PAL-SCS QA PLAN

SHEET 5 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	THERMOCOUPLES	INSTRUMENTS	OXYGEN METER	CARBON METER
DRAWING NUMBER	NA	NA	NA	NA
M&E NUMBER	See M & E List	See M & E List	NA	NA
QA CATEGORY OR TYPE	III	III	II	II
DESIGN COGNIZANCE	WADCO	WADCO	WADCO	WADCO
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	See Drawings	See Drawings	Assembled by JAJ	Assembled by JAJ
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	Revision to be made to HWS-1800	HWS-9071	ANSI B31.7, Class II	ANSI B31.7, Class II
RDТ STANDARDS	NA	NA	NA	NA
TRACEABILITY (MATERIAL OR PARTS)	No	NA	Na-Wetted steel traceable to mill heat of material	Na-Wetted steel traceable to mill heat of material
DESIGN REVIEW LEVEL	I	I	I	I
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No	No	No
PROPRIETARY DESIGN OR PROCESS?	No	No	No	No
SUPPLIER EVAL. REQUIRED?	No	Yes	No	No
SOURCE SURVEILLANCE?	No	Yes	No	No
TYPE OF CERTIFICATIONS REQUIRED	Certification of com- pliance with spec & with mat'l req'mnts.	Compliance with HWS-9071	Compliance with ANSI B31.7, Class II	Compliance with ANSI B31.7, Class II
SAMPLING PLAN?	No	No	No	No
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	No - Put restriction on Min Dia of coil in shipping container	HWS-9071	RDT STD F5-1T	RDT STD F5-1T
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	No	No	Welds & welders per RDT STD F6-1T	Welds & welders per RDT STD F6-1T
CONSTRUCTION OR ASSEMBLY DOCUMENT	No	No	ANSI B31.7, CL. II	ANSI B31.7, CL. II
IS TRAVELER REQUIRED?	No	No	Yes	Yes
ATP OR TEST PLAN?	ATP	ATP	ATP	ATP
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	Receiving Inspection Procedure	Receiving Inspection Procedure	Receiving Inspection Procedure	Receiving Inspection Procedure
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	Purity of insulation material	No	Mill analysis & physical reports on Na-wetted steel	Mill analysis & physical reports on Na-wetted steel
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	WADCO Use Site
THIRD-PARTY INSPECTION?	No	No	No	No
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	WADCO Use Site
RECEIVING INSPECTION?	Yes	Yes	Yes	Yes
SUPPLIER QA PLAN REQ'D?	Yes	No	Yes	Yes
TYPES OF NDT REQUIRED AND WHERE REQUIRED	*Pressure Test and Leak Test	See HWS-9071	*Pressure Test and Leak Test	*Pressure Test and Leak Test
QUAL. RECORD FILE NO.				
REMARKS	*100% radiograph of junction; sheath leak test; insu- lation res.; TC lead continuity and resistance.		*Pressure Test and 100% radiograph all pressure boundary welds; dye pen welds after pressure test.	*Pressure Test and 100% radiograph all pressure boundary welds; dye pen welds after pressure test.

TABLE III
PAL-SCS QA PLAN

SHEET 6 OF 9

SCS QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	PLUGGING METER	VACUUM DISTILLATION SAMPLER	FLOW-THRU TUBE SAMPLER	PAL SCS ENCLOSURE
DRAWING NUMBER	H-3-32321	H-3-32192	H-3-32315	*
M&E NUMBER	NA	NA	NA	NA
QA CATEGORY OR TYPE	II	II	II	III
DESIGN COGNIZANCE	WADCO	WADCO	WADCO	WADCO
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	Assembled by JAJ	Assembled by JAJ	Assembled by JAJ	Assembled by JAJ
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	ANSI B31.7, Class II	ANSI B31.7, Class II	ANSI B31.7, Class II	Steel per ASTM A36 and ASTM A108
RDT STANDARDS	NA	NA	NA	NA
TRACEABILITY (MATERIAL OR PARTS)	To mill heat of mat'l for steel pressure or stressed parts	To mill heat of mat'l for steel pressure or stressed parts	To mill heat of mat'l for steel pressure or stressed parts	NA
DESIGN REVIEW LEVEL	I	I	I	I
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	No	No	No	No
PROPRIETARY DESIGN OR PROCESS?	No	No	No	No
SUPPLIER EVAL. REQUIRED?	No	No	No	No
SOURCE SURVEILLANCE?	No	No	No	No
TYPE OF CERTIFICATIONS REQUIRED	Compliance with ANSI B31.7, Class II; also on steel physical tests and analyses	Compliance with ANSI B31.7, Class II; also on steel physical tests and analyses	Compliance with ANSI B31.7, Class II; also on steel physical tests and analyses	NA
SAMPLING PLAN?	No	No	No	No
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOCUMENT.	RDT STD F5-1T	RDT STD F5-1T	RDT STD F5-1T	NA
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	Welder and weld pro- cedures per RDT STD F6-1T	Welder and weld pro- cedures per RDT STD F6-1T	Welders and weld pro- cedures per RDT STD F6-1T	NA
CONSTRUCTION OR ASSEMBLY DOCUMENT	ANSI B31.7, CL II *	ANSI B31.7, CL II *	ANSI B31.7, CL II *	Welding per HW-4926-S
IS TRAVELER REQUIRED?	Yes	Yes	Yes	No
ATP OR TEST PLAN?	ATP	ATP	ATP	No
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	Receiving Inspection Procedure	Receiving Inspection Procedure	Receiving Inspection Procedure	Receiving Inspection Procedure
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	Mill analysis and physical test results on Na-wetted steel	Mill analysis and physical test results on Na-wetted steel	Mill analysis and physical test results on Na-wetted steel	No
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	NA
THIRD-PARTY INSPECTION?	No	No	No	No
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO Use Site	WADCO Use Site	WADCO Use Site	WADCO Use Site
RECEIVING INSPECTION?	Yes	Yes	Yes	Yes
SUPPLIER QA PLAN REQ'D?	Yes	Yes	Yes	No
TYPES OF NDT REQUIRED AND WHERE REQUIRED	*Pressure Test and Leak Test	*Pressure Test and Leak Test	*Pressure Test and Leak Test	None
QUAL. RECORD FILE NO.				
REMARKS	*Pressure Test and 100% Radiograph all pressure boundary welds; dye pen welds after pressure test	*Pressure Test and 100% Radiograph all pressure boundary welds; dye pen welds after pressure test	*Pressure Test and 100% Radiograph all pressure boundary welds; dye pen welds after pressure test	*H-3-32226 H-3-32227

TABLE III
PAL-SCS QA PLAN

SHEET 7 OF 9

PAL QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	SODIUM CIRCULATING SYSTEM			
	RESERVOIR	PIPING	VALVES	ELECTRO-MAGNETIC PUMP
DRAWING NUMBER	H-3-32156	H-3-32151	NA	H-3-32151
M&E NUMBER				
QA CATEGORY OR TYPE	II	II	II	II
DESIGN COGNIZANCE	WADCO * SSE	WADCO SSE	WADCO SSE	WADCO SSE
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	SEPARATE	SEPARATE	SEPARATE	SEPARATE
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	SECTION III, CLASS C, ASME BOILER & PRESS. VESSEL CODE (1968) & WHAN-M-13 **	ANSI B31.7, CLASS II (1968) & WHAN-M-13 *	MANUFACTURER'S STD. -- MUST BE PROVEN DESIGN THAT HAS BEEN USED IN SIMILAR SERV.	THIS PUMP IS MSA RESEARCH, STYLE VI-A
RDT DESIGN STANDARDS	E10-3T FOR VESSEL	NA	NA	NA
TRACEABILITY (MATERIAL OR PARTS)	STEEL TRACEABLE TO MILL HEAT NUMBER	STEEL TRACEABLE TO MILL HEAT NUMBER	NA	STEEL TRACEABLE TO MILL HEAT NUMBER
DESIGN REVIEW LEVEL	I	I	I	I
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	NO	NO	NO	NO
PROPRIETARY DESIGN OR PROCESS?	NO	NO	NO	NO
SUPPLIER EVAL. REQUIRED?	YES	YES	NO	NO
SOURCE SURVEILLANCE?	YES	NO	NO	YES
TYPE OF CERTIFICATIONS REQUIRED	NOTARIZED MAT'L CERTS & CERT. COPIES OF MILL CHEM. ANAL. & PHYS. TEST REPORTS	CERT. COPIES OF MILL CHEM. ANALYSIS & PHYS. TEST REPORTS	NA	FOR MATERIAL PARTS, AND PROCESSES
SAMPLING PLAN?	NO	NDT 100%	NO	NO
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	RDT F5-1T	RDT F5-1T	RDT F5-1T	SEC. IX OF RDT STD. F2-4; RDT STD. F7-2
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T	NDT PERSONNEL PER ANSI B31.7, CL. II	NO	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T *
CONSTRUCTION OR ASSEMBLY DOCUMENT	SEE DESIGN CODES	SEE DESIGN CODES	ASSEMBLY INTO SYST PER ANSI B31.7, CL. II *	ASSEMBLY INTO SYST PER ANSI B31.7, CL. II
IS TRAVELER REQUIRED?	YES	WHEN PUT INTO SYSTEM	WHEN PUT INTO SYSTEM	NO
ATP OR TEST PLAN?	***	***	**	**
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	***	***	**	**
CONTROLS ON CONTRACTOR- PROCURED MAT'L'S OR PARTS?	MUST HAVE MILL CHEM. ANALYSIS & PHYS. TEST REPORTS ON MAT'L	MUST HAVE MILL CHEM. ANALYSIS & PHYS. TEST REPORTS ON RAW MAT'L	SST BODY MUST BE TYPE 304 WITH 4% MIN. CARBON	YES - QUALITY & TRACE- ABILITY ON PROCURED MATERIAL & PARTS
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	NO	NO	WADCO USE SITE	WADCO USE SITE
THIRD-PARTY INSPECTION?	YES	NO	NO	NO
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	WADCO USE SITE
RECEIVING INSPECTION?				
SUPPLIER QA PLAN REQ'D?	YES	NO	NO	YES
TYPES OF NDT REQUIRED AND WHERE REQUIRED	SEE DWG. H-3-32157	SEE PAL DRAWINGS	SEE PAL DRAWINGS	SEE HWS-8562
QUAL. RECORD FILE NO.				
REMARKS	* SODIUM SYSTEMS ENGINEERING (SODIUM TECHNOLOGY) ** RESERVOIR TO BE CODE STAMPED *** SEE DRAWING H-3-32174	* PIPE MAT'L PER ASTM A376 INSPECTED TO RDT F3-8T, LEVEL S-2. FITTINGS TO ASTM A403, INSPECTED TO RDT STD. F3-6T ** WELDERS & WELD PROCEDURES TO BE QUALIFIED PER RDT STD. F6-1T *** SEE DRAWING H-3-32174	* EXCEPT WELDING SHALL BE PER RDT STD. F6-1T ** SEE DRAWING H-3-32174	* NDT PERSONNEL PER RDT STD. F6-1T ** SEE DRAWING H-3-32175

TABLE III
PAL-SCS QA PLAN

SHEET 8 OF 9

PAL QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION			
	SODIUM CIRCULATING SYSTEM (Cont.)	NaK COOLANT SYSTEM		
	FLOWMETERS (3)	ELECTRO-MAGNETIC * PUMP	COLD TRAP	EXPANSION TANK
DRAWING NUMBER	TEMTEX	H-3-32180	H-3-32154	H-3-32170
M&E NUMBER				
QA CATEGORY OR TYPE	II	II	II	II
DESIGN COGNIZANCE	WADCO - SSE	WADCO - SSE	WADCO - SSE	WADCO - SSE
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	SEPARATE	SEPARATE	SEPARATE	SEPARATE
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	HWS-9102, APPENDIX "D" ANSI B31.7, CLASS II ASTM A376 FOR FLOW TUBE MATERIAL *	DWG. H-3-32180; ANSI B31.7, CLASS II	DWG. H-3-32154 ASME SECT. III, CLASS "C" (CODE STAMP)	DWG. H-3-32170 ASME SECT. III, CLASS "C" (NO CODE STAMP)
RDT DESIGN STANDARDS	RDT C4-5T	NA	RDT STD. E10-3T	NA
TRACEABILITY (MATERIAL OR PARTS)	STEEL IN FLOW TUBE TRACEABLE TO MILL HEAT NUMBER	STEEL TRACEABLE TO MILL HEAT NUMBER: NICKEL TRACE TO MILL	SODIUM - WETTED STEEL TRACEABLE TO MILL HEAT NUMBER	SODIUM-WETTED STEEL TRACEABLE TO MILL HEAT NUMBER
DESIGN REVIEW LEVEL	I	I	I	I
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	NO	NO	NO	NO
PROPRIETARY DESIGN OR PROCESS?	NO	NO	NO	NO
SUPPLIER EVAL. REQUIRED?	YES	YES	YES	NO
SOURCE SURVEILLANCE?	YES	YES	YES	NO
TYPE OF CERTIFICATIONS REQUIRED	COMPLIANCE WITH HWS- 9102 & ON ANALYSIS & PHYSICAL TESTS ON ALL MATERIALS USED	CERTS ON STEEL CHEM. ANALYSIS & PHYS. TEST REPORTS. ALSO ON FITTINGS IN TUBE.	CERTS ON STEEL CHEM. ANALYS. & PHYS. TESTS ANALYS. & PHYS. TEST RESULTS ON ALL MAT'L USED.	CERTS ON STEEL CHEM. ANALYSIS & PHYS. TESTS
SAMPLING PLAN?	NO	NO	NO	NO
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC'MNT.	RDT STD. F-7-2 & HWS-9102	RDT STD. F5-1T & RDT STD. F7-2	RDT STD. F5-1T & RDT STD. F7-2	RDT STD. F5-1T & RDT STD. F7-2
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T
CONSTRUCTION OR ASSEMBLY DOCUMENT	HWS-9102	DWG. H-3-32180 & ANSI B31.7, CL. II	DWG. H-3-32154	DWG. H-3-32170
IS TRAVELER REQUIRED?	YES	NO	YES	YES
ATP OR TEST PLAN?	ATP	ATP ON ASSEMBLED PUMP	ATP	NO
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	RECEIVING INSPECTION PROCEDURE	RECEIVING INSPECTION PROCEDURE	INSPECTION PLAN & REC. INSP. PROCEDURE	RECEIVING INSPECTION PROCEDURE
CONTROLS ON CONTRACTOR- PROCURED MAT'LS OR PARTS?	MILL ANALYSES & PHYS. TESTS ON TUBE METALS: PHYS. TESTS ON OTHERS	MILL ANALYSES & PHYS. TESTS ON STEEL FROM MILL	MILL ANALYSES & PHYS. TESTS ON STEEL FROM MILL *	MILL ANALYSES & PHYS. TEST RESULTS ON STEEL FROM MILL
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO USE SITE	DEMONSTRATION OF ASSEMBLED UNIT AT WADCO USE SITE	WADCO USE SITE	WADCO USE SITE
THIRD-PARTY INSPECTION?	NO	NO	YES	NO
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	WADCO USE SITE
RECEIVING INSPECTION?	YES	YES	NO	NO
SUPPLIER QA PLAN REQ'D?	YES	YES	YES	YES
TYPES OF NDT REQUIRED AND WHERE REQUIRED	* DYE PEN ATTACHMENT WELDS PER RDT STD F3-6	SEE DWG. H-3-32180	SEE DWG. H-3-32154	SEE DWG. H-3-32170
QUAL. RECORD FILE NO.				
REMARKS	* ULTRASONIC INSPECTION OF FLOW TUBE TO RDT STD. F3-8, LEVEL S-2.	* SUPPLIER TO FABRI- CATE FLOW TUBE, ASSEMBLE PUMP FROM EXISTING PARTS SUPPLIED BY AEC, & DEMONSTRATE PUMP PERFORMANCE.	* MUST HAVE CHEM. ANALYSIS ON ALL SODIUM-WETTED MATERIALS & PHYS. & CHEM. CHARACTER- ISTICS ALL OTHER MATERIALS.	

TABLE III
PAL-SCS QA PLAN

SHEET 9 OF 9

PAL QA ACTION OR INFORMATION REQUIRED	ITEM DESCRIPTION		
	NaK COOLANT SYSTEM (Cont.)		PIPING INSULATION, ELECTRICAL, THERMOCOUPLES, AND INSTRUMENTS SAME AS FOR PAL SCS
	NaK COOLER	FLOWMETER	
DRAWING NUMBER	H-3-32169	TEMTEX	
M&E NUMBER			
QA CATEGORY OR TYPE	II	II	
DESIGN COGNIZANCE	WADCO - SSE	TEMTEX	
SEPARATE PROCUREMENT ITEM OR PART OF PACKAGE?	SEPARATE	SEPARATE	
DESIGN OR PROCUREMENT CODES, STANDARDS, OR SPECIFICATIONS	ANSI B31.7 FOR NaK - EXPOSED PARTS	HWS-9102, APPENDIX "D", ANSI B31.7, CL. II; ASTM A376 FOR FLOW TUBE MATERIAL *	
RDT DESIGN STANDARDS	NA	RDT C4-5T	
TRACEABILITY (MATERIAL OR PARTS)	ALL STAINLESS STEEL TRACEABLE TO MILL HEAT	STEEL IN FLOW TUBE TRACEABLE TO MILL HEAT NUMBER	
DESIGN REVIEW LEVEL	I	I	
IS PROTOTYPE OR DEVELOP- MENTAL MODEL REQUIRED?	NO	NO	
PROPRIETARY DESIGN OR PROCESS?	NO	NO	
SUPPLIER EVAL. REQUIRED?	YES	YES	
SOURCE SURVEILLANCE?	YES	YES	
TYPE OF CERTIFICATIONS REQUIRED	CERTS ON CHEM. ANALYS. & PHYS. TESTS ON STEEL; ALSO COMPLIANCE WITH DWG.	COMPLIANCE WITH HWS- 9102 & ON ANALYSIS & PHYSICAL TESTS ON ALL MATERIALS USED.	
SAMPLING PLAN?	NO	NO	
HANDLING, SHIPPING, CLEAN- ING DOC. IF OTHER THAN REF. PROCUREMENT DOC/MNT.	RDT STD. F5-1T RDT STD. F7-2	RDT STD. F7-2 & HWS-9102	
PROCESS OR PERSONNEL QUALIFICATION REQUIRED?	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T.	WELDERS & WELD PROCEDURES PER RDT STD. F6-1T.	
CONSTRUCTION OR ASSEMBLY DOCUMENT	ANSI B31.7, CL. II; DWG. H-3-32169	HWS-9102	
IS TRAVELER REQUIRED?	YES	YES	
ATP OR TEST PLAN?	ATP	ATP	
WADCO INSPECTION PLAN OR PROCEDURE OR BOTH	RECEIVING INSPECTION PROCEDURE	RECEIVING INSPECTION PROCEDURE	
CONTROLS ON CONTRACTOR- PROCURED MAT'L'S OR PARTS?	MUST HAVE COPIES OF MILL CHEM. ANALS. & PHYS. TESTS ON SST	MILL ANALYSIS & PHYS. TEST REPORTS ON TUBE STEEL. *	
PERFORM. DEMONSTRATION? SUPPLIER'S SITE WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	
THIRD-PARTY INSPECTION?	NO	NO	
POINT OF ACCEPTANCE SUPPLIER'S SITE WADCO USE SITE	WADCO USE SITE	WADCO USE SITE	
RECEIVING INSPECTION?	YES	YES	
SUPPLIER QA PLAN REQ'D?	YES	YES	
TYPES OF NDT REQUIRED AND WHERE REQUIRED	SEE DWG. H-3-32169	DYE PEN ATTACHMENT WELDS PER RDT F3-6 **	
QUAL. RECORD FILE NO.			
REMARKS		* PHYSICAL TEST REPORTS ON OTHER MATERIALS ** ULTRASONIC INSPECTION OF FLOW TUBE TO RDT STD. F3-8, LEVEL S-2.	

TABLE IV
QUALITY RECORDS PLAN/INDEX FOR
PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

PAGE 1 OF 10

DATE 11/23/71

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
1.	ADMINISTRATION								
1.1	See PAL-SDD		N/A		APB	X			
1.3	Description								
1.3.4	QAPP - See PAL				APB	X			
1.5	See FRTEF - PERT & SPACS - SCS Schedule	SK-		JP Kelly P Corbett ME Schockley DW Bennett	APB	X			
1.8	Correspondence				APB				
1.8.1	From Requester				APB	X			
1.8.2.1	J. A. Jones			DL Short	APB	X			
1.8.3	Prog. Mgt. (from Na Tech)			DHL, VFF	APB, VFF	X			
1.9	Status Reports								
2.	DESIGN & DEVELOPMENT								
2.1	Design Planning								
2.1.2	Dwg. List	H-3-32220		DHL	APB			X	Central Vault
2.1.3	DR Board Member List	N/A		DHL	APB	X			
2.1.5	List of Major Components			DHL, APB	APB				See QAPP
2.1.6	EROs/Print Control Log			DHL	APB	X			
2.2	Distribution Loop								
2.2.2	Dwgs. & Specs	H-3-32220*		DHL	APB	X		X	Central Vault
2.2.3	Design Calculations			DHL	APB	X			
2.2.4	Design Review Reports			DHL	APB	X			
2.2.4.1	Liquid Metal Data Sheet			DHL	APB	X			
2.2.5.1	Stress Analysis			DHL	APB	X			
2.3	Process Instrumentation								
2.3.2	Dwgs. & Specs.	H-3-32325*		VP Kelly JA Yount DHL	G. Mettler APB	X			

RHA = AEC Records Holding Area

O/M = To be turned over to Operations and/or Maintenance

Refer. = Reference location of documents

* Indicate location per 14-1-1 or alternate

* EFD of P&ID

QF 14-1-2

DHL - DH Lester
APB - AP Bohringer
VFF - VF FitzPatrick

RHA Box #s _____

QPM Signature _____

PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

DATE 11/23/71

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
2.3.4 2.3.5.2 2.3.5.3 2.3.8	Design Review Reports Failure Studies O&M Studies Development Test Results			G. Meadows NaTech Personnel Responsible Mgt.	NaTech Personnel	X			General NaTech Activity Dept. Wide SA&T Incident Report File
2.3.9	Failure Reports	F, I&MR (A-7310-042.1)						X	
2.4	Carbon Meter Module (ANL)								
2.4.1 2.4.2 2.4.3 2.4.4	Design Description Dwgs. & Specifications Design Calculations Design Review Reports	H-3-32333*		L. Burris (ANL) K. Sowa (HEDL)	APB APB	X		X	See PAL-SDD CVI File ANL Function
2.4.5.2 2.4.5.3	Failure Mode O&M			K. Sowa					
2.4.9	Failure Reports	I, M&FR (A-7310-042.1)		G. Meadows		X			
2.5	O ₂ /H ₂ Meter Module (ANL)								See PAL-SDD
2.5.1	Design Description								
2.5.2	Dwgs. & Specifications	H-3-32328*							
2.5.3	Design Calculations								
2.5.5.2 2.5.5.3	Failure Mode O&M			See Carbon Meter					
2.5.9	Failure Reports	See 2.4.9							
2.6	Plugging & Temperature Indicator (WADCO) (520)								
2.6.1 2.6.2	Design Description Dwgs. & Specifications	H-3-32350*		G. Bloom JA Yount JA Yount	APB APB	X X			
2.6.3	Design Calculations								

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* Indicate location per 14-1-1
or alternate

* EFD (Engineering Flow Diagram) or P&ID (Piping & Instrument Diagram)

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RHA Box #s _____

QPM Signature _____

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PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
2.6.4	Design Review Reports	H-3-32337		JA Yount	APB	X			See PAL-SDD
2.6.5.1	Stress Analysis			JA Yount	APB	X			
2.6.9	Failure								
2.7	Vacuum Distillation								
	Sampler (WADCO) (560)								
2.7.1	Design Description			DW Bennett	APB	X			
2.7.2	Dwgs. & Specifications			DW Bennett	APB	X			
2.7.3	Design Calculations			DW Bennett	APB	X			
2.7.4	Design Review Reports			DW Bennett	APB	X			
2.7.5.1	Stress Analysis								
2.7.9	Failure Reports	See 2.4.9							See PAL-SDD
2.8	Flow-Through Tube Sampler (WADCO) (570)								
2.8.1	Design Description				APB				
2.8.2	Dwgs. & Specifications			JA Yount	APB	X			
2.8.3	Design Calculations			JA Yount	APB	X			
2.8.4	Design Review Reports			JA Yount	APB	X			
2.8.5.1	Stress Analysis			JA Yount	APB	X			
2.8.9	Failure Reports								
3.	PROCUREMENT								
3.1	Procurement Planning								
3.1.1	Procurement Schedule								
3.1.2	List of Items/Services to be Procured			DHL	APB	X			
				Jones Personnel					
3.2	Matl. for Distribution Loop (WADCO) (Jones)			APB	APB	X			
				DL Scott (JAJ)					
3.2.1	P.R. & P.O.			APB	APB	X			
				DHL					

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O/M = To be turned over to Operations and/or Maintenance

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RHA Box #s _____

QPM Signature _____

PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

DATE 11/23/71

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
3.2.2	Dwgs. & Specifications			Vendor	APB			X	CVI File
3.2.3	Supplier Eval. Data & Bid Reviews			Q.S. DHL	APB (Bid Reviews)	X			
3.2.5	Inspection, Test & Analysis Plans (IT&APs) Inspection & Test Instructions (ITIs)			DHL APB	APB	X			
3.2.6	Inspection Reports								
3.2.6.2	Receiving							X	Copy in QS Supplier History File
3.2.6.5	Analytical Lab - Overcheck			DHL APB	APB	X			
3.2.7	Certifications							X	Copy by Heat # in QS File
3.2.7.1	Material Certification								
3.2.10	Disposition Documents			QS	APB	X		X	QS Supplier History File
3.3	Loop (Process)								
	Instrumentation (Jones)								
3.3.1	P.R./P.O.			VP Kelly/JAJ	APB	X			
3.3.2	Dwgs. & Specifications			WADCO/VITRO	APB			X	CVI File
3.3.3	Supplier Eval. Data			QS					
3.3.5	IT&A Plan & ITIs				APB	X			
3.3.6	Inspection Reports								
3.3.6.2	Receiving Reports (Including Stds. Lab Checkout)			ARHCO JA Jones	APB	X			
3.3.10	Disposition Documents			QS	APB				
3.4	Carbon Meter Materials (WADCO/Jones)								
3.4.1	P.O./P.R.			APB JL Gibson	APB	X			

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RHA Box #s _____

QPM Signature _____

QF 14-1-2

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PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

DATE 11/23/71

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
3.4.2	Dwgs. & Specifications			Vendors	APB			X	CVI File
3.4.3	Supplier Eval. Data			QS					
3.4.5	IT&A Plan & ITIs			K Sowa	APB	X			
3.4.6	Inspection Reports								
3.4.6.2	Receiving Reports			ARHCO	APB	X			
3.4.10	Disposition Documents			JA Jones					CVI
3.5	O ₂ H ₂ Meter Materials (WADCO/Jones)			QS	APB	X			
3.5.1	P.R./P.O.			APB					
				JL Gibson					
3.5.2	Dwgs. & Specifications								
3.5.3	Supplier Eval. Data							X	
3.5.5	IT&A Plan & ITIs			See 3.4					
3.5.6	Inspection Reports								
3.5.6.2	Receiving Reports								
3.5.10	Disposition Documents								
3.6	Plugging & Temperature Indicator Material								
3.6.1	P.R./P.O.								
3.6.2	Dwgs. & Specifications								
3.6.3	Supplier Eval. Data								
3.6.5	IT&A Plan & ITIs			See 3.4					
3.6.6	Inspection Reports								
3.6.1.2	Receiving Reports								
3.6.10	Disposition Documents								
3.7	Vacuum Distillation Sampler Matl.								
3.7.1	P.R./P.O.								
3.7.2	Dwgs. & Specifications								

RHA = AEC Records Holding Area

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* Indicate location per 14-1-1 or alternate

RHA Box #s _____

QPM Signature _____

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PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
3.7.3	Supplier Eval. Data			See 3.4					
3.7.5	IT&A Plan & ITIs								
3.7.6	Inspection Reports								
3.7.10	Receiving Reports								
3.8	Flow Through Sampler								
3.8.1	P.R./P.O.			See 3.4					
3.8.2	Dwgs. & Specifications								
3.8.3	Supplier Eval. Data			See 3.4					
3.8.5	IT&A Plan & ITIs								
3.8.6	Inspection Reports								
3.8.6.2	Receiving Reports								
3.8.10	Disposition Documents								
3.19	Certified Vendor Information								See Individual Items
3.19.3	Process Instrumentation								
3.19.3.1	O&M Manuals			Honeywell	APB		X	X	CVI File
3.19.3.2	Spare Parts List			Honeywell	APB		X	X	
3.19.3.3	As-Built Dwgs.			Honeywell	APB		X	X	
3.19.3.5	Circuit Diagrams			Honeywell	APB		X	X	
3.20	Archive Data								
3.20.2	Distribution Loop			DHL	APB	X			
3.20.4	C ₂ Meter			DHL	APB	X			
3.20.5	O ₂ /H ₂ Meter			DHL	APB	X			
3.20.6	Plugging Meter			DHL	APB	X			
3.20.7	Vacuum Sampler			DHL	APB	X			
3.20.8	Flow Through Sampler			DHL	APB	X			
+	FABRICATION/A								
+	FABRICATION/ASSEMBLY								
4.1	F&A Planning			JA Jones	Jones QC				
4.1.1	Schedule			JA Jones	Jones QC				
4.1.2	List of Items to be Fabricated & Assembled			JA Jones	Jones QC				

RHA = AEC Records Holding Area

O/M = To be turned over to Operations and/or Maintenance

Refer. = Reference location of document

* Indicate location per 14-1-1 or alternate

RHA Box #s _____

QPM Signature _____

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PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
4.1.4	IT&A Plan	WL-0263		HB Sargent	HB Sargent	X			Dwg. Vault
4.2	Distribution Loop (Jones)								
4.2.1	Work Authorization								
4.2.2	Dwgs. & Specifications								
4.2.3	Travelers & IT&A Plan								
4.2.4	ITIs & Reports								
4.2.5	Weld & Material Maps								
4.2.6	NDT Reports & Originals								
4.2.8	Qualifications								
4.2.8.1	Personnel - See 4.2.3								
4.2.8.2	Procedures								
4.2.10	Disposition Documents					X			
4.4	C ₂ Meter Module (Jones)	WL-		See 4.2	APB				
4.4.1	Work Authorization								
4.4.2	Dwgs. & Specifications								
4.4.3	Travelers & IT&A Plan								
4.4.4	ITIs & Reports								
4.4.5	Weld & Material Maps								
4.4.6	NDT Reports & Originals								
4.4.8	Qualifications								
4.4.8.1	Personnel - See 4.4.3								
4.4.8.2	Procedures								
4.4.10	Disposition Documents					X			
4.5	O ₂ H ₂ Meter Module (Jones)								
4.5.1	Work Authorization								
4.5.2	Dwgs. & Specifications								
4.5.3	Travelers & IT&A Plan								
4.5.4	ITIs & Reports								
4.5.6	Weld & Material Maps								
4.5.8	NDT Reports & Originals								
	Qualifications								

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FILE LOCATION*	RECORD/DOCUMENT	FORM/ DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
4.5.10	Disposition Documents	WL-		See 4.2					
4.5	O ₂ /H ₂ Meter Module (Jones)								
4.5.1	Work Authorization								
4.5.2	Dwgs. & Specifications								
4.5.3	Travelers & IT&A Plan								
4.5.4	ITIs & Reports								
4.5.5	Weld & Material Maps								
4.5.6	NDT Reports & Originals								
4.5.8	Qualifications								
4.5.8.1	Personnel								
4.5.8.2	Procedures	WL-		See 4.2					
4.5.10									
4.6	Plugging Meters (Jones)								
4.6.1	Work Authorization								
4.6.2	Dwgs. & Specifications								
4.6.3	Travelers & IT&A Plan								
4.6.4	ITIs & Reports								
4.6.5	Weld & Material Maps								
4.6.6	NDT Reports & Originals								
4.6.8	Qualifications								
4.6.8.1	Personnel - See 4.6.3	WL-		See 4.2					
4.6.8.2	Procedures								
4.6.10	Disposition Documents								
4.7	Vacuum Distillation Sampler (Jones)								
4.7.1	Work Authorization								
4.7.2	Dwgs. & Specifications								
4.7.3	Travelers & IT&A Plan								
4.7.4	ITIs & Reports								
4.7.5	Weld & Material Maps								

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FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
4.7.6	NDT Reports & Originals	WL-		See 4.2					
4.7.8	Qualifications								
4.7.8.1	Personnel - See 4.7.3								
4.7.8.2	Procedures								
4.7.10	Disposition Documents								
4.8	Flow Through Tube Sampler (Jones)								
4.8.1	Work Authorization								
4.8.2	Dwgs. & Specifications								
4.8.3	Travelers & IT&A Plan								
4.8.4	ITIs & Reports								
4.8.5	Weld & Material Maps								
4.8.6	NDT Reports & Originals								
4.8.8	Qualifications								
4.8.8.1	Personnel - See 4.8.3								
4.8.8.2	Procedures								
4.8.10	Disposition Documents								
4.19	Certified Vendor Information			DHL Honeywell Honeywell Honeywell Honeywell JA Yount	APB APB APB APB APB APB APB APB APB APB				CVI
4.19.2	Distribution Loop								
4.19.2.3	As-Built Dwgs								
4.19.3.1	Spare Parts List								
4.19.3.2	O&M Manuals								
4.19.3.3	As-Built Dwgs.								
4.19.3.5	Circuit Diagrams								
4.19.4	Carbon Meter								
4.19.4.2	O&M Manuals								
4.19.4.3	As-Built Dwgs.								
4.19.4.5	Circuit Diagrams								
4.19.5	O ₂ /H ₂ Meter Module			See 4.19	APB APB				CVI
4.19.5.2	O&M Manuals								

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QPM Signature _____

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PROTOTYPE APPLICATIONS LOOP - SODIUM CHARACTERIZATION SYSTEM (XII-1-7)

DATE 11/23/71

FILE LOCATION*	RECORD/DOCUMENT	FORM/DOCUMENT #	NEED DATE	INITIATOR	PROJECT COPY FILED BY (NAME)	FINAL DISPOSITION			REMARKS
						RHA	O/M	REF.	
4.19.5.3	As-Built Dwgs.				APB		X	X	CVI
4.19.5	Circuit Diagrams				APB		X	X	CVI
4.19.6	Plugging Indicator				APB		X	X	CVI
4.19.6.2	O&M Manuals				APB		X	X	CVI
4.19.6.3	As-Builts				APB		X	X	CVI
4.19.6.5	Circuit Diagrams				APB		X	X	CVI
4.19.7	Vacuum Distillation Sampler (WADCO)				APB		X	X	CVI
4.19.7.2	O&M Manuals			See 4.19	APB		X	X	CVI
4.19.7.3	As-Builts				APB		X	X	CVI
4.19.7.5	Circuit Diagrams				APB		X	X	CVI
4.19.8	Flow Through Sampler				APB		X	X	CVI
4.19.8.2	O&M Manuals				APB		X	X	CVI
4.19.8.3	As-Built Drawings				APB		X	X	CVI
4.19.8.5	Circuit Diagrams				APB		X	X	CVI
5.	CONSTRUCTION & INSTALLATION (This is included in 4. as part of Fabrication & Assembly)				APB		X	X	CVI

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and/or Maintenance

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or alternate

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QF 14-1-2

14. Turn on the following circuit breakers in Panel C, one at a time and using a 120 VAC meter check that the circuits are energized.

CircuitTrace Heater Circuits

1.	1 & 3
2	25, 26 & 27
3	2
4	28, 29, 30
5	4, 5
6	31
7	6, 7
8	32
9	8, 9
10	cover gas control panel
11	10, 11
12	cover gas control panel
13	12, 13
14	spare
15	14, 15
16	spare
17	16, 17, 18
18	spare
19	19, 20, 21
20	spare
21	22, 23, 24
22	

15. Turn off K-1 contactor by depressing the Loop Power "Off" switch.
16. Check the two emergency shut down stations (one at the landing of each stairway) by depressing the loop power switch, then depressing each shut down switch.

By

Date

11-15-71

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #2

Trace Heater Resistances

The object of this procedure is to record the trace heater resistances and to clarify the system is not shorted to ground prior to turning on the system.

Procedure

1. Disconnect the heater leads on terminal No. 1 on each of the trace heater controllers and measure and record the resistances.

<u>Heater #</u>	<u>Loop Resistance</u>	<u>Resistance to Ground</u>
	022.3	None
1	124.5	None
2	037.9	None
3	023.7	None
4	026.6	None
5	018.1	None
6	026.2	None
7	066.1	None
8	044.5	None
9	038.0	None
10	032.4	None
11	020.2	None
12	181.1	None
13	155.6	None
14	026.2	None
15	066.3	None
16	055.8	None
17	064.5	None
18	033.6	None
19	028.2	None
20	024.1	None
21	179.4	None
22	053.5	None
23	180.1	None
24	033.8	None
25	028.9	None
26	181.5	None
27	025.7	None
28	181.8	None
29	039.3	None
30	030.8	None
31	012.5	None
X	014.4	None
Y	010.2	None
Z	008.8	None
Base	027.5	None
33	023.6	None
34	024.0	None

2. Reconnect the leads to each individual trace heater controller.

By *H. J. Ritchard* *T.S.O.*

Date *11/12/71* *11-12-71*

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #3

Thermocouple Resistances

The purpose of this procedure is to document the thermocouple resistances for future maintenance and to verify the wiring as per design.

Procedure

1. Disconnect the thermocouples from the controllers and recorders and using a simpson 269 or equal record the following resistances on each of the thermocouples:

<u>TC No.</u>		<u>Loop Resistance</u>	<u>Ground Resistance</u>
TC-1	KR x 1 ↓	053.8	None
TDR-1		048.9	None
TC-2		053.2	None
TDR-2		050.1	None
TC-3		063.9	None
TC-4A		061.9	None
TDR-3		055.6	None
TC-4B		053.5	None
TC-5A		059.0	None
TDR-4		052.8	None
TC-5B		050.2	None
TDR-5		045.7	None
TC-6		053.0	None
TC-7A		021.0	None
TDR-6		050.8	None
TC-7B		048.3	None
TC-8A		047.4	None
TDR-7		045.3	None
TC-8B		048.8	None
TC-9A		019.2	None
TDR-8		040.5	None
TC-9B		046.7	None
TDR-9		044.8	None
TC-10		024.5	None
TC-11A		060.3	None
TDR-10		064.2	None
TC-11B		050.6	None
TC-12A		050.8	None
TDR-11		060.5	None
TC-12B		051.1	None
TDR-12		060.1	None
TC-13		021.0	None

Thermocouple Resistances Continued

TC No.		Loop Resistance	Ground Resistance
TC-14A	KR x 1	021.1	None
TDR-13		054.8	None
TC-14B		055.9	None
TC-15A		056.0	None
TDR-14		067.7	None
TC-15B		064.3	None
TDR-15		055.0	None
TC-16		061.5	None
TDR-16		055.5	None
TC-17		046.2	None
TC-18A		047.0	None
TDR-17		047.3	None
TC-18B		014.9	None
TC-19A		038.4	None
TDR-18		035.9	None
TC-19B		037.2	None
TDR-19		038.1	None
TC-20		033.0	None
TC-21A		032.7	None
TDR-20		046.5	None
TC-21B		028.5	None
TDR-21		043.2	None
TC-22		031.8	None
TC-23A		032.3	None
TDR-22		040.4	None
TC-23B		032.4	None
TDR-23		042.7	None
TC-24		014.5	None
TC-25A		035.5	None
TDR-24		045.2	None
TC-25B		035.6	None
TC-26A		035.5	None
TDR-25		050.2	None
TC-26B		039.7	None
TDR-26		051.8	None
TC-27		037.2	None
TC-28A		038.2	None
TDR-27		051.3	None
TC-28B		039.7	None
TDR-28		051.8	None
TC-29		033.0	None
TDR-29		044.9	None
TC-30A		033.0	None
TDR-30		040.3	None
TC-30B		038.8	None
TDR-31		038.3	None
TC-31		038.5	None

Thermocouple Resistances Continued

3

<u>TC No.</u>	<u>Loop Resistance</u>	<u>Ground Resistance</u>
TC-32	035.4	None
TDR-32	044.4	None
TDR-33	050.3	None
TDR-37	047.9	None
TDR-41	055.8	None
TDR-42	045.5	None
TDR-43	049.7	None
RTC-1	066.6	None
RTC-2 Pos. #36	061.5	None
CTTC-1	055.9	None
Cold Trap Spare #1Pos. #34	046.3	None
Cold Trap Spare #2Pos. #35	045.4	None

2. Reconnect the thermocouple leads to their respective recorders and controllers.

By *H. G. Pritchard* *T.D.* *O*
 Date *11/16/71* *11-16-71*

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #4

Metrascope & Alarm System

The object of this procedure is to document that the recording and alarm system is as shown on Print #H-3-32162, Sheet #2.

Procedure

1. Check that the power is on to the loop's transformer. Mcc 1 compartment A-4.
2. Check that all trace heater controllers are off.
3. Turn on metrascope & printers. Turn print mode to alarm.
4. Turn on loop power by depressing loop power on button located on the control panel.
5. Turn on trace heater power by depressing trace heater "on" button located on the control panel.

(Note) Any of the first 31 channels high alarm will deenergize the trace heater circuits and will light channel 19 on the alarm panel as well as ring a bell.
6. Start with channel TDR-1 on the metrascope. Lower the alarm set below the displayed bar graph. This should set the alarm system in to operation. Channel 19 should light up a bell should ring, the printer will print out until reset and the channel in alarm should print either high or low in red in addition the trace heater circuit will kick out.
7. Reset the alarm on TDR-1.
8. Restart the trace heater circuit.
9. Repeat steps 6 through 8 for the first 31 channels.
10. Shut off the trace heater power.
11. Set TDR-32 high alarm to a point below the displayed bar graph. Channel 15 on the alarm panel should light and the printer should print out in red, high.
12. Reset TDR-32 high alarm.

13. Repeat steps 11 and 12 on channel TDR-33. Channel 16 on the alarm panel should light. Also #1 EM pump circuit should be de-energized.
14. Reset TDR 33 alarm..
15. Channels 34, 35, 36 are spares and do not have alarms.
16. Repeat steps 11, 12 on channel 37 - should light channel 20 on alarm panel.
17. Reset TDR-37.
18. Channels 38, 39, 40 are spares and no alarms are provided.
19. Repeat steps 11, 12 on channels 41, 42. Alarms on channel 17 for 41 and 18 for channel 42 should light.
20. Reset TDR 41, 42 alarms.
21. Repeat steps 11, 12 for channel 43. Alarm channel #2 should light.
22. Reset TDR-43.
23. A 10 - 50 milliamp power source will have to be provided for channels 44, 45.
24. Using the 10 - 50 ma power supply add enough power to bring the display bar to approximately mid-scale on channels 44.
25. Set the high alarm indicator below the display bar. Channel 5 on the alarm panel should light.
26. Reset channel 44 alarm.
27. Set the low alarm indicator above the bar display on channel 44. Channel 6 on the alarm system should light up.
28. Reset channel 44 alarm.
29. Disconnect the power supply from channel 44 and reconnect the sensor leads.
30. Disconnect the leads on the metroscope from channel 45 and connect up the power supply used on channel 44.
31. Set channel 45 bar graph approximately mid-scale.
32. Lower the high alarm indicator below the displayed bar graph, channel 23 on the alarm panel should light.
33. Reset channel 45 alarm.

34. Disconnect the power supply leads and reconnect the sensor leads.
- X35. Lower the alarm set point indicator on channel 46 to a point below the bar graph, channel #3 on the alarm panel should light up.
36. Reset channel 46 high alarm
37. The low liquid level alarm will be checked out with the EM pump #1 ATP.
38. Channel 50 on the metrascope has no alarms.
39. Disconnect the input leads from channel 47 on the metrascope and connect up a 0-25 mv D.C. power supply.
40. Crank in sufficient millivolts to bring the bar chart to ~ 50% of chart.
41. Set the channel 47 high alarm indicator below the bar display. Channel 7 on the loop alarm panel should light.
42. Reset channel 47 high alarm.
43. Raise channel 48 low alarm above the display bar. Channel 8 on the loops alarm should light.
44. Reset channel 48 low alarm.
45. Disconnect the power supply, reconnect the sensor leads to channel 48.
46. Repeat steps 39 through 45 for channel 49
47. Turn off power to metrascope and printer.

By T. J. O'S M VDate 11-30-71

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #5

Trace Heater & Thermocouple Relationship

The object of this test is to verify and document the control and recording thermocouples and trace heaters as per Print #H-3-32163.

Procedure:

1. Check to assure all the circuit breakers are in the "on" position in distribution Panel C.
2. Check that all the trace heater controllers are in the "off" position.
3. Turn on K-1 by depressing loop power "on" switch.
4. Turn on power to the metrascope.
5. Turn on power to trace heater circuits.
6. Turn on power to the printer.
7. Set the trace heater controllers to the manual position and turn the manual adjust pots to zero output. Set the controller set point to zero.
8. Turn on trace heat controller #1 and adjust the output voltage to 115 volts, observe the null meter and TDR-1 on the metrascope. As soon as the null meter starts to the + side and the TDR-1 increases by 10°F or more shut off the #1 controller.
9. Repeat steps 7 and 8 until all of the controllers have been checked out.
10. Turn off trace heater control power by depressing trace heater "off" switch.
11. Turn off loop power.

By

Date

12-10-11

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #6

Trace Heater Heat Up Rate

The object of this test is to determine the heat up rate of the system in order to set up the controllers for automatic operation under various conditions.

Procedure

1. Turn on the power to metrascope and printer.
2. Check that all trace heater controllers are in the "off" position.
3. Check the control power is on - green lights should be on on panel.
4. Energize K-1 relay by depressing the loop power on switch - red light should come on, on panel.
5. Energize the trace heater control circuit by depressing trace heater on switch or control panel.
6. Set all high level alarms on the metrascope to 250°F.
7. Set the Heater #1 Controller on manual, set the manual adjust pot fully counter clockwise.
8. Turn on power to No. 1 heater controller.
9. Using an AC voltmeter across output pins 1 and 3 on the controller, set the output voltage to 75 volts.
10. Record the heat up rate on heater #1 on a data sheet using printer.
11. Adjust the output power on heater #1 to obtain 100°F/hr. Do not exceed 250°F.
12. Repeat steps 7 through 11 for all 32 trace heaters.
13. Record data using printer (plot data).
14. Turn off trace heater circuit.
15. Turn off K-1 (loop power).
16. Shut off metrascope & printer.

5720
12-11-77

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE PROCEDURE #7

ELECTRIC VALVE OPERATORS SYSTEM

The object of this procedure is to document the wiring of the valve operator system to assure that it is as per print H-3-32162, sheet #2.

Note: Valves #1, 2, 3, 4, 5 and 6 are equipped with low temperature permission switches, that prevent their operation while the temperature is below a selected set point. The set points are on Channels 9 for V-1, 22 for V-2, 29 for V-3, 24 for V-4, 27 for V-5, and 13 for V-6 on the metrascope.

Procedure

1. Turn on the metrascope and set the following low temperature alarms below the displayed bar graphs,- Channels 9, 22, 29, 24, 27 and 13.
2. Turn on power to the valve operator station.
3. Depress valve #1 selector switch - switch will lock in position.
4. Turn open/close switch to open and observe meter. It should go toward 100%.
5. Turn open/close switch to close, and observe meter - it should return to zero.
6. Set Channel 9 low alarm above display bar graph.
7. Turn open/close switch to open - it shoudn't operate.
8. Depress valve #2 selector switch.
9. Repeat steps #4 and #5.
10. Set Channel 22 low alarm below display bar graph.
11. Repeat step #7.
12. Depress valve #3 selector switch.
13. Repeat steps #4 and #5.
14. Set Channel 29 low level alarm below display bar graph.
15. Repeat step #7.
16. Depress valve #4 selector switch

Electric Valve Operators System Continued

17. Repeat steps #4 and #5.
18. Set Channel 24 low alarm below display bar graph.
19. Repeat step #7.
20. Depress valve #5 selector switch.
21. Repeat steps #4 and #5
22. Set Channel 27 low alarm below display bar graph.
23. Repeat step #7.
24. Depress valve #6 selector switch.
25. Repeat steps #4 and #5.
26. Set Channel 13 low alarm below display bar graph.
27. Repeat step #7.
28. Depress valve #7 selector switch.
29. Repeat steps #4 and #5 for the remaining valve operators.
30. Shut off metrascope and printer.
31. Shut off power to valve operators.

By

M. H. Whitland 120

Date

12/6/71 12-7-71

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #8

Em Pump #1 & Control Circuit

The object of this procedure is to document the operation and control circuitry of the above equipment.

Procedure

1. Disconnect the power leads EM -14 and EM 1-2 at the pump's junction box. Tape leads to prevent grounding.
2. Turn on circuit breaker #1 in power distribution panel A.
3. Disconnect the input leads LDR-50 + LDR-50 - on Channel 46 on the metrascope and connect up a 0 -25 milliwatt DC power supply.
4. Turn on the metrascope.
5. Crank in about 5 millivolts to the metrascope (enough to get above the low level alarm).
6. Check that the overtemperature alarm TDR-33 is above the temperature indicated on the bar graph.
7. Turn the pump increase/decrease switch to the decrease position and hold for 30 sec.
8. Turn on power to K-1 by depressing loop power switch to on.
9. Turn on power to pump by depressing pump on switch, - red light should come on.
10. Turn selector switch to increase and watch voltmeter-should increase up to 270 volts.
11. Turn selector switch to decrease and set voltage to zero.
12. Set the low level alarm on channel 46 on the metrascope up above the bar chart. Pump circuit should drop out.
13. Decrease the alarm and restart the pump circuit.
14. Lower the high temperature alarm channel 33 on the metrascope to a point below the bar graph. The pump circuit should trip out.
15. Reset the overtemperature alarm trip.

Oct. 11-30-71

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #9

#2 Electromagnetic Pump & Control Circuit

The object of this procedure is to document the wiring for this system is as per Drawing H-3-32162, sheet #1.

Procedure

1. Check to assure the power switch on the H/p D.C. power supply is in the "off" position.
2. Disconnect the output from the Em pump DC power supply (rear of the control panel) and connect a 500 ampere shunt across the load leads.
3. Turn on the fuse disconnect #2 on the west wall of 335.
4. Turn on the Em pump #2 circuit on MCC #1 Compartment No. A-3.
5. Turn the current and voltage adjust pots to zero.
6. Turn on power to the Em pump #2 by depressing Em-2 pump on switch - red light should come on.
7. Turn off "on" switch on the H/p D.C. power controller to the "on" position.
8. Adjust the current set pot until this current meter starts to read.
9. Adjust the voltage set pot until 1 volt is obtained.
10. Readjust the current upscale until 100 amperes is obtained.
11. Reduce the current and voltage pots to zero.
12. Turn H/p D.C. power supply toggle switch to "off" position.
13. Turn off the D.C. Em pump control circuit by depressing the "off" switch.
14. Shut off the fused disconnect #2 at the west wall.
15. Disconnect the shunt and reconnect the pump leads. The polarity will have to be determined with NaK in the system.

16. Shut off the pump circuit by depressing the stop button (green light should come on).
17. Reconnect the pump leads EM 1-4 and Em 1-2 at the pump junction box.
18. Turn off circuit 1 on distribution panel-A.
19. Disconnect the MV power supply and reconnect reservoir liquid level leads LDR-50 + LDR-50 -
20. Turn off loop power by depressing loop power off button (green light should come on).

By

P. J. Quinn

Date

11-30-71

PROTOTYPE APPLICATIONS LOOP

Acceptance Test Procedure #10

Piping Hanger Setup

The object of this procedure is to verify the piping support hangers are set at the required cold loadings as shown on Print H-3-32153 and the piping slopes and low points are as per Print H-3-32145.

PROCEDURE

Using Print #H-3-32145 as a reference set the slopes and low points as shown and record the following spring hanger readings:

Hanger #

2

15

16

17

18

22

All other hangers are not the spring type and require no weight reading.

T. J. Carr

1-17-72

PROTOTYPE APPLICATIONS LOOP

Acceptance Test Procedure #11

Cold Trap Cooling System

The object of this procedure is to document that the cold trap cooling system is wired as per Print H-3-32162 and to clarify that the system is operational.

PROCEDURE

1. Check that circuits B-2-1 and B-3-1 are on.
2. Turn on cold trap blower switch and observe rotation of fan (should be blowing into cooler).
3. Turn on cold trap damper motor switch.
4. Set the cold trap temperature controller to 50°F and observe damper motor. Should open damper on NaK cooler.
5. Raise the cold trap temperature controller to 100°F and observe damper motor. It should close off NaK cooler damper
6. If the system operates as required, shut off the blower motor and the damper motor.
7. The proportional band and reset rate will be set during the OATP's.

By T. J. Cullen

Date 11-30-71

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #12

Loop Blower Checkout

1. Check the installation of the blower and duct work for consonance with Drawing H-3-32147, Sheets 1 & 2. Sight any nonconformities at the end of this ATP. *Sub OK*
2. Assure that circuit breaker H-2 in power distribution panel A is in the closed position. *Sub OK*
3. Press the loop power "on" switch. The cooler blower green light shall light. *Sub OK*
4. Verify that the 4 ventilation dampers open. *Sub OK*
5. Press the loop cooler blower "on" switch. The blower should start immediately. *Sub OK*
6. Allow blower to run and test outlet air flow in three positions as shown in Figure 12-1 with a duct velocity meter capable of velocity measurements to 100 ft/sec. Enter the velocity readings here:

Position 1 50 ft/sec.

Position 2 53 ft/sec.

Position 3 50 ft/sec.

7. Push loop cooler blower "off" switch. Blower shall shut down the cooler. Blower red light shall go out, and the cooler blower green light shall come on. *Sub OK*
8. Push the loop power "off" switch and open circuit breaker A-2 to deenergize the circuitry. *Sub OK*

Figure 12-1, Velocity Measurement Coordinates

* (X) POSITION NO.

GROSS AIR FLOW IS APPROX. 3000 CFM

System approved adequate and ATP completed by DW Bennett
2-22-72

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE NO. 13

Smoke Detector Checkout

1. Inspect the smoke detector sensing head located in the loop cooler blower exhaust duct for concurrence with Drawing H-3-32159. Note any nonconformances at the end of the ATP.
2. Place circuit breakers 1, 2, 9 & 11 in instrument power distribution panel B in the "on" position.
3. Push the loop power "on" switch.
4. Push the loop cooler blower "on" switch.
5. Assure that the smoke detector bypass switch is in the "normal" position.
6. Place approximately 2 oz. of plumber's oakum in a flat metal dish. Place this dish on a hot plate immediately in front of the loop cooler blower draft opening. Turn the hot plate on to burn the oakum.
7. Verify that the smoke detector senses the smoke by:
 - a. Shutting down the loop cooler blower.
 - b. Shutting the ventilation damper.
 - c. Lighting the red loop power light
 - d. Energizing drop #22 on the annunciator panel.
 - e. Lighting the "fire" indicator light on the smoke detector panel.
8. Remove the burning oakum from the exhaust duct.
9. Press the "acknowledge" and "Reset" buttons on the annunciator panel.
10. Place the smoke detector bypass switch in the "bypass" position.
11. Press the loop power "on" switch.
12. Press the loop cooler blower "on" switch.
13. Replace the burning oakum in the blower draft duct. No reaction shall be noted.
14. Place the smoke detector bypass switch in the normal position. The same reactions as were specified in Setp #8 should immediately occur.
15. Repeat steps #9 & #10.
16. Open circuit breakers 1, 2, 9 & 11 in instrument power distribution Panel B.

[Handwritten Signature]

1-4-72

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE # 14

RESERVOIR HEATER RESISTANCES

The object of this procedure is to record the furnace resistances for future references and to assure the system is operable.

Procedure

1. Disconnect the input leads at each of the junction boxes on the reservoir furnaces.
2. Using a model 269 simpson or equal that has been calibrated within the last 30 days, check and record the following.

<u>Section</u>	<u>Loop Resistance</u>	<u>Resistance to Ground</u>
X	14.4 Ω	Infinity
Y	10.2 "	"
Z	8.8 "	"
ST-1	42.4 "	↓
ST-2	42.4 "	
TA	26.7 "	
TB	16.3 "	
TC	10.5 "	
TD	16.4 "	

Base Section

3. Reconnect the input leads and replace the junction box covers.

By 67. J. Allen
Date 12-1-71

PROTOTYPE APPLICATIONS LOOP
ACCEPTANCE TEST PROCEDURE # 15

Bottom Reservoir Heater Controller Check Out

The object of this procedure is to verify the operation of the reservoir heater temperature and power controller prior to turning power on to the furnace.

Procedure

1. Check to assure that the power is off to contactor K-4 Panel A circuit breaker #6.
2. Remove power output lead from bottom heater power phaser.
3. Connect a 50 amp shunt across the phaser output.
4. Set the reservoir bottom temperature controller to manual position.
5. Turn the manual set pot fully counter-clockwise.
6. Turn on the temperature controller power switch.
7. Turn on power to bottom heater furnace, contactor K-4, Panel A circuit breaker #6.
8. Turn on loop power by depressing loop power "on" button on control panel.
9. Turn on reservoir bottom heater by depressing reservoir bottom heater "on" button.
10. Slowly increase power to shunt by turning the manual set pot clockwise while observing wattmeter located just below the R & I thermac temperature controller.
11. Increase power until approximately 10 kW is reached on wattmeter.
12. Check out current limiter by reducing power to 5KW using limiter.
13. Return the manual power adjust to zero.
14. Turn off power to reservoir bottom heater.
15. Turn off loop power.
16. Disconnect shunt from phaser output.
17. Reconnect furnace leads to phaser.

By

Date

12-9-71

PROTOTYPE APPLICATIONS LOOP
ACCEPTANCE TEST PROCEDURE # 16

Top Reservoir Heater Controller

The object of this procedure is to verify the operation of the reservoir heater temperature and power controller prior to turning on power to the reservoir furnace.

Procedure

1. Check to assure that the power is off to contactor K-5 Distribution Panel A circuit breaker #8.
2. Remove power output leads from top reservoir heater.
3. Connect a 3000 watt shunt across the output of the top heater power phaser.
4. Set the reservoir top temperature controller to manual position.
5. Turn the manual set pot fully counter-clockwise.
6. Turn the temperature controller power switch to the "on" position.
7. Turn on power to the top reservoir heater contactor K-5 Distribution Panel A circuit breaker #8.
8. Turn on loop power by depressing loop power "on" button on control panel.
9. Turn on power to reservoir top heater by depressing reservoir top heater "on" button.
10. Slowly increase power to the shunt by turning the manual set pot clockwise while observing the wattmeter located just below the top reservoir temperature controller.
11. Increase the power to ~ 2500 watts.
12. Turn the current limiter clockwise to check for operability lower to 1000 watts.
13. Return manual set pot to zero.
14. Turn off power to reservoir top heater.
15. Turn off loop power.
16. Disconnect shunt and reconnect power leads to reservoir top heater.

By

Date

1-2-57

PROTOTYPE APPLICATIONS LOOP

Cover Gas Acceptance Test Procedure #17

PRESSURE CONTROLLERS & VALVE OPERATION

The object of this procedure is to verify the system is connected up as shown on Prints #H-3-32173 and H-3-32176, and to document that the system is operational.

PROCEDURE

1. Check to assure that the reservoir is ready to receive argon gas. (Gas pressure sensor valved in & relief valve is in place). Install a 0-10 psig pressure gage (calibrated) in the outlet filter leak check port, located on the PAL mezzanine.
2. Check to assure argon line is valved off at header.
3. Set the GE/mac 540 pressure controller on manual.
4. Check to assure that the air is adjusted to 20 psig on the I/P convertors.
5. Turn the manual set knob on the GE/mac controller clockwise while observing the valve operation; the valve should open.
6. Isolate the gas pressure sensor from the cover gas system by shutting the valve at the pressure sensor.
7. Slowly increase gas outlet pressure from the PRV until the pressure relief valve actuates. Immediately reduce pressure to 0 psig. Record the relief valve actuation pressure here.

_____ 5 psig _____ psig

By _____

Date _____ 2-1-72 _____

8. Reopen the pressure sensor isolation valve to place the pressure sensor back in service.
9. Turn manual set knob counter clockwise and close the valve. (This will check out controller, valve, I/P convertors.

10. The reservoir pressure sensor is calibrated to 0-20" H₂O and is read out on the metrascope - PDR-44 and is recorded on the GE/mac recorder on the cover gas control panel.
11. Check to assure the metrascope is on and the power is on to the cover gas control panel.
12. Set the GE/mac controller on automatic and set the setpoint to 25% (this should be 4 inches of water pressure in the reservoir).
13. Open the valve from the argon supply to the cover gas system.
14. Set the PRV to 5 psig, observe the pressure reading on the recorder and metrascope. The recorder should read ~ 25% and the metrascope should read ~ 20%, (the check valve may not crack at 5 psig, if so, reset the PRV to 10 psig).
15. Set the GE/mac 540 controller to 50%. This should read 50% on the recorder and 30% on the metrascope.
16. Leave controls at this setting and proceed to flow control AT-P.

G. J. Owen

2-7-72

PROTOTYPE APPLICATIONS LOOP

Cover Gas Acceptance Test Procedure #18

FLOW CONTROLLERS & VALVE

The object of this procedure is to verify the system is connected up as shown on Prints #H-3-32173 & H-3-32176, and to document that the system is operational.

PROCEDURE

1. With the pressure system in operation open the recirculation valve.
2. Close the flow-flowmeter bypass valve.
3. Check that the standby filters are on line.
4. Set the GE/mac 540 controller in the manual position.
5. Turn the 540 controller manual set clockwise and observe the valve operation. The valve should open.
6. Turn the 540 controller to automatic control and set the set point to 25%.
7. Turn on the pump and observe flow. The flowmeter is a 0-3000 cc/min unit. The flow is recorded on the GE/mac 531 recorder. Check that it reads 25% chart.
8. Set the alarm switch to 30% and depress the alter-reset button. This should turn out the panel alarm #24 on PAL control panel and switch the filter to the operational side.
9. Set the GE/mac 540 controller to 50% and observe the flow recorder, (the filters should switch and the panel alarm should sound).
10. Allow the pressure & flow systems to remain in this position and proceed to the vent control test.

By

[Signature]

Date

2-7-72

PROTOTYPE APPLICATIONS LOOP

Cover Gas Acceptance Test Procedure #19

BLEED CONTROLLER & VALVE

The object of this procedure is to verify the system is connected up as shown on prints No. H-3-32173 & H-3-32176 and to document that the system is operational.

PROCEDURE

1. Check to assure that the power is on to the vent recorder and the MV/I convertor.
2. Check that the vent flowmeter bypass valve is closed.
3. Set the vent system flow controller on manual control with the manual set fully counter clockwise.
4. Slowly turn manual set clockwise and observe vent valve action, (valve should open) do not open valve over 50%.
5. If system works on manual, set the set pointer to 25% and switch system to automatic.
6. After system has leveled out increase set point to 50% and observe. The pressure and flow systems should be controlling on their respective set points.
7. If the system control is in the automatic condition, shut down the pressure, flow and vent controllers and close off the argon header valve.

By

J. D. Allen

Date

2-7-72

PROTOTYPE APPLICATIONS LOOP
NaK Pressure Transducer Checkout

Procedure No. 20

The object of this procedure is to ascertain the operability of the cover gas pressure transducer on the NaK system.

PROCEDURE

1. Ascertain that the valve located on top of the NaK surge tank is closed. Remove the pressure connecting tube from the pressure transducer.
2. Attach a bottled argon source to the pressure transducer.
3. Turn on the metrascope, and adjust the high alarm on channel 45 to 50 psig.
4. Slowly increase argon pressure from the bottle. The alarm should trip at approximately 50 psig indicated on the metrascope and on the argon supply PRV. Tripping of metrascope channel 45 high alarm should trip annunciator drop No. 23.
5. Remove pressure from the transducer and disconnect the test pressure supply line. Reconnect the pressure line from the surge tank.

By

Date

[Signature]
1-7-72

ACCEPTANCE TEST PROCEDURE

For

THE PROTOTYPE APPLICATIONS LOOP
SODIUM CHARACTERIZATION SYSTEM
(PAL-SCS)

Approved by 2/8/72
J. A. Yount
Systems Engineering
Sodium Technology
Date

Approved by 2/9/72
D. H. Lester
Systems Engineering
Sodium Technology
Date

Approved by 3/2/72
V. F. FitzPatrick, Manager
Systems Engineering
Sodium Technology
Date

Donald R. Ross MSCIS

J. K. Inswald

THE PROTOTYPE APPLICATIONS LOOP

SODIUM CHARACTERIZATION SYSTEM
(PAL-SCS)

Index

ACCEPTANCE TEST PROCEDURE

For

THE PROTOTYPE APPLICATIONS LOOP SODIUM CHARACTERIZATION SYSTEM (PAL-SCS)

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1.0 Initial conditions which must exist prior to application of electrical or pneumatic power to any portion of the PAL SCS.

1.1 C & MI Console

1.1.1 Drawer S-10 Sodium Sampling Loop

1.1.1.1 Module VCS-S12 shall have the following switch settings:

<u>Switch</u>	<u>Setting</u>
Push Button POV-S12-A	Close
Push Button POV-S12-B	Close
Key Switch POV-S12-C	Off
Key Switch POV-S12-A Valve Safety	Normal
Key Switch POV-S12-B Valve Safety	Normal

Don Ross misc/s 2/10/72
J.A. Grant "u" 2/10/72

1.1.1.2 Temperature controller TIMC-S13 shall have its horizontal thumb wheel rotated to the extreme left position (approximately 3 turns).

DR 2/10/72 JAG

1.1.2 Drawer S-20 Plugging Temperature Indicator

1.1.2.1 Module BC-S23 shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
Hi Limit Set	750
Lo Limit Set	250
Blower	Off

DR 2/10/72 JAG
AKH.

1.1.2.2 Controller TIMC-S24 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"S-M" Selector	"S"

Horizontal thumbwheel shall be in extreme left turn position (approximately 3 turns).

AK 2/10/72 Jay

1.1.2.3 Module VCS-S25 shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
Push Button SOV-S25	Off

AK 2/10/72 Jay

1.1.3 Drawer S-40 Oxygen Meter

1.1.3.1 Module VCS-S41 shall have the following initial condition:

<u>Switch</u>	<u>Setting</u>
Cooler Blower	Off

AK 2/10/72 Jay

1.1.3.2 Module BC-S42 Deviation Indicating Controller shall have the initial settings:

<u>Switch</u>	<u>Setting</u>
"M-A" Selector	"M"
Vertical Thumb wheel	200°F

AK 2/10/72 Jay

AKH.

- 1.1.3.3 Controller TIC-S43 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"S-M-A" Selector	"S"
Vertical Thumb wheel	200°F

OK 2/10/12 Jay

- 1.1.3.4 Module TIC-S44 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
Rotary O ₂ Meter Select Switch	"O ₂ Meter 1"
Blower	Off

OK 2/10/12 Jay

- 1.1.3.5 Pressure regulator module FI-S47 shall have its regulator hand wheels rotated counter-clockwise until free of the regulator diaphragm.

OK 2/10/12 Jay

- 1.1.3.6 Digital voltmeters DVM-S48 and DVM-S49 shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
Power	Off
Range	1
Null Sens	.1
Polarity	+
Digital Selector	0-0-0-0

OK 2/10/12 Jay

J K Hines

1.1.4 Drawer S-50 Carbon Meter

1.1.4.1 Module FID-S54 Hydrocarbon Analyzer shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
Range Multiplier	1
Zero	0
Span	0
Power	Off
Fuel Shutoff	Normal

OK 2/10/72 Jay

1.1.4.2 Module FCS-S55 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
Mode	Off

OK 2/10/72 Jay

1.1.4.3 Controller TIC-S56 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"S-M-A" Selector	"S"
Vertical Thumb wheel	0°F

OK 2/10/72 Jay

1.1.4.4 Flow Controller FI-S58-1, -2, -3, -4 regulator hand wheels rotated counter-clockwise until free of the regulator diaphragm.

OK 2/10/72 Jay

OK 2/10/72 Jay

1.1.5 Drawer S-60 Vacuum Distillation and Overflow Sampler

1.1.5.1 Module PI-S60 shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
PCS-S60	Off

AK 2/10/12 Jay

1.1.5.2 Module PIC-S62 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
VCS-S62A	Close
VCS-S62B	Close

AK 2/10/12 Jay

1.1.5.3 Module PIC-S63 shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
VCS-S63	Close

AK 2/10/12 Jay

1.1.5.4 Module VCS-S64 shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
LL-SZ	0
POV-S64A	Close

AK 2/10/12 Jay

1.1.5.5 Module BCS-S65 shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
BCS-S65	Off

AK 2/10/12 Jay
AK 2/10/12

1.1.5.6 Controller TIC-S67 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"M-A" Selector	"M"
Vertical Thumb wheel	0°F

AK 2/10/12 Jay

1.1.5.7 Controller TIC-S68 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"S-M-A" Selector	"S"
Vertical Thumb wheel	0°F

AK 2/10/12 Jay

1.1.5.8 Module VCS-S69 shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
LL-S1	0
POV-S69B	Close

AK 2/10/12 Jay

1.1.6 Drawer S-70 Flow Thru Tube Sampler

1.1.6.1 Module VCS-S72B shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
VCS-S72B	Close

AK 2/10/12 Jay

1.1.6.2 Module VCS-S72A shall have the following initial setting:

<u>Switch</u>	<u>Setting</u>
POV-S72A	Close

AK 2/10/12 Jay

AKM

1.1.6.3 Controller TIC-S73 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
"M-A" Selector	"M"
Vertical Thumb wheel	0°F

OK 2/10/12 Jey

1.1.6.4 Module VCS-S75 shall have the following initial settings:

<u>Switch</u>	<u>Setting</u>
POV-S75A	Close
POV-S75B	Close

OK 2/10/12 Jey

1.1.7 Heat Trace Temperature Controller System

1.1.7.1 All H.T. Temperature control modules shall be set as follows:

<u>Switch</u>	<u>Setting</u>
Auto-Off-Manual Rotary	Off
Reset In/Out Toggle	In

OK 2/10/12 Jey

1.1.7.2 All auxiliary temperature set point modules shall be set as follows:

<u>Switch (Pot)</u>	<u>Setting</u>
Local/Remote Rotary Switch	Remote
Temp. Adj. 10 Turn pot	0°F dial reading

OK 2/10/12 Jey

OK

1.1.7.3 Heat Trace Controller power supply modules shall be set as follows:

<u>Switch</u>	<u>Setting</u>
Power On/Off Switch	On
Master/Program Switch	Master
Auto/Manual Sequence Switch	Automatic

OK 2/10/12 Jay

1.1.7.4 The H. T. Master Setpoint module shall have the following initial settings:

<u>Switch (Pot)</u>	<u>Setting</u>
H.T. System Off/On	Off
Auto/Manual Sequence	Auto
Digital Potentiometer	200°F

OK 2/10/12 Jay

1.1.8 Circuit Breakers CB1, 2, 3, & 4 accessible through the center back cabinet door shall be in the OFF (down) position.

OK 2/10/12 Jay

SKH

1.2 Argon Supply

1.2.1 Insure that the pressurized argon gas supply is charged by observing that a minimum of three 244 cu. ft. argon gas bottles are connected into the appropriate manifold supplying PAL SCS at the North end of Building 335 and that the manifold pressure is 500 psig minimum. 125/100

OK 2/23/72 Jcy

1.2.2 Insure that hand operated bellows valve HOV-S11-B is closed (hand wheel full clockwise).

OK 2/23/72 Jcy

1.2.3 Argon supply to System S 60 VD/OS.

1.2.3.1 Insure that the Nupro SS-4BW bellows seal hand operated valve (located near the vacuum pump on top of the SCS frame) is in the closed position (full clockwise).

OK 2/23/72 Jcy

* 1.2.3.2 Insure that the Nupro SS-4BK hand operated valve (located on the side of the VD/OS assembly box) is in the closed position (full clockwise).

OK 2/23/72 Jcy

1.2.3.3 Insure that the Matheson hand operated pressure reducing valve (located just below the VD/OS assembly on one of the SCS frame uprights) is closed by turning the handwheel full counter-clockwise.

OK 2/23/72 Jcy

OK 2/23/72 Jcy

1.2.4 Argon supply to Vanadium Wire Device when used in lieu of VD/OS.

1.2.4.1 Perform step 1.2.3.1.

OK 2/23/72 Juy

1.2.4.2 Insure that the Nupro SS⁶ ABW hand operated bellows valve located in the Argon line on top of the VW device is in the closed position (full clockwise). (562-C)

OK 2/23/72 Juy

1.2.5 Argon supply to Carbon Meter System S-50

1.2.5.1 Close hand operated valve which supplies Argon to constant volume chamber of Carbon Meter (fully clockwise). S-52C

OK OK 2/23/72 Juy

1.2.6 Argon supply to Freeze Vent of System-10 Sodium Sampling Loop.

1.2.6.1 Close hand operatee valve S-11B which supplies Argon to the Vacuum/Argon inlet tee feeding the Freeze Vent (fully clockwise).

OK 2/23/72 Juy

JKH.

1.3 Vacuum Supply

- 1.3.1 The vacuum requirements of the system during PAL-SCS fill are satisfied by employing a portable vacuum system which will connect to the other leg of the tee feeding the Freeze Vent (referring to the tee mentioned in step 1.2.6.1).

not applicable - J.A. Goulet
NA DR 2/23/72

- 1.3.1.1 Connect the aforementioned vacuum pump and isolate it from the PAL-SCS loop by closing the appropriate cutoff valve.

not applicable - J.A. Goulet
NA DR 2/23/72

- 1.3.2 Vacuum requirements of the Vacuum Distillation/Overflow Sampler (S-60) the Carbon Meter (S-50) and the Flow Thru Tube Sampler (S-70) are accommodated thru the use of a Welch 1402 B Vacuum Pump located on top of the PAL-SCS structural frame.

NOTE: Initially the System S-60 VD/OS will be replaced by a Vanadium Wire Equilibration Device.

- 1.3.2.1 Vacuum setup for S-60 VD/OS.

- 1.3.2.1.1 Vacuum is supplied to the VD/OS POV's immediately upon startup of the aforementioned vacuum pump and there are no hand operated valves which require an initial set.

- 1.3.2.2 Vacuum setup for S-60 Vanadium Wire Device.

- 1.3.2.2.1 Insure that the Nupro SS-5BW bellows seal valve located at the outlet of the 2-3/4" flexible coupling on top of the VW Device is in the closed position (full clockwise).

SG2 D
DR 2/23/72 JAG

JAG.

1.3.2.3 Vacuum service to Flow Thru Tube Sampler S-70.

1.3.2.3.1 Insure the HOV-S75 is in the closed position by rotating full clockwise.

OK 2/23/73 JH

1.3.2.4 Vacuum service to Carbon Meter System S-50.

1.3.2.4.1 Close hand operated valve HOV-S52D in line which supplies vacuum to constant volume chamber feeding Carbon Meter probe.

OK 2/23/73 JH

1.3.2.4.2 Close hand operated valve HOV-S53A in pipe section between constant volume chamber and Carbon Meter probe.

OK 2/23/73 JH

1.4 Compressed Air Supply

1.4.1 Compressed air rather than dry nitrogen will be used initially to cool the sodium in the S-70 FTTS.

1.4.2 Establish by inspection that the building compressed air supply is operating.

OK 2/12/72 JH

1.4.3 Locate the HORV which regulates the air supply to be used by System S-70 and set the supply to 30 psig.

OK 2/12/72 JH

1.4.4 Insure that HOV-S71 is closed by turning the handwheel full clockwise.

OK 2/12/72 JH

SKM.

- 1.5 PAL-SCS Piping Assembly includes all sodium wetted piping, directly associated instrument modules & ancillary fluid systems mounted into the Sodium Sampling package frame.

1.5.1 Initial instrument setup within the SSP frame.

- 1.5.1.1 Two Bendix Model GTC-100 Vacuum Gage Readout boxes are located on top of the frame's southwest corner. Set the OFF/ON operation switches to OFF.

DR 2/23/73 Jey

- 1.5.1.2 Two Nortec NOT-116 Ultrameters are located on top of the SSP frame within a wire protective cover. Set the ON/OFF operation switches in the OFF position.

DR 2/23/73 Jey

- 1.5.1.3 One Wayne-Kerr TE-100 Pressure Transducer readout is located on top of the east end of the SSP frame. Set the ON/OFF operation switch to OFF.

DR 2/23/73 Jey

1.6 Transmitter Cabinet

- 1.6.1 No manual control functions are available to be performed in the transmitter cabinet, therefore a visual check of the internal cabinet areas is sufficient to determine that nothing obvious is damaged or omitted.

DR 2/10/72 Jey

SKH.

1.7 SCR Cabinet

- 1.7.1 Like the Transmitter Cabinet, the SCR cabinet does not have any external manual controls. Inspect visually for obvious damage or omissions.

OK 2/10/12 Jay

254.

2.0 POWER TURN-ON

2.1 C & MI Console Power

- 2.1.1 Turn on circuit breaker labeled "Instrument Power" (behind C & MI on west wall) providing main power to the PAL-SCS C & MI.

OK 2/11/72 Jay

- 2.1.2 Turn on circuit breaker CB 1, through center door @ rear of PAL-SCS C & MI cabinet. Observe that 115 VAC is available between terminals TB27-1 and TB28-11.

OK 2/11/72 Jay

- 2.1.3 Perform similar checks as follows:

<u>Circuit Breaker</u>	<u>From</u>	<u>To</u>
2	TB27-10	TB28-11
3	TB27-7	TB28-11
4	TB27-9	TB28-11

OK 2/11/72 Jay

- 2.1.4 Check for presence of AC voltage difference between TB28-11 and cabinet frame. No voltage should exist.

OK 2/11/72 Jay

- 2.1.5 24 VDC power supply check; verify that 24 VDC is available between the following terminals:

<u>Power Supply No.</u>	<u>From (+)</u>	<u>To (-)</u>
PS#1	TB30-1	TB31-1
PS#2	TB22-1	TB31-1
PS#3	TB22-6	TB20-2

OK 2/11/72 Jay

OK H.

- 2.1.6 24 VAC transformer check; verify that 24 VAC is available between terminals TB24-1 and TB26-1.

OK 2/11/72 Jay

- 2.1.7 From the front of the C & MI check that all drawer graphic display panels are back lighted. Make this same check on the Heat Trace status display panel.

OK 2/11/72 Jay

- 2.1.8 Turn the potentiometer labeled "Graphics" on the master control module from stop to stop and observe that the drawer graphic panel back lighting dims and brightens accordingly.

OK 2/11/72 Jay

- 2.1.9 Perform the same test of the "Heat Trace" control (similarly located) versus the Heat Trace Status Panel.

OK 2/11/72 Jay

- 2.1.10 Push the "Lamp Test" button in the center section of the master control module. All switch lights & indicator lights should illuminate on the drawer fronts and the Heat Trace controllers.

OK 2/11/72 Jay

- 2.1.11 Push the "Annunciator Lamp Test" button in the right section of this same panel and verify that all indicator lights on the Heat Trace Status panel illuminate.

OK 2/11/72 Jay

OK.

2.1.12 Set the blower control OFF/RESET to RESET; located in the left hand portion of the Master Control Module.

OK 2/11/72 Jay

2.1.13 Make the following switch settings on the Emergency Action panel:

2.1.13.1 Smoke Alarm Auto/Bypass shall be in the Auto position.

OK 2/23/73 Jay

2.1.13.2 Depress the Emergency Reset button.

OK 2/23/73 Jay

2.1.13.3 Argon flood OFF/ON shall be in the OFF position.

OK 2/23/73 Jay

2.1.14 Recalibrate Master Set Point module (MSP); this step is done for dry runs only.

OK 2/13/72 Jay

2.1.14.1 Connect a D.C. V.T.V.N.P. to pins 1 and 4 (- lead to 1 and + lead to 4) on term. Strip on rear of MSP enclosure.

OK 2/13/72 Jay

2.1.14.2 Turn upper keyswitch to "ON" and read a -1.200 volt indication on VTVM.

OK 2/13/72 Jay

2.1.14.3 Turn upper keyswitch to "OFF".

OK 2/13/72 Jay

OK.

- 2.1.14.4 Remove MSP module from rack, install extender board in its place and install MSP module into extender board.

OK 2/13/72 Jay

- 2.1.14.5 Turn upper keyswitch "ON" and by adjusting R2, obtain a
- 0.510 $\pm$.002 VDC reading on the VTVM in place of the
- 1.200 VDC reading. This allows an 85°F thermocouple
input to activate a heat trace controller when the MSP
module dial reads 200°F.

OK 2/13/72 Jay

- 2.1.14.6 Return keyswitch to "OFF"; remove extender card; replace
MSP module as original.

OK 2/13/72 Jay

- 2.1.14.7 Turn keyswitch to "ON".

OK 2/13/72 Jay

2.2 SCR Cabinet Power

- 2.2.1 Turn on circuit breaker numbers 23, 24, 25 and 26 in large power
panel immediately behind C & MI (on west wall).

OK 2/13/72 Jay

- 2.2.1.1 Insure that the four fans in the SCR cabinet top plate are
running.

OK 2/13/72 Jay

J.K.R.

- 2.2.2 Turn on the following additional circuit breakers in the power panel mentioned in step 2.2.1: CB1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 12. This supplies power on command to the SCS heating elements.

DR 2-13-72 Jay

2.3 Transmitter Cabinet Power

- 2.3.1 Turn on circuit breaker number 17 located in the power panel mentioned in step 2.2.1. Insure that the ventilating fans in the base of the transmitter cabinet are functioning.

DR 2-13-72 Jay

2.4 Power to SCS Framed Package

- 2.4.1 Verify off status of circuit breakers 19, 20, 21 and 22 in power panel mentioned in step 2.2.1. These supply power to the electro-magnetic pump switching circuit in SCS and will be enabled as needed.

DR 2-13-72 Jay

- 2.4.2 Turn on circuit breaker number 28 to activate service outlets located inside the SCS frame (same power panel as in 2.2.1).

DR 2-13-72 Jay

- 2.4.3 Turn on each instrument associated with the vacuum and argon supply to System S-60 VD/OS.

<u>Instrument</u>	<u>Switch</u>	<u>Switch Setting</u>
Bendix Vacuum Gage Readout - (2)	OFF/ON	ON
Nortec Ultrameters - (2)	OFF/ON	ON
Wayne-Kerr Pressure Xdcr - (1)	OFF/ON	ON

DR 2/23/73

24.9.

- 2.4.4 Open valve number HOV-S11-B (fully counter-clockwise) supplying Argon gas pressure to system.

OK 2/23/73 JCH

- 2.4.5 Open Nupro SS-4BW bellows valve located on top of SCS frame near the vacuum pump (fully counterclockwise). This valve supplies Argon to MOV-61.

OK 2/23/73 JCH

- 2.4.6 Open the HOV feeding Argon to the S-50 constant volume chamber inlet tee (fully counterclockwise). (S52C)

OK 2/23/73 JCH

- 2.4.7 Open the HOV feeding Argon to the S-10 freeze vent (fully counter clockwise).

not applicable - J.A. Grant
NA OK 2/23/73

- 2.4.8 Open the HOV which isolates the portable vacuum pump from the S-10 freeze vent (fully counter-clockwise).

not applicable - J.A. Grant
NA OK 2/23/73

- 2.4.9 Open HOV-S5 which supplies vacuum service to the constant volume chamber inlet tee of the Carbon Meter (fully CCW).

OK 2/23/73 JCH

- 2.4.10 Open HOV-S71 which supplies compressed air to SOV-S72B of the FTS. Turn HOV fully CCW.

OK 2/23/73 JCH

3.0 SYSTEM TEST PAL-SCS

3.1 System Test of S-10 Sodium Sampling Loop

3.1.1 Input temperature controller (T.C) 10-A1 enable circuit (sequence input) by applying +24 vdc to terminal (9) nine (4th terminal down from top of strip.

3.1.1.1 Observe - White light on TC 10-A1 on.

DR 2-13-72 Jay

3.1.1.2 Observe - White light S 10-A1 on Heat Trace Graphic Panel (H.T.G.P) on.

DR 2-13-72 Jay

3.1.2 Set Manual - Off-Auto (M-O-A) switch on TC 10A1 to Auto position.

DR 2-13-72 Jay

3.1.2.1 Observe: White (W) light S 10-A1 on HTGP changed to Amber (A).

DR 2-13-72 Jay

3.1.2.2 Observe: At 15 ± 10 minutes (min)(A) light S 10-A1 changed to Green (G)

DR 2-13-72 Jay

3.1.2.3 Observe: (W) light S 10-A2 on HTGP on.

DR 2-13-72 Jay

3.1.2.4 Observe: (W) light on TC 10A2 on.

DR 2-13-72 Jay

DR 2-13-72 JKH.

3.1.3 Set M-O-A switch on TC 10A2 to Auto.

OK 2/13/72 Jay

3.1.3.1 Observe: (W) light S 10-A2 on HTGP changed to (A).

OK 2/13/72 Jay

3.1.3.2 Observe: At 15 ± 10 min (A) light S 10-A2 on HTGP change to (G).

OK 2/13/72 Jay

3.1.4 Place normal-override switch VCS-S12-A in the override position

OK 2/13/72 Jay

3.1.5 Enable valve POV-S12A by depressing the valve opening switch VCS-S12-A (Valve may be exercised by pressing the "open" and "closed" switches alternately.

OK 2/13/72 Jay

3.1.5.1 Observe: By visual check the operation of the valve.

OK 2/13/72 Jay

3.1.5.2 Observe: the change in state of the valve position indicators located on the S 10 drawer graphic panel.

OK 2/13/72 Jay

3.1.5.3 Observe: (W) light S 10-B1 on HTGP on and White preheat waiting light adjacent to pump control switches on.

OK 2/13/72 Jay

3.1.5.4 Observe: (W) light TC 10B1 on.

OK 2/13/72 Jay

3.1.6 Place normal override key switch VCS-S12A in normal position.

OK 2/13/72 Jay

3.1.6.1 Observe: Valve POV-S12A can no longer be controlled by "open" or "closed" switches VCS-S12A.

OK 2/13/72 Jay

3.1.6.2 Return normal override switch to override position.

OK 2/13/72 Jay

3.1.6.3 Verify item 3.1.5.3, 3.1.5.4.

OK 2/13/72 Jay

3.1.7 Set the M-O-A switch on TC 10B1 to Auto.

OK 2/13/72 Jay

3.1.7.1 Observe: (W) light S 10-B1 on HTGP change to (A) and (A) preheat light adjacent to pump controls on.

OK 2/13/72 Jay

3.1.7.2 Observe: at 15 ± 10 min (A) light S 10-B1 on HTGP change to (G) and green temperature range light adjacent to pump controls on.

OK 2/13/72 Jay

JAY

3.1.7.3 Observe: (W) light S 10-B2 on HTGP on.

OK FEB 13 1972 Jay

3.1.7.4 Observe: (W) light TC 10-B2 on.

OK FEB 13 1972 Jay

3.1.8 Set M-O-A switch on TC 10-B2 to Auto.

OK FEB 13 1972 Jay

3.1.8.1 Observe: (W) light S 10-B2 on HTGP change to (A).

OK FEB 13 1972 Jay

3.1.8.2 Observe: at 15 ± 10 min the (A) light changes to (G).

OK FEB 13 1972 Jay

3.1.8.3 Observe: (W) light on TC 10-B3 on.

OK FEB 13 1972 Jay

3.1.8.4 Observe: low flow annunciator is on and the S 10 low to flow indicator is on.

OK FEB 13 1972 Jay

3.1.8.5 Observe: (W) light S 10-B3 on HTCP is on.

OK FEB 13 1972 Jay

3.1.9 Set M-O-A switch on TC 10-B3 to Auto.

OK FEB 13 1972 Jay

3.1.9.1 Observe: (W) light S 10-B3 on HTGP change to (A).

OR FEB 13 1972

Jay

3.1.9.2 Observe: At 15 $\pm$ 10 min the (A) light changes to (G).

OR FEB 13 1972

Jay

3.1.9.3 Observe: (W) light S 10-B4 on HTGP is on.

OR FEB 13 1972

Jay

3.1.9.4 Observe: (W) light on TC 10-B4 is on.

OR FEB 13 1972

Jay

3.1.10 Set the M-O-A switch on TC 10 B-4 to Auto.

OR FEB 13 1972

Jay

3.1.10.1 Observe: (W) light S 10-B4 on HTGP changes to (A).

OR FEB 13 1972

Jay

3.1.10.2 Observe: At 15 $\pm$ 10 min (A) light S 10-B4 changes to (G).

OR FEB 13 1972

Jay

3.1.10.3 Observe: (W) lights S 10-B5, B6, B7, S 60-A1, S 70-A1 on HTGP on.

OR FEB 13 1972

Jay

3.1.10.4 Observe: (W) lights on TC's 10-B5 10-B6, 10-B7, 60-A1, 70-A1 on.

OR FEB 13 1972

Jay

OKB.

3.1.11 Set the M-O-A switches on TC's 10-B5, 10-B6, 10-B7 to Auto.

OK FEB 13 1972 *Jay*

3.1.11.1 Observe: (W) lights S 10-B5, B6, B7 on HTGP change to (A).

OK FEB 13 1972 *Jay*

3.1.11.2 Observe: At 15 ± 10 min (A) lights S 10-B5, B6, B7 on HTGP change to (G).

OK FEB 13 1972 *Jay*

3.1.11.3 Observe: (W) light on TC 10 B8 on.

OK FEB 13 1972 *Jay*

3.1.11.4 Observe: (W) light S 10-B8 on HTGP on.

OK FEB 13 1972 *Jay*

3.1.12 Set the M-O-A switch on TC 10-B8 to Auto.

OK FEB 13 1972 *Jay*

3.1.12.1 Observe: (W) light S 10-B8 on HTGP change to (A).

OK FEB 13 1972 *Jay*

3.1.12.2 Observe at 15 ± 10 min (A) light S 10-B8 changes to (G)

OK FEB 13 1972 *Jay*

JAY

3.1.13 Enable valve MOV-S18B by placing switch VCS-S18B in the open position (spring loaded switch)

DR FEB 13 1972 Jay

3.1.13.1 Observe - Visual check of valve operation - open and close as necessary to verify operation.

DR FEB 13 1972 Jay

3.1.13.2 Observe - when valve is completely open white light S 10-B9 on HTGP will illuminate.

DR FEB 13 1972 Jay

3.1.13.3 Observe - when valve is completely open white light on TC 10-B9 will illuminate.

DR FEB 13 1972 Jay

3.1.13.4 Observe valve pos indicator for indication only.

DR FEB 13 1972 Jay

3.1.14 Close valve MOV-S18B by depressing switch VCS-S18B closed.

DR FEB 13 1972 Jay

3.1.15 Set the M-O-V switch on TC 10-B9 to Auto.

DR FEB 13 1972 Jay

3.1.15.1 Observe - (W) light S 10-B9 on HTGP changed to (A)

DR FEB 13 1972 Jay

RECEIVED
FEB 13 1972
JAY.

3.1.15.2 Observe - At 15 ± 10 min the (A) light S 10-B9 changed to (G)

DR FEB 13 1972 Jay

3.1.15.3 Observe - (W) lights on TC 10-B10, TC 20 A1, TC 40 A1, TC 50 A1 illuminate.

DR FEB 13 1972 Jay

3.1.15.4 Observe: (W) lights S 10-B10, S 20-A1, S 40-A1, S 50-A1 on HTGP on.

DR FEB 13 1972 Jay

3.1.15.5 Set the M-O-V switch on TC 10 B10 to Auto.

DR FEB 13 1972 Jay

3.1.15.6 Observe: (W) light S 10-B10 on HTGP changes to (A)

DR FEB 13 1972 Jay

3.1.15.7 Observe: At 15 ± 10 min (A) light S 10-B10 on HTGP changes to (G)

DR FEB 13 1972 Jay

3.1.16 Input temperature controller TC 10 C1 enable circuit (sequence input) by applying +24 vdc to terminal 9 (4th terminal down from top).

DR FEB 13 1972 Jay

3.1.16.1 Observe: (W) light on TC 10 C1 on.

DR FEB 13 1972 Jay

JKB.

3.1.16.2 Observe: (W) light S 10-C1 on HTGP on.

OK FEB 13 1972 Jay

3.1.17 Set M-O-A switch on TC 10 C1 to Auto.

OK FEB 13 1972 Jay

3.1.17.1 Observe: (W) light S 10-C1 on HTGP change to (A).

OK FEB 13 1972 Jay

3.1.17.2 Observe: At 15 $\pm$ 10 min the (A) light S 10-C1 change to (G).

OK FEB 13 1972 Jay

3.1.17.3 Observe: (W) light S 10-C2 on HTGP is on.

OK FEB 13 1972 Jay

3.1.17.4 Observe: (W) light on TC 10-C2 on.

OK FEB 13 1972 Jay

3.1.18 Set M-O-A switch on TC 10-C2 to Auto.

OK FEB 13 1972 Jay

3.1.18.1 Observe: (W) light S 10-C2 on HTGP change to (A).

OK FEB 13 1972 Jay

J.S.S.

3.1.18.2 Observe: At 15 ± 10 min (A) light S 10-C2 on HTGP changes to (G)

OR FEB 13 1972 *Jay*

3.1.18.3 Observe: (W) light S 10-C3 on HTGP on.

OR FEB 13 1972 *Jay*

3.1.18.4 Observe: (W) light on TC 10 C3 on.

OR FEB 13 1972 *Jay*

3.1.19 Set M-O-A switch on TC 10 C3 to Auto.

OR FEB 13 1972 *Jay*

3.1.19.1 Observe: (W) light S 10-C3 on HTGP change to (A).

OR FEB 13 1972 *Jay*

3.1.19.2 Observe: At 15 ± 10 min (A) light S 10-C3 on HTGP changes to (G)

OR FEB 13 1972 *Jay*

3.1.20 Set normal override switch VCS-S12 B2 in override position.

OR FEB 13 1972 *Jay*

3.1.21 Enable valve POV-S12 B by depressing the valve opening switch VCS-S12B (valve may be exercised by pressing the "open" and "closed" switches alternately).

OR FEB 13 1972 *Jay*

J.R.S.

3.1.21.1 Observe: (W) light S 10-D1 on HTGP on.

OK FEB 13 1972 Jay

3.1.21.2 Observe: (W) light on TC 10-D1 on.

OK FEB 13 1972 Jay

3.1.22 Set M-O-A switch on TC 10 D to Auto and close valve POV-S12B by depressing switch VCS-S12B close

OK FEB 13 1972 Jay

3.1.22.1 Observe: (W) light S 10-D1 on HTGP changes to (A).

OK FEB 13 1972 Jay

3.1.22.2 Observe: At 15 ± 10 min (A) light S 10-D1 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.1.22.3 Observe: (W) light S 10-D2 on HTGP on.

OK FEB 13 1972 Jay

3.1.22.4 Observe: (W) light on TC 10-D2 on.

OK FEB 13 1972 Jay

3.1.23 Set M-O-A switch on TC 10-D2 to Auto.

OK FEB 13 1972 Jay

3.1.23.1 Observe: (W) light S 10-D2 on HTGP changes to (A).

OK FEB 13 1972 Jay

OK

3.1.23.2 Observe: At 15 $\pm$ 10 min (A) light S 10-D2 on HTGP changes to (G)

DR FEB 13 1972 *Jay*

3.1.23.3 Observe: (W) light S 10-D3 on HTGP on.

DR FEB 13 1972 *Jay*

3.1.23.4 Observe: (W) light on TC 10-D3 on.

DR FEB 13 1972 *Jay*

3.1.24 Set M-O-A switch on TC 10-D3 to auto.

DR FEB 13 1972 *Jay*

3.1.24.1 Observe: (W) light S 10-D3 on HTGP changes to (A).

DR FEB 13 1972 *Jay*

3.1.24.2 Observe: At 15 $\pm$ 10 min (A) light S 10-D3 changes to (G).

DR FEB 13 1972 *Jay*

3.1.24.3 Observe: (W) lights S10-D4, D7, E1 on HTGP on.

DR FEB 13 1972 *Jay*

3.1.24.4 Observe: (W) lights on TC 10-D4, D7, E1 on.

DR FEB 13 1972 *Jay*

3.1.25 Set M-O-A switches on TC 10-D4, D7, E1 to auto.

DR FEB 13 1972 *Jay*

JKH.

3.1.25.1 Observe: (W) lights S 10-D4, D7, E1 on HTGP change to (A).

OK FEB 13 1972 Jay

3.1.25.2 Observe: At 15 ± 10 min (A) lights S 10-D4, D7, E1 change to (G)

OK FEB 13 1972 Jay

3.1.25.3 Observe: (W) lights S 10-D5, D8, S60-B1 S70-B1 on HTGP on.

OK FEB 13 1972 Jay

3.1.25.4 Observe: (W) lights on TC 10 D5, D8 TC 60 B1, TC 70 B1 on.

OK FEB 13 1972 Jay

3.1.26 Set M-O-A switch on TC 10 D5 to auto.

OK FEB 13 1972 Jay

3.1.26.1 Observe: (W) light S 10-D5 on HTGP change to (A).

OK FEB 13 1972 Jay

3.1.26.2 Observe: At 15 ± 10 min (A) light S 10-D5 changes to (G).

OK FEB 13 1972 Jay

3.1.26.3 Observe: (W) light S 10-D6 on HTGP on.

OK FEB 13 1972 Jay

3.1.26.4 Observe: (W) light on TC 10 D6 on.

OK FEB 13 1972 Jay

OK.

3.1.27 Set M-0-A switch on TC 10-D8 to Auto.

OK FEB 13 1972 Jay

3.1.27.1 Observe: (W) light S 10-D8 on HTGP changes to (A).

OK FEB 13 1972 Jay

3.1.27.2 Observe: At 15 ± 10 min (A) light S 10-D8 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.1.28 Enable valve MOV-S18C by placing switch VCS-S18C in the open position (spring loaded switch)

OK FEB 13 1972 Jay

3.1.28.1 Observe: Visual check of valve operation. Open and close as necessary to verify operation.

OK FEB 13 1972 Jay

3.1.28.2 Observe: When valve is completely open (W) light S 10-D9 on HTGP on.

OK FEB 13 1972 Jay

3.1.28.3 Observe: When valve is completely open (W) light on TC 10-D9 on.

OK FEB 13 1972 Jay

3.1.28.4 Observe as valve is open and closed valve position indicator will give degree of closure.

OK FEB 13 1972 Jay

J.K.V.

3.1.29 Set the M-O-V switch on TC 10-D9 to Auto and leave valve MOV-S18C in the closed position.

OK FEB 13 1972

Jay

3.1.29.1 Observe: (W) light S 10-D9 on HTGP changes to (A).

OK FEB 13 1972

Jay

3.1.29.2 Observe: At 15 ± 10 min (A) light S 10-D9 on HTGP changes to (G)

OK FEB 13 1972

Jay

3.1.29.3 Observe: (W) lights S 20-B1 and S 40-B1 and S 50-B1 on HTGP on.

OK FEB 13 1972

Jay

3.1.29.4 Observe: (W) lights on TC 20-B1, 40-B1 and 50-B1 on.

OK FEB 13 1972

Jay

3.1.30 Adjust TIMC¹³ (slowly increase heating rate until (W) light S 10-B2 comes on.

OK 2/23/73

Jay

3.1.30.1 Return TIMC¹³ control to its lowest setting.

OK 2/23/73

Jay

3.1.31 Set the M-O-V switch on TC 10 E2 to auto.

OK FEB 13 1972

Jay

3.1.31.1 Observe: (W) light S10-E2 on HTGP changes to (A)

OK FEB 13 1972

Jay

3.1.31.2 Observe: At 15 ± 10 min (A) light S10-E2 on HTGP changes to (G)

OK FEB 13 1972

Jay

OK

3.1.32 Electro Magnetic Pump Checkout

3.1.32.1 Disconnect lead LL1A at variable transformer

OK FEB 1 1972 Jay

3.1.32.2 Connect an AC volt meter set to $\bar{>}$ 300 V range across LL1a LL2.

OK FEB 1 1972 Jay

3.1.32.3 Set Circuit Breaker CKT 20 - 22 to on.

OK FEB 1 1972 Jay

3.1.32.4 Hold pump increase/decrease switch SW-S15 in decrease position for 30 sec.

OK FEB 1 1972 Jay

3.1.32.5 Observe: Variable transformer will move to min position (CCW).

OK FEB 1 1972 Jay

3.1.32.6 Hold pump increase/decrease switch SW-S15 in increase position for 30 sec.

OK FEB 1 1972 Jay

3.1.32.7 Observe: Variable transformer will move to max position (CW)

OK FEB 1 1972 Jay

3.1.32.8 Hold pump increase/decrease switch SW-S15 in decrease position for 30 sec.

OK FEB 1 1972 Jay

3.1.32.9 Observe: Variable transformer will move to min position - Note that slider movement has stopped.

OK FEB 1 1972 Jay

3.1.32.10 Momentarily depress pump on switch while observing volt meter.

OK 2/15/72 Jay

3.1.32.11 Observe: Voltage indication very low $\approx$ 25 VAC.

LR FEB 17 1972

Jay

3.1.32.12 Turn off CB CKT 20-22 and reconnect lead LL1A.

LR FEB 17 1972

Jay

3.1.32.13 Turn on CB CKT 20-22 and momentarily depress pump on switch while observing panel volt and amp meters (located adjacent to pump on switch).

LR FEB 17 1972

Jay

3.1.32.14 Observe: No (or very low) indication on volt and amp meters.

LR FEB 17 1972

Jay

3.1.32.15 Observe: Sodium low flow indicator next to pump on switch will be on.

LR FEB 17 1972

Jay

3.1.32.16 While holding pump on switch on, turn increase-decrease switch momentarily in the increase direction.

Caution: Proceed with care.

LR FEB 17 1972

Jay

3.1.32.17 Observe: An increase on volt and amp meter scales and an increase of voltage on the volt meter connected across LL1A & LL2. As soon as any positive indication is noted return increase/decrease switch to decrease position for 30 sec.

INCORRECT METER MOVEMENT
1-10V & 1-100V

LR FEB 17 1972

Jay

3.1.33 Freeze Vent

3.1.33.1 Adjust temp switch TS-S12-C1 (TS-3) to disable VTY-S12-C1.

LR 2/12/72

Jay

JKN.

- 3.1.33.2 Observe: Red light TSL-S12-C located on VCS-S12 and labeled $> 190^{\circ}\text{F}$ will come on.

OK FEB 1 1972 Jay

- 3.1.33.3 Observe: Red light TGL-S12C located on S10 graphic panel over freeze vent symbol on. (Upper section of freeze vent at 190°F)

OK FEB 1 1972 Jay

- 3.1.33.4 Annunciator light Freeze Vent temp 190° on.

OK FEB 1 1972 Jay

- 3.1.33.5 Set temp switch TS-S12-C1 (TS-3) to enable VTY-S12-C1.

OK FEB 1 1972 Jay

- 3.1.33.6 Observe: Red lights TGL-S12-C & TSL-S12-C off.
(Upper section of freeze vent at 190°F)

OK FEB 1 1972 Jay

- 3.1.33.7 Adjust T.S. TS-S12-C3 (TS-4) to enable VTY-S12-C3.

OK FEB 1 1972 Jay

- 3.1.33.8 Observe: Green light TGL-S12-C located adjacent to Freeze Vent symbol on S-10 Graphic panel on. (Lower section of freeze vent at 400°F)

OK FEB 1 1972 Jay

- 3.1.33.9 Adjust T.S. TS-S12-C3 to disable VTY-S12-C3.

OK FEB 1 1972 Jay

JKH.

3.1.33.10 Observe Green light TGL-S12-C off. (Lower section of freeze vent at 400°F)

OK FEB 1 1972 Jay

3.1.33.11 Adjust TS. TS-S12-C2 (TS5) to enable VTY-S12-C2.

OK FEB 1 1972 Jay

3.1.33.12 Observe: Flashing Amber light VZL-S12-C (POV-S12-Closed) located on VCS-S12 changes to solid Amber.

OK FEB 1 1972 Jay

3.1.33.13 Observe: Amber light VGL-S12-C located on S-10 Graphic Panel. Adjacent to freeze vent symbol on

OK FEB 1 1972 Jay

3.1.33.14 Place drain-off-fill switch MMS-S12-C to Fill position.

OK FEB 1 1972 Jay

3.1.33.15 Observe: POV-S12-C will open. Verify visually at valve.

OK FEB 1 1972 Jay

3.1.33.16 Observe: Amber lights VZL-S12-C and VGL-S12-C Off

OK FEB 1 1972 Jay

3.1.33.17 Observe Green lights VZL-S12-C (POV-S12-C OPEN) and VGL-S12-C on

OK FEB 1 1972 Jay

3.1.33.18 Adjust TS-S12-C1 (TS-3) to disable VTY-S12-C1.

OK FEB 1 1972 Jay

OK

3.1.33.19 Observe: POV-S12-C Closes. Verify visually at valve.

OK FEB 14 1972 Jay

3.1.33.20 Observe: Green lights VZL-S12 B and VGL-S12-C (POV-S12-C Open) off.

OK FEB 14 1972 Jay

3.1.33.21 Observe: Amber lights VZL-S12-C and VGL-S12-C (POV-S12-C Closed) on.

OK FEB 14 1972 Jay

3.1.33.22 Adjust TS-S12-C1 (TS-3) to enable VTY-S12-C1.

OK FEB 14 1972 Jay

3.1.33.23 Observe - Steps 3.1.33.12, 3.1.33.13, and 3.1.33.14 will reoccur.

OK FEB 14 1972 Jay

3.1.33.24 Place Drain-Off-Fill switch MMS-S12-C in off position.

OK FEB 14 1972 Jay

3.1.33.25 Observe: Steps 3.1.33.16, 3.1.33.17 and 3.1.33.18 will reoccur.

OK FEB 14 1972 Jay

3.1.33.26 Adjust TS-S12-C3 (TS-4) to enable VTY-S12-C3.

OK FEB 14 1972 Jay

3.1.33.27 Observe: (G) light TGL-S12-C located adjacent to Freeze Vent symbol is on. (Lower section of freeze vent at 400°F)

OK FEB 14 1972 Jay

3.1.33.28 Place Drain-Off-Fill MMS-S12-C switch to Drain position.

OR FEB 14 1972 Jay

3.1.33.29 Observe: Valve POV-S12-C opens.

OR FEB 14 1972 Jay

3.1.33.30 Observe: Steps 3.1.33.13, 3.1.33.14 reoccur.

OR FEB 14 1972 Jay

3.1.33.31 Place Drain-Off-Fill switch MMS-S12-C to off.

OR FEB 14 1972 Jay

3.1.33.32 Adjust TS-S12-C2 (TS5) until Amber light VZL-S12-C flashes.

OR FEB 14 1972 Jay

3.1.34 Pump Controls

3.1.34.1 Place VCS-S12-B2 key lock in Normal position.

OR 2/15/72 Jay

3.1.34.2 Place switch VCS-S12-B in Close position.

OR 2/15/72 Jay

3.1.34.3 Adjust TS-S12-B (TS-2) to enable relay VTY-S12-B

OR 2/15/72 Jay

2/15/72

3.1.34.4 Observe: Red flashing light VZL-S12-B changes to solid Red.
(POV-S12-B closed)

OR FEB 1 1972 Jay

3.1.34.5 Observe: Red light VGL-S12-B On.

OR FEB 1 1972 Jay

3.1.34.6 Place VCS-S12-B2 key lock in override position and depress
VCS-S12-B - Open switch.

OR FEB 1 1972 Jay

3.1.34.7 Observe: Valve POV-S13-B Opens.

OR FEB 1 1972 Jay

3.1.34.8 Observe: Red lights VZL-S12-B and VGL-S12-B Off

OR FEB 1 1972 Jay

3.1.34.9 Observe: Green lights VZL-S12-B and VGL-S12-B On

OR FEB 1 1972 Jay

3.1.34.10 Place Normal-Override switch VCS-S12-B2 in Normal position.

OR FEB 1 1972 Jay

3.1.34.11 Observe: Red lights VZL-S12-B and VGL-S12-B On

OR FEB 1 1972 Jay

3.1.34.12 Hold switch VCS-S12-B "OPEN" on and momentarily depress pump
on switch (PB-S15-A)

Caution: Pump on switch on only as long as necessary.

OR FEB 1 1972 Jay

406
JKB

3.1.34.13 Observe: Steps 3.1.34.7, 8 & 9 reoccur.

OK FEB 17 1972 Jay

3.1.35 Pump Circuitry Test

3.1.35.1 Adjust temperature indicating switch T15-S15 low alarm set point pot to enable Y-S15-A1.

OK FEB 17 1972 Jay

3.1.35.2 Observe: Annunciator light labeled EMP-S15 throat temp # on

OK FEB 17 1972 Jay

3.1.35.3 Observe: Red lights TGL-S15-located on S 10 Graphic Panel, L-S15-M located on FMC-S15 module and TIS-S15 on temp indicating switch on

OK FEB 17 1972 Jay

3.1.35.4 Disengage circuit breakers CKT 19, CKT 21.

OK FEB 17 1972 Jay

3.1.35.5 Observe:: Annunciator light labeled EMP-S15 C/B tripped On

OK FEB 17 1972 Jay

3.1.35.6 Engage circuit breakers & reset annunciator.

OK FEB 17 1972 Jay

3.1.35.7 Observe: Annunciator light EMP-S15 CB tripped off

OK FEB 17 1972 Jay

(420 023) JKB

3.1.35.8 Repeat item 3.1.35.4

OK FEB 1 1972 Jay

3.1.35.9 Depress "pump on" switch PB-S15-A

OK FEB 1 1972 Jay

3.1.35.10 Observe: Green "pump on" light L-S15-B located on FMC-S15 module on.

OK FEB 1 1972 Jay

3.1.35.11 Observe: Red "pump off" light L-S15-C located on FMC-S15 module off.

OK FEB 1 1972 Jay

3.1.35.12 Hold "pump on" switch on and adjust temp indicating switch TIS-S15 High Alarm setpoint pot to enable point.

OK FEB 1 1972 Jay

3.1.35.13 Observe: Green pump on light will change state from on to off

OK FEB 1 1972 Jay

3.1.35.14 Return high alarm set point to original setting.

OK FEB 1 1972 Jay

3.1.35.15 Adjust flow switch FSH-S15A (TS 6) to enable relay Y-S15-A6.

OK FEB 1 1972 Jay

OK

3.1.35.16 Observe: Annunciator light FAH-S15A labeled MFM-S15-A
Hi Flow on

OK FEB 17 1972 Jay

3.1.35.17 Observe: Red light L-S15 G located on FMC-S15 module
and labeled MFM-S15-A Hi Flow on

OK FEB 17 1972 Jay

3.1.35.18 Observe: (G) light FGL-S15-A labeled MFM-S15-A normal
flow and located on Graphic panel off

OK FEB 17 1972 Jay

3.1.35.19 Observe: (R) light FGL-S15-A labeled MFM-S15-A Hi or Low
Flow and located on Graphic panel on

OK FEB 17 1972 Jay

3.1.35.20 Observe: (A) light L-S15-F labeled MFM-S15-A Lo Flow located
on FMC-S15 module off

OK FEB 17 1972 Jay

3.1.35.21 Reset: TS 6 to disable Y-S15-A6.

OK FEB 17 1972 Jay

3.1.35.22 Observe: All low flow indicators listed in 3.1.35.16, 17, 18,
19 and 20 off

OK FEB 17 1972 Jay

3.1.35.23 Adjust flow switch FS L-S15-B (TS-7) to enable relay Y-S15-A7.

OK FEB 17 1972 Jay

OK.

3.1.35.24 Observe: Annunciator light - FAL-S15-A labeled MFM-S15-A
"Inlet Flow Low" on

OR FEB 15 1972 Jay

3.1.35.25 Observe: (A) light L-S15-F located on FMC-S15 module and
labeled MFM-S15-A low Flow on

OR FEB 15 1972 Jay

3.1.35.26 Observe: (G) normal flow light MFM-S15-A off

OR FEB 15 1972 Jay

3.1.35.27 Observe: Red Hi or Low Flow light on

OR FEB 15 1972 Jay

3.1.35.28 Adjust TS 7 until relay is disenabled.

OR FEB 15 1972 Jay

JKB.

3.1.36 Valve Checkout

3.1.36.1 Adjust TS-S18-A (TS-8) to enable relay VTY-S18-A.

OK FEB 13 1972 Jay

3.1.36.2 Observe: (A) light VZL-S18-A- labeled MOV-S18-A closed and located on VCS-S18-A changed from flashing to solid as relay was enabled.

OK FEB 13 1972 Jay

3.1.36.3 Observe: (A) light VGL-S18-A on Graphic Panel on

OK FEB 13 1972 Jay

3.1.36.4 Hold VCS-S18-A in the open position.

OK FEB 13 1972 Jay

3.1.36.5 Observe: Meter VZI-S18-A will indicate a change in amount of valve opening.

OK FEB 13 1972 Jay

3.1.36.6 Observe: (G) light VZL-S18-A located on VCS-S18-A module on (light is only off in fully closed position).

OK FEB 13 1972 Jay

3.1.36.7 Observe: (G) light VGL-S18-A on

OK FEB 13 1972 Jay

3.1.36.8 Hold VCS-S18-A in the closed position.

OK FEB 13 1972 Jay

3.1.36.9 Observe: Meter indication decreases.

OK FEB 18 1972 Jay

3.1.36.10 Observe: At fully closed position the Amber closed lights come on and the Green open lights turn off.

OK FEB 18 1972 Jay

3.1.36.11 Adjust TS-8 to its initial position.

OK FEB 18 1972 Jay

3.1.36.12 Adjust TS-S18-B (TS-9) to enable relay VTY-S18-B

OK FEB 18 1972 Jay

3.1.36.13 Observe: (A) light VZL-S18-B labeled MOV-S18-B closed and located on VCS-S18-B changed from flashing to solid as relay was enabled.

OK FEB 18 1972 Jay

3.1.36.14 Observe: (A) light VGL-S18-B on Graphic panel on

OK FEB 18 1972 Jay

3.1.36.15 Hold VCS-S18-B in the open position.

OK FEB 18 1972 Jay

3.1.36.16 Observe: Meter VZI-S18-B will indicate a change in the amount of valve opening.

OK FEB 18 1972 Jay

JAY

3.1.36.17 Observe (G) light VZL-S18-B located on VCS-S18-B module
on. (Light is only off in fully closed position)

OK FEB 10 1972 Jay

3.1.36.18 Observe: (G) light VGL-S18-B on

OK FEB 10 1972 Jay

3.1.36.19 Hold VCS-S18-B in the closed position.

OK FEB 10 1972 Jay

3.1.36.20 Observe Meter indication decreases.

OK FEB 10 1972 Jay

3.1.36.21 Observe: At fully closed position the Amber closed lights come
on and the (G) open lights turn off.

OK FEB 10 1972 Jay

3.1.36.22 Adjust TS-9 to its initial position.

OK FEB 10 1972 Jay

JKH

3.2 System Test S-20 Plutting Temperature Indicator

3.2.1 (W) light S20-A1 on HTGP on from previous test of S-10 system.

OR FEB 10 1972 Jay

3.2.2 Set M-0-A switch on TC 20-A1 to auto.

OR FEB 10 1972 Jay

3.2.2.1 Observe: (W) light S-20-A1 on HTGP changes to (A).

OR FEB 10 1972 Jay

3.2.2.2 Observe: IN 15 ± 10 min (A) light S 20-A1 on HTGP changes to (G)

OR FEB 10 1972 Jay

3.2.2.3 Observe: (W) light S 20-A2 on HTGP on

OR FEB 10 1972 Jay

3.2.2.4 Observe: (W) light on TC 20-A2 on

OR FEB 10 1972 Jay

3.2.3 Set M-0-A switch on TC 20-A2 to Auto

OR FEB 10 1972 Jay

3.2.3.1 Observe: (W) light S 20-A2 on HTGP changes to (A)

OR FEB 10 1972 Jay

3.2.3.2 Observe: In 15 ± 10 min (A) light S 20-A2 on HTGP changes to (G)

OR FEB 10 1972 Jay

- 3.2.4 Set MOV-S21 temp switch TS-S21 (TS-1) to enable VTY-S21-(Red valve closed light VZL-S21 will change from flashing to solid on)

OK 2/15/72 Jay

- 3.2.5 Hold VCS-S21-switch in the open position until (W) light S20-A3 on.

OK 2/15/72 Jay

- 3.2.6 Hold VCS-S21 in close position until valve is closed.

OK FEB 18 1972 Jay

- 3.2.6.1 Observe: (W) light on TC 20-A3 on

OK FEB 18 1972 Jay

- 3.2.7 Set M-O-A switch on TC 20-A3 to Auto.

OK FEB 18 1972 Jay

- 3.2.7.1 Observe: (W) light S 20-A3 on HTGP changes to (A)

OK FEB 18 1972 Jay

- 3.2.7.2 Observe: In 15 ± 10 min (A) light S20-A3 on HTGP changes to (G)

OK FEB 18 1972 Jay

- 3.2.7.3 Observe: White light S 20-B1 on HTGP on (from previous drawer test)

OK FEB 18 1972 Jay

JAY.

3.2.7.4 Observe: (W) light on TC 20-B1 on.

OK FEB 10 1972 Jay

3.2.8 Set M-0-A switch on TC 20-B1 to auto.

OK FEB 10 1972 Jay

3.2.8.1 Observe: (W) light S 20-B1 on HTGP change to (A)

OK FEB 10 1972 Jay

3.2.8.2 Observe: In 15 ± 10 min (A) light S 20-B1 on HTGP changes to (G)

OK FEB 10 1972 Jay

3.2.8.3 Observe: (W) light S 20-B2 on HTGP on

OK FEB 10 1972 Jay

3.2.8.4 Observe: (W) light on TC 20-B2 on

OK FEB 10 1972 Jay

3.2.9 Set M-0-A switch on TC 20-B2 to Auto

OK FEB 10 1972 Jay

3.2.9.1 Observe: (W) light S 20-B2 on HTGP changes to (A)

OK FEB 10 1972 Jay

3.2.9.2 Observe: In 15 ± 10 min (A) light S 20-B2 on HTGP changes to (G)

OK FEB 10 1972 Jay

OK

3.2.9.3 Observe: TIMC S24 Enabled.

OK 2/13/72 Jay

3.2.10 VCS-S21 Check Out

3.2.10.1 Observe: Red light VZL-S21 located on VCS-S21 is on.

OK FEB 1 1972 Jay

3.2.10.2 Observe: (R) light VGL-S21 on Graphic Panel on.

OK FEB 1 1972 Jay

3.2.11 Hold switch VCS-S21 in the open position.

OK FEB 1 1972 Jay

3.2.11.1 Observe: Valve MOV-S21 opens.

OK FEB 1 1972 Jay

3.2.11.2 Observe: Valve position meter VZI-S21 indicates valve position.

OK FEB 1 1972 Jay

3.2.11.3 Observe: Red valve closed light VZL-S21 on VCS-21 module off.

OK FEB 1 1972 Jay

3.2.11.4 Observe: Green valve open light VZL-S21 on VCS-21 module on.

OK FEB 1 1972 Jay

3.2.11.5 Observe: Red light VGL-S21 on Graphic Panel off.

OK FEB 1 1972 Jay

OK
QC
023

3.2.11.6 Observe: Green light VGL-S21 on Graphic Panel on

OK FEB 1 1972 Jay

3.2.12 Hold switch VCS-S21 in the close position.

OK FEB 1 1972 Jay

3.2.12.1 Observe: Meter VZI-S21 indication decreases.

OK FEB 1 1972 Jay

3.2.12.2 Green valve open lights off.

OK FEB 1 1972 Jay

3.2.12.3 Red valve closed lights on.

OK FEB 1 1972 Jay

3.2.13 Return TS-S21 (TS-1) to a disabled condition.

OK FEB 1 1972 Jay

3.2.14 Blower Control BC-S23

3.2.15 Place BCS-S23 in the on position.

OK FEB 1 1972 Jay

3.2.16 Adjust Hi and Low Limit set pots to enable relay BCY-S23-C

OK FEB 1 1972 Jay

JAY

3.2.16.1 Observe: When relay BCY-S23-C is enabled Amber light BLL-S23 on BC-S23 module and Red push button light BSL-S23 (blower off) on BC-S23 module till turn off.

OK FEB 1 1972 Jay

3.2.16.2 Observe (G) lights BLL-S23-1, Hi Limit Set and BSL-S23-2 Blower on switch on BC-S23 module on.

OK FEB 1 1972 Jay

3.2.16.3 Observe: Plugging Meter blower on. (Note air exhaust.)

OK FEB 1 1972 Jay

3.2.17 Place damper motor switch in closed position.

OK FEB 1 1972 Jay

3.2.17.1 Observe air exhaust decrease.

OK FEB 1 1972 Jay

3.2.17.2 Observe: Red damper closed light FZL-S24 on (located on Module FIC-S24 on FIC-S24)

OK FEB 1 1972 Jay

3.2.17.3 Observe: Green damper open light off (located on Module FIC S24)

OK FEB 1 1972 Jay

JKH.

3.2.20.2 VCS-S25 on.

OK FEB 1 1972 Jay

3.2.21 Place TIC-S24 on controller TIC-S24 on.

OK FEB 1 1972 Jay

3.2.21.1 Observe Red light TAL-S24-B off.

OK FEB 1 1972 Jay

3.2.21.2 Observe: Red light TAL-S24-A on.

OK FEB 1 1972 Jay

3.3 System test of S-40 Oxygen Meter Module

3.3.1 Lights S-40-A1 and S-40-B1 on HTGP will be on (white) from previous drawer test. (S10)

OK FEB 1 1972 Jay

3.3.2 Set M-0-A switch on TC 40-A1 to auto.

OK FEB 1 1972 Jay

3.3.2.1 Observe: (W) light S-40-A1 on HTGP change to (A).

OK FEB 1 1972 Jay

3.3.2.2 Observe: In 15 ± 10 min the (A) light S-40-A1 on HTGP changes to (G)

OK FEB 1 1972 Jay

3.3.2.3 Observe: (W) light S-40-A2 on HTGP on.

OK FEB 1 1972 Jay

OK

3.3.2.4 Observe: (W) light on TC 40-A2 on.

OK FEB 10 1972 Jay

3.2.3 Set M-O-A switch on TC 40-A2 to Auto.

OK FEB 10 1972 Jay

3.2.3.1 Observe: (W) light S-40-A2 on HTGP changes to (A)

OK FEB 10 1972 Jay

3.2.3.2 Observe: In 15 ± 10 min (A) light S 40-A2 on HTGP changes to (G)

OK FEB 10 1972 Jay

3.3.3.3 Observe: (W) light S-40-A3 on HTGP on.

OK FEB 10 1972 Jay

3.3.3.4 Observe: (W) light on TC 40-A3 on.

OK FEB 10 1972 Jay

3.3.4 Set M-O-A switch on TC 40-AC to Auto.

OK FEB 10 1972 Jay

3.3.4.1 Observe: (W) light S 40-A3 on HTGP changes to (A).

OK FEB 10 1972 Jay

3.3.4.2 Observe: In 15 ± 10 min (A) light S-40-A3 on HTGP changes to (G)

OK FEB 10 1972 Jay

OK

3.3.5 Set M-O-A switch on TCA-40-B1 to Auto.

OK FEB 13 1972 Jay

3.3.5.1 Observe: (W) light S-40-B1 on HTGP changes to (A)

OK FEB 13 1972 Jay

3.3.5.2 Observe: In 15 ± 10 min (A) light S-40-B1 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.3.5.3 Observe: (W) light on TC 40-B2 is on.

OK FEB 13 1972 Jay

3.3.5.4 Observe: (W) light on TC 40-B2 is on.

OK FEB 13 1972 Jay

3.3.6 Set M-O-A switch on TC 40-B2 to Auto.

OK FEB 13 1972 Jay

3.3.6.1 Observe: (W) light S-40-B2 on HTGP changes to (A).

OK FEB 13 1972 Jay

3.3.6.2 Observe: In 15 ± 10 min (A) light S-40-B2 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.3.6.3 Observe: (W) light S-40-A4 on HTGP on.

OK FEB 13 1972 Jay

3.3.6.4 Observe: (W) light on TC 40-A4 on.

OK FEB 10 1972 Jay

3.3.7 Set M-O-A switch on TC 40-A4 to Auto.

OK FEB 10 1972 Jay

3.3.7.1 Observe: (W) light S-40-A4 on HTGP changes to (A)

OK FEB 10 1972 Jay

3.3.7.2 Observe: In 15 ± 10 min (A) light S-40-A4 on HTGP changes to (G)

OK FEB 10 1972 Jay

3.3.7.3 Observe: (W) lights S-40-C1 and S-40-D1 on HTGP on.

OK FEB 10 1972 Jay

3.3.7.4 Observe: (W) lights on TC 40-C1 and TC 40-D1 on.

OK FEB 10 1972 Jay

3.3.8 Set M-O-A switch on TC 40-C1 to Auto.

OK FEB 10 1972 Jay

3.3.8.1 Observe: (W) light S-40-C1 on HTGP changes to (A).

OK FEB 10 1972 Jay

3.3.8.2 Observe: In 15 ± 10 min. (A) light S40-J on HTGP changes to (G)

OK FEB 10 1972 Jay

OK

3.3.8.3 Observe: (W) light S 40-C2 on HTGP on.

FEB 18 1972

Jay

3.3.8.4 Observe: (W) light on TC 40-C2 on.

FEB 18 1972

Jay

3.3.9 Set M-O-A switch on TC 40-C2 to Auto.

FEB 18 1972

Jay

3.3.9.1 Observe: (W) light S 40-C2 on HTGP changes to (A)

FEB 18 1972

Jay

3.3.9.2 Observe: In 15 ± 10 min (A) light S 40-C2 changes to (G)

FEB 18 1972

Jay

3.3.10 Set M-O-A switch on TC 40-D1 to Auto.

FEB 18 1972

Jay

3.3.10.1 Observe: (W) light S 40-D1 on HTGP changes to (A)

FEB 18 1972

Jay

3.3.10.2 Observe: In 15 ± 10 min (A) light S 40-D1 on HTGP changes to (G)

FEB 18 1972

Jay

3.3.10.3 Observe: (W) light S 40-S43 on HTGP on.

FEB 18 1972

Jay

J.K.S.

3.3.10.4 Observe: (W) light on TC 40-43 on.

OK FEB 10 1972 Jay

3.3.11 Set M-O-A switch on TC 4043 to Auto.

OK FEB 10 1972 Jay

3.3.11.1 Observe: (W) light S 40-S 43 on HTGP change to (A)

OK FEB 10 1972 Jay

3.3.11.2 Observe: In 15 ± 10 min (A) light S 40-S 43 on HTGP changes to (G)

OK FEB 10 1972 Jay

3.3.11.3 Observe: (W) light S40-D2 on HTGP on.

OK FEB 10 1972 Jay

3.3.11.4 Observe: (W) light on TC 40-D2 on.

OK FEB 10 1972 Jay

3.3.12 Set M-O-A switch on TC 40-D2 to Auto.

OK FEB 10 1972 Jay

3.3.12.1 Observe: (W) light S 40-D2 on HTGP changes to (A)

OK FEB 10 1972 Jay

3.3.12.2 Observe: In 15 ± 10 min (A) light S 40-D2 changes to (G)

OK FEB 10 1972 Jay

3.3.13 Check out of Module FMC-41

OK FEB 1 1972 Jay

3.3.14 Adjust TS-S41 to enable VTY-S41

OK FEB 1 1972 Jay

3.3.14.1 Observe: As relay is enabled the flashing state of (A) light VZL-S41-A (mod) will change to a solid state.

OK FEB 1 1972 Jay

3.3.14.2 Observe: (A) light VGL-S41 (G.P) on.

OK FEB 1 1972 Jay

3.3.15 Engage valve MOV-S41 open-off close switch FMC-41 to the open position.

OK FEB 1 1972 Jay

3.3.15.1 Observe: Valve FMC-41 opens - visual indication of valve.

OK FEB 1 1972 Jay

3.3.15.2 Observe: A positive meter indication on meter VZI-S41.

OK FEB 1 1972 Jay

3.3.15.3 Observe: (A) lights VZL-S41 (mod) and VGL-S41 (G.P) off.

OK FEB 1 1972 Jay

3.3.15.4 Observe: (G) lights VAL-S41 (mod) and VGL-S41 (GP) on.

OK FEB 1 1972 Jay

(OK) JKH.

3.3.16 Engage valve MOV-S41 open-off-close switch FMC-41 to the close position.

LR FEB 1 1972 Jay

3.3.16.1 Observe: Indication on meter VZI-S41 decreases.

LR FEB 1 1972 Jay

3.3.16.2 Observe: Valve MOV-S41 closes - Visual indication at valve.

LR FEB 1 1972 Jay

3.3.16.3 Observe: When valve is fully closed Green lights VZL-S41 (mod) and VGL-S41 (GP) off.

LR FEB 1 1972 Jay

3.3.16.4 Observe: (A) lights VZL-S41 (mod) and VGL-S41 (GP) on

LR FEB 1 1972 Jay

3.3.17 Reset TS-S41 to initial setting.

LR FEB 1 1972 Jay

3.3.17.1 Observe: (A) light VZL-S41 resumes its flashing state.

LR FEB 1 1972 Jay

3.3.18 Engage cooler blower switch BCS-S41 to on position.

LR FEB 1 1972 Jay

3.3.18.1 Observe: Cooler blower on - visual/tactile indication at blower.

LR FEB 1 1972 Jay

3.3.18.2 Observe: (G) light VZL-S41 (switch) on.

OK FEB 1 1972 Jay

3.3.18.3 Observe: (R) light VZL-S41 (switch) off

OK FEB 1 1972 Jay

3.3.19 Engage cooler blower switch BCS-S41 to off position.

OK FEB 1 1972 Jay

3.3.19.1 Observe: (G) light VZL-S41 (switch) off

OK FEB 1 1972 Jay

3.3.19.2 Observe: (R) light VZL-S41 (switch) on.

OK FEB 1 1972 Jay

3.3.20 Enable switch TIC-S43 on TIC-S43 controller

OK FEB 1 1972 Jay

3.3.20.1 Observe: (R) light TAL-S43-B off

OK FEB 1 1972 Jay

3.3.20.2 Observe: (R) light TAL-S43-A on.

OK FEB 1 1972 Jay

3.3.20.3 Observe: TIC-S43 reads $85^{\circ} \pm 5^{\circ}$ input from JC-S43

OK 2/15/71 FEB 1 1972 Jay

3.3.21 Reset switch TIC-S43 to its initial position.

(QC 5) OK

OK 2/15/71 FEB 1 1972 Jay

3.3.21.1 Observe: (R) light TAL-S43-B on

OK FEB 1 1972 Jay

3.3.21.2 Observe: Red light TAL-S43-A off

OK FEB 1 1972 Jay

3.3.22 TIS-S44 Checkout

3.3.22.1 Adjust TS-S44-A to enable relay BCY-S44-B

OK FEB 1 1972 Jay

3.3.22.2 Place switch TCS-S44 in the oxygen cell #1 position

OK FEB 1 1972 Jay

3.3.22.2.1 Observe: Indication of temperature on PM-S44, oxygen cell temperature meter.

OK FEB 1 1972 Jay

3.3.22.2.2 Observe: (R) light TAL-S44-B on

OK FEB 1 1972 Jay

3.3.22.2.3 Observe: (R) light TAL-S44-A off

OK FEB 1 1972 Jay

3.3.22.3 Adjust TS-344-B to enable relay BCY-S44-A.

OK FEB 1 1972 Jay

3.3.22.3.1 Observe Red light TAL-S44-A on

OK FEB 1 1972 Jay

3.3.22.4 Place switch TCS-S44 in the oxygen cell #2 position.

OK FEB 1 1972 Jay

3.3.22.4.1 Observe: Indication of temp on meter PM-S44

OK FEB 1 1972 Jay

3.3.22.5 Reset TS-S44-A & TS-S44-B to initial settings.

OK FEB 1 1972 Jay

3.3.22.6 Depress blower switch BCS-S44 to on.

OK FEB 1 1972 Jay

3.3.22.6.1 Observe: Oxygen cell blower by visual & tactile indication

OK FEB 1 1972 Jay

3.3.22.6.2 Observe: (G) light BSL-S44 switch on

OK FEB 1 1972 Jay

3.3.22.6.3 Observe: (R) light BSL-S44 (switch) off

OK FEB 1 1972 Jay

3.3.22.7 Depress blower switch BCS-S44 to off.

OK FEB 1 1972 Jay

3.3.22.7.1 Observe: Blower off. Visual/tactile indication

OK FEB 1 1972 Jay

OK

3.3.22.7.2 (R) light BSL-S44 (switch) on

OR 2/12/72 Jay

3.3.22.7.3 (G) light BSL-S44 (switch) off

OR 2/12/72 Jay

3.4 System Test of the Carbon Meter Module.

3.4.1 Check out of Heat Trace System.

3.4.2 (W) lights S50-A1 and S50-B1 will be on from previous test.

OR FEB 10 1972 Jay

3.4.3 Set M-0-A on TC 50-A1 to Auto.

OR FEB 10 1972 Jay

3.4.3.1 Observe: (W) light S50-A1 on HTGP changes to (A)

OR FEB 10 1972 Jay

3.4.3.2 Observe: In 15 ± 10 min (A) light S 50-A1 on HTGP changes to (G)

OR FEB 10 1972 Jay

3.4.3.3 Observe: (W) light S 50-A2 on HTGP on.

OR FEB 10 1972 Jay

3.4.3.4 Observe: (W) light on TC 50 A-2 on.

OR FEB 10 1972 Jay

3.4.4 Set M-O-A switch on TC 50-A2 to Auto.

WR FEB 13 1972 Jay

3.4.4.1 Observe: (W) light S50-A2 on HTGP changes to (A)

WR FEB 13 1972 Jay

3.4.4.2 Observe: In 15 ± 10 min (A) light S50-A2 on HTGP changes to (G)

WR FEB 13 1972 Jay

3.4.5 Set M-O-A switch on TC 50-B1 to Auto.

WR FEB 13 1972 Jay

3.4.5.1 Observe: (W) light S50-B1 on HTGP changes to (A)

WR FEB 13 1972 Jay

3.4.5.2 Observe: In 15 ± 10 min (A) light S50-B1 on HTGP changes to (G)

WR FEB 13 1972 Jay

3.4.5.3 Observe: (W) light S50-B2 on HTGP on.

WR FEB 13 1972 Jay

3.4.5.4 Observe: (W) light on TC 50-B2 on.

3.4.6 Set M-O-A switch on TC 50-B2 to Auto.

WR FEB 13 1972 Jay

3.4.6.1 Observe: (W) light S 50-B2 on HTGP changes to (A)

OK FEB 18 1972 Jay

3.4.6.2 Observe: In 15 ± 10 min (A) light S 50-B2 on HTGP changes to (G)

OK FEB 18 1972 Jay

3.4.6.3 Observe: (W) light S 50-B3 on HTGP on.

OK FEB 18 1972 Jay

3.4.6.4 Observe: (W) light on TC 50-B3 on.

OK FEB 18 1972 Jay

3.4.7 Set M-0-A switch on TC 50-B3 to Auto.

OK FEB 18 1972 Jay

3.4.7.1 Observe: (W) light S50-B3 on HTGP changes to (A)

OK FEB 18 1972 Jay

3.4.7.2 Observe: In 15 ± 10 min (A) light S50-B3 on HTGP changes to (G)

OK FEB 18 1972 Jay

3.4.8 Adjust TS-S51 to enable relay VTY-S51

OK FEB 18 1972 Jay

3.4.9 Open valve MOV-S51 by placing switch FMC-S51 in the open position.

OK FEB 18 1972 Jay

OK.

3.4.9.1 Observe: (W) light S50-B4 on.

OR FEB 10 1972 Jay

3.4.9.2 Observe: (W) light on TC 50-B4 on.

OR FEB 10 1972 Jay

3.4.10 Close Valve MOV-S51

OR FEB 10 1972 Jay

3.4.11 Reset TS-S51 to initial setting.

OR FEB 10 1972 Jay

3.4.12 Set M-O-A switch on TC 50-B4 to Auto.

OR FEB 10 1972 Jay

3.4.12.1 Observe: (W) light S 50-B4 on HTGP changes to (A).

OR FEB 10 1972 Jay

3.4.12.2 Observe: In 15 ± 10 min (A) light S 50-B4 on HTGP changes to (G)

OR FEB 10 1972 Jay

3.4.12.3 Observe: (W) light S50-C1 on HTGP on.

OR FEB 10 1972 Jay

3.4.12.4 Observe: (W) light on TC 50-C1 on.

OR FEB 10 1972 Jay

3.4.13 Set M-O-A switch on TC 50-C1 to Auto.

LR FEB 13 1972 Jay

3.4.13.1 Observe: (W) light S50-C1 on HTGP changes to (A)

LR FEB 13 1972 Jay

3.4.13.2 Observe: In 15 ± 10 min (A) light S 50-C1 on HTGP changes to (G)

LR FEB 13 1972 Jay

3.4.13.3 Observe: (W) light S50-S56 on HTGP on.

LR FEB 13 1972 Jay

3.4.13.4 Observe: (W) light on TC 50-S56 on.

LR FEB 13 1972 Jay

3.4.14 Set M-O-A switch on TC 50-S56 to Auto.

LR FEB 13 1972 Jay

3.4.14.1 Observe: (W) light S50-S56 on HTGP changes to (A)

LR FEB 13 1972 Jay

3.4.14.2 Observe: In 15 ± 10 min (A) light S50-S56 on HTGP changes to (G)

LR FEB 13 1972 Jay

3.4.14.3 Observe: (W) light on S50-D1 on HTGP on.

LR FEB 13 1972 Jay

JKH.

3.4.13.4 Observe: (W) light on TC 50-S56 on.

OR FEB 18 1972 Jay

3.4.14 Set M-0-A switch on TC 50-S56 to Auto.

OR FEB 18 1972 Jay

3.4.14.1 Observe: (W) light S50-S56 on HTGP changes to (A)

OR FEB 18 1972 Jay

3.4.14.2 Observe: In 15 ± 10 min (A) light S50-S56 on HTGP changes to (G)

OR FEB 18 1972 Jay

3.4.14.3 Observe: (W) light on S50-D1 on HTGP on.

OR FEB 18 1972 Jay

3.4.14.4 Observe: (W) light on TC 50-D1 on.

OR FEB 18 1972 Jay

3.4.15 Set M-0-A switch on TC 50-D1 to Auto.

OR FEB 18 1972 Jay

3.4.15.1 Observe: (W) light S50-D1 on HTGP changes to (A)

OR FEB 18 1972 Jay

3.4.15.2 Observe: In 15 ± 10 min (A) light S50-D1 on HTGP changes to (G)

OR FEB 18 1972 Jay

OK

3.4.15.3 Observe: (W) light S 50-D2 on HTGP on

OK FEB 13 1972 Jay

3.4.15.4 Observe: (W) light on TC 50-D2 on.

OK FEB 13 1972 Jay

3.4.16 Set M-0-A switch on TC 50-D2 to Auto.

OK FEB 13 1972 Jay

3.4.16.1 Observe: (W) light S50-D2 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.4.16.2 Observe: In 15 ± 10 min (A) light S50-D2 on HTGP changes to (G)

OK FEB 13 1972 Jay

3.4.17 Check out of FMC-S51 (*Valves noted in this section are not accessible-
Valve checks only possible if drawer opened.)

3.4.17.1 Adjust TS-S51 to enable relay VTY-S51.

OK FEB 13 1972 Jay

3.4.17.1.1 Observe: When relay VTY-S51 is enabled the flashing state
of (R) light VZL-S51 (mod) is changed to a solid state.

OK FEB 13 1972 Jay

3.4.17.1.2 Observe: (G) lights VZL-S51 (mod) and VGL-S51 (GP) off

OK FEB 13 1972 Jay

JKH.

3.4.17.1.3 Observe: (R) light VGL-S51 (GP) on

WR FEB 11 1972 Jay

3.4.17.2 Open valve MOV-S51 by placing switch FMC-S51 in the open position.

WR FEB 11 1972 Jay

3.4.17.2.1 Observe: Valve MOV-S51 opens - Visual indication at valve.

WR FEB 11 1972 Jay

3.4.17.2.2 Observe: Valve position meter VZI-S51 indicates valve position.

WR FEB 11 1972 Jay

3.4.17.2.3 Observe: (R) lights VZL-S51 (mod) and VGL-S51 (GP) off

WR FEB 11 1972 Jay

3.4.17.2.4 (G) lights VZL-S51 (mod) and VGL-S51 (GP) on

WR FEB 11 1972 Jay

3.4.17.3 Close Valve MOV-S51 by placing switch FMC-S51 in the closed position.

WR FEB 11 1972 Jay

3.4.17.3.1 Observe: Valve position meter VZI-S51 indicates valve closure.

WR FEB 11 1972 Jay

3.4.17.3.2 Observe: (G) lights VZL-S51 (mod) and VGL-S51 (GP) on.

WR FEB 11 1972 Jay

OK.

3.4.17.3.3 Observe: (R) lights VZL-S51 (mod) and VGL-S51 (GP) off.

OR FEB 1 1972 Jay

3.4.17.4 Reset TS-S51 to initial setting.

OR FEB 1 1972 Jay

3.4.17.4.1 Observe: Flashing state of (R) light VZL-S51 (mod) resumes.

OR FEB 1 1972 Jay

3.4.18 Check out of FCS-S55

3.4.18.1 Set oven switch HCS-S54 and probe switch VCS-S55-1 to on position

OR FEB 1 1972 Jay

3.4.18.1.1 Observe: (B) light VZL-S55 off

OR FEB 1 1972 Jay

3.4.18.1.2 Observe: (A) light HIL-S54 off

OR FEB 1 1972 Jay

3.4.18.2 Place over switch HCS-S54 to off position

OR FEB 1 1972 Jay

3.4.18.2.1 Observe: (A) light HIL-S54 on.

OR FEB 1 1972 Jay

R-100

3.4.18.2.2 Observe: (B) light VZL-S55 off

OK FEB 1 1972 jay

3.4.18.2.3 Observe: SOV-S55-4 not enabled.

OK FEB 1 1972 jay

3.4.18.3 Place probe switch VCS-S55-1 to off position.

OK FEB 1 1972 jay

3.4.18.3.1 Observe: (B) light VZL-S55 on

OK FEB 1 1972 jay

3.4.18.3.2 Observe: (A) light HIL-S54 on

OK FEB 1 1972 jay

3.4.18.3.3 Observe: Valve SOV-S55-4 opens. Visual indication at valve. *

OK FEB 1 1972 jay

3.4.18.4 Depress zero switch VCS-S55-4

OK FEB 1 1972 jay

3.4.18.4.1 Observe (Y) light VZL-S55 on.

OK FEB 1 1972 jay

3.4.18.4.2 Observe: Valve SOV-555-1 enabled - Visual indication at valve. *

OK FEB 1 1972 jay

OK.

3.4.18.5 Release zero switch VCS-S55-4

OK FEB 1 1972 Jay

3.4.18.6 Depress calib switch VCS-S55-2

OK FEB 1 1972 Jay

3.4.18.6.1 Observe: (R) light VZL-S55 on.

OK FEB 1 1972 Jay

3.4.18.6.2 Observe: Valve SOV-555-1 enabled. *

OK FEB 1 1972 Jay

3.4.18.6.3 Observe: Valve SOV-555-3 enabled.*

OK FEB 1 1972 Jay

3.4.18.7 Release Calib switch VCS-S55-4

OK FEB 1 1972 Jay

3.4.18.7.1 Observe: (R) light VZL-S55 off.

OK FEB 1 1972 Jay

3.4.18.8 Depress conv. ch, switch VCS-S55-3

OK FEB 1 1972 Jay

3.4.18.8.1 Observe: (G) light VZL-S55 on

OK FEB 1 1972 Jay

OK

3.4.18.8.1 Observe: Valve SOV-555-2 enabled.*

OK FEB 13 1972 Jay

3.4.18.9 Release conv. ck. switch VCS-S55-3

OK FEB 13 1972 Jay

3.4.19 TIC-S56 controller checkout

3.4.19.1 Observe: (R) light on TIC-S56 on and changes position as switch is activated.

OK FEB 13 1972 Jay

3.4.19.2 Observe: Temp indication on controller temp. meter.
Approx. 85°F

OK FEB 13 1972 Jay

3.4.19.3 Place TIC-S56 switch in the man position

OK FEB 13 1972 Jay

3.4.19.4 Turn thumb wheel a small amount to increase temp.

OK FEB 13 1972 Jay

3.4.19.4.1 Observe: Temp increase on TIC S56 meter.

OK FEB 13 1972 Jay

3.4.19.4.2 Observe: Temp increase on TC 50-S56 temp meter.

OK FEB 13 1972 Jay

3.4.19.4.3 Observe: Fault on TC 50S56.

OK FEB 13 1972 Jay

OK

3.4.20.5 Return switch TIC-S56 to s position.

OK FEB 13 1972 Jay

3.4.20.5.1 Observe: Temp decreases on TIC-S56 meter & TC 50S56 meter.

OK FEB 13 1972 Jay

3.5 System Test of Vacuum Distillation/Overflow Sampler - S60

3.5.1 White light S60-A1 on HTGP and White light on TC-60-B1 will be on as a result of the System S-10 test.

OK FEB 13 1972 Jay

3.5.2 Set M-O-A switch on TC 60-A1 to Auto.

OK FEB 13 1972 Jay

3.5.2.1 Observe: White light S60-A1 on HTGP changes to Amber (A)

OK FEB 13 1972 Jay

3.5.2.2 Observe: In 15 ± 10 min. light S-60-A1 on HTGP changes to Green. (G)

OK FEB 13 1972 Jay

3.5.2.3 Observe: White light on controller TC-60-A2 on.

OK FEB 13 1972 Jay

3.5.2.4 Observe: White light S-60-A2 on HTGP on.

OK FEB 13 1972 Jay

OK

3.5.3 Set M-0-A switch on TC 60-A2 to Auto.

OK FEB 1 1972 Jay

3.5.3.1 Observe: White light S 60-A2 on HTGP changes to Amber

OK FEB 1 1972 Jay

3.5.3.2 Observe: In 15 ± 10 min light S 60-A2 on HTGP changes to Green.

OK FEB 1 1972 Jay

3.5.3.3 Observe: (W) light S 60-A3 on HTGP on.

OK FEB 1 1972 Jay

3.5.3.4 Observe: (W) light on TC 60-A3 on

OK FEB 1 1972 Jay

3.5.4 Set M-0-A switch on TC 60-A3 to Auto.

OK FEB 1 1972 Jay

3.5.4.1 Observe: (W) light S 60-A3 on HTGP change to (A)

OK FEB 1 1972 Jay

3.5.4.2 Observe: In 15 ± 10 min (A) light S 60-A3 changes to (G)

OK FEB 1 1972 Jay

3.5.4.3 Observe: (W) light S 60-A4 on HTGP on.

OK FEB 1 1972 Jay

3.5.4.4 Observe: (W) light on TC 60-A4 on

OK FEB 1 1972 Jay

OKB

3.5.5 Set M-O-A on TC 60-A4 to Auto.

WR FEB 1 1972 Jay

3.5.5.1 Observe: (W) lights S 60-A4 on HTGP changes to (A)

WR FEB 1 1972 Jay

3.5.5.2 Observe: In 15 $\pm$ 10 min (A) light S 60-A4 on HTGP changes to (G)

WR FEB 1 1972 Jay

3.5.6 Adjust: TS-S64A to enable Relay VTY-S64A

WR FEB 1 1972 Jay

3.5.6.1 Observe: As relay is enabled the flashing state of (G) light VGL-S65A (GP) will change to a solid state.

WR FEB 1 1972 Jay

3.5.7 Open Valve SOV-S64A by depressing close open switch PBS-S64A3 (open)
(Note: If valve does not engage-disable LLY-S64A, low level detector)

WR FEB 1 1972 Jay

3.5.7.1 Observe: (W) light S60-A5 on HTGP on

WR FEB 1 1972 Jay

3.5.7.2 Observe: (W) light on TC 60A5 on

WR FEB 1 1972 Jay

WR

3.5.8 Close valve SOV-S64A by depressing close/open switch PBS-S64A1 (close)

OK FEB 1 1972 Jay

3.5.8.1 Observe: (G) light VGL-S64A on

OK FEB 1 1972 Jay

3.5.9 Reset TS-S64A to initial setting.

3.5.10 Set M-O-A switch on TC 60A5 to Auto.

OK FEB 1 1972 Jay

3.5.10.1 Observe: (W) light S60-A5 on HTGP change to (A)

OK FEB 1 1972 Jay

3.5.10.2 Observe: (W) light S60-A5 on HTGP change to (A)

OK FEB 1 1972 Jay

3.5.11 Adjust TS-S64B to enable relay VTY-S64B

OK FEB 1 1972 Jay

3.5.11.1 Observe: As relay is enabled flashing state of (G) light VZL-S64B (mod) will change to solid state.

OK FEB 1 1972 Jay

3.5.12 Open valve MOV-S64B by placing switch VCS-S64-B in the open position.

OK FEB 1 1972 Jay

OK

3.5.12.1 Observe: White light S60-A6 on HTGP on.

LR FEB 1 1972 pay

3.5.13 Observe: (W) light on TC 60-A6 on

LR FEB 1 1972 pay

3.5.14 Close Valve MOV-S64-B by placing switch VCS-S64-B in the closed position.

LR FEB 1 1972 pay

3.5.14.1 Observe: (G) light VZL-S64-B (mod) on

LR FEB 1 1972 pay

3.5.15 Set M-O-A switch on TC 60A6 to Auto.

LR FEB 1 1972 pay

3.5.15.1 Observe: (W) light S 60-A6 on HTGP changes to (A)

LR FEB 1 1972 pay

3.5.15.2 In 15 ± 10 min (A) light S60-A6 changes to (G)

LR FEB 1 1972 pay

3.5.16 Set M-O-A switch on TC 60B1 to Auto. (Note: (W) light S60-B1 on from previous drawer test)

LR FEB 1 1972 pay

3.5.16.1 Observe: (W) light S60-B1 on HTGP changes to (A)

LR FEB 1 1972 pay

() OK.

3.5.16.2 Observe: In 15 ± 10 min (A) light S 60-B1 on HTGP changes to (G)

OK FEB 14 1972 jay

3.5.16.3 Observe: (W) light S 60-B2 on HTGP on

OK FEB 14 1972 jay

3.5.16.4 Observe: (W) light on TC 60-B2 on.

OK FEB 14 1972 jay

3.5.17 Set M-0-A switch on TC 60-B2 to Auto.

OK FEB 14 1972 jay

3.5.17.1 Observe: (W) light S60-B2 on HTGP changes to (A)

OK FEB 14 1972 jay

3.5.17.2 Observe: In 15 ± 10 min (A) light S 60-B2 on HTGP changes to (G)

OK FEB 14 1972 jay

3.5.18 Adjust TS-S69B to enable relay VTY-S69-B

OK FEB 14 1972 jay

3.5.18.1 Observe: As relay is enabled the flashing state of (G) light VZL-S69B will change to a solid state.

OK FEB 14 1972 jay

(OK)

3.5.19 Open valve SOV-S69B by depressing switch PB-S69 B (open)

Note: If valve does not open-disable LLY-S69 B (Low level detector)

OR FEB 1 1972 jay

3.5.19.1 Observe: (W) light S60-B3 on HTGP on.

OR FEB 1 1972 jay

3.5.19.2 Observe: (W) light on TC 60B3 on

OR FEB 1 1972 jay

3.5.20 Set M-O-A switch on TC 60B3 to Auto.

OR FEB 1 1972 jay

3.5.20.1 Observe: (W) light S60-B3 on HTGP changes to (A)

OR FEB 1 1972 jay

3.5.21 Close Valve SOV-S69B by depressing switch PB-S69-B closed

OR FEB 1 1972 jay

3.5.22 Reset TS-S69B to its initial setting.

OR FEB 1 1972 jay

3.5.23 Adjust TS-S69A to enable relay VTY-S69-A

OR FEB 1 1972 jay

JKN

3.5.23.1 Observe: As relay is enabled the flashing state of (G) light VZL-S69A will change to a solid state.

OK FEB 14 1972 Jay

3.5.24 Open valve MOV-S69A by placing switch VCS-S69-A in the open position.

OK FEB 14 1972 Jay

3.5.24.1 Observe: (W) light S60-B4 on HTGP on

OK FEB 14 1972 Jay

3.5.24.2 Observe: (W) light on TC 60B4 on

OK FEB 14 1972 Jay

3.5.25 Close Valve MOV-S69A by placing switch VCS-S69A in the close position.

OK FEB 14 1972 Jay

3.5.25.1 Observe: (G) light VZL-S69-A on.

OK FEB 14 1972 Jay

3.5.26 Reset TS-69 A to initial position.

OK FEB 14 1972 Jay

3.5.27 Set M-O-A switch on TC 60-B4 to Auto.

OK FEB 14 1972 Jay

3.5.27.1 Observe: (W) light S60-B4 on HTGP changes to (A)

OK FEB 14 1972 Jay

OK

3.5.27.2 Observe: In 15 ± 10 min (A) light S 60-B4 on HTGP changes to (G)

OK FEB 14 1972 Jcy

3.5.27.3 Observe: (W) light S 60-D1 on HTGP on.

OK FEB 14 1972 Jcy

3.5.27.4 Observe: (W) light on TC 60-D1 on

OK FEB 14 1972 Jcy

3.5.28 Set M-O-A switch on TC 60-D1 to Auto.

OK FEB 14 1972 Jcy

3.5.28.1 Observe: (W) light S 60-D1 on HTGP changes to. (A)

OK FEB 14 1972 Jcy

3.5.28.2 Observe: In 15 ± 10 min (A) light S 60-D1 on HTGP changes to (G)

OK FEB 14 1972 Jcy

3.5.28.3 Observe: (W) light S 60-D2 on HTGP on

OK FEB 14 1972 Jcy

3.5.28.4 Observe: (W) light on TC 60-D2 on

OK FEB 14 1972 Jcy

3.5.29 Set M-O-A switch on TC 60-D2 to Auto.

OK FEB 14 1972 Jcy

3.5.29.1 Observe: (W) light S 60-D2 on HTGP changes to (A)

OK FEB 14 1972 Jay

3.5.29.2 Observe: In 15 ± 10 min (A) light S 60-D2 on HTGP changes to (G)

OK FEB 14 1972 Jay

3.5.29.3 Observe: (W) light S 60-S 68 on HTGP on

OK FEB 14 1972 Jay

3.5.29.4 Observe: (W) light on TC 60-S68 on

OK FEB 14 1972 Jay

3.5.30 Set M-O-A switch on TC 60-S68 to Auto

OK FEB 14 1972 Jay

3.5.30.1 Observe: (W) light S 60-S68 on HTGP changes to (A)

OK FEB 14 1972 Jay

3.5.30.2 Observe: In 15 ± 10 min. (A) light S 60-S68 on HTGP changes to (G)

OK FEB 14 1972 Jay

3.5.31 Enable controller TIC-S67 to close alarm contacts.

OK FEB 14 1972 Jay

3.5.31.1 Observe: (W) light on S60-C1 on HTGP on

OK FEB 14 1972 Jay

3.5.31.2 Observe: (W) light on TC 60-C1 on

OK

OK FEB 14 1972 Jay

3.5.32 Set M-O-A switch on TC 60-C1 to Auto.

OK FEB 14 1972 Jay

3.5.32.1 Observe: (W) light S60-C1 on HTGP change to (A)

OK FEB 14 1972 Jay

3.5.32.2 Observe: In 15 ± 10 min (A) light S60-C1 on HTGP changes to (G)

OK FEB 14 1972 Jay

3.5.32.3 Observe: (W) light S 60-C2 on HTGP on

OK FEB 14 1972 Jay

3.5.32.4 Observe: (W) light TC 60-C2 on

OK FEB 14 1972 Jay

3.5.33 Set M-O-A switch on TC 60-C2 to Auto.

OK FEB 14 1972 Jay

3.5.33.1 Observe: (W) light S 60-C2 on HTGP changes to (A)

OK FEB 14 1972 Jay

3.5.33.2 Observe: In 15 ± 10 min (A) light S 60-C2 changes to (G)

OK FEB 14 1972 Jay

3.5.34 Checkout of PIC-S60 Module

3.5.34.1 Engage switch PCS-S60 to start position.

OK 2/23/71 Jay
OK

3.5.34.1.1 Observe: Motor PM-S60 on. Visual indication at motor.

OK 2/23/71 *Jay*

3.5.34.1.2 Observe: (R) light VZL-S60 (switch) on

OK 2/23/71 *Jay*

3.5.34.1.3 Observe: (R) light VGL-S60 (GP) on

not applicable - Jay

3.5.34.1.4 Observe: (G) lights VZL-S60 (switch) and ^(n.a. Jay) VGL-S60 (GP) off.

OK 2/23/71 *Jay*

3.5.34.1.5 Observe: Pressure change on P.I. gage.

3.5.34.2 Place switch PCS-S60 in stop position.

OK 2/23/72 *Jay*

3.5.34.2.1 Observe: (G) lights VZL-S60 (switch) and ^(n.a. Jay) VGL-S60 (GP) on

OK 2/23/72 *Jay*

3.5.34.2.2 Observe: (R) lights VZL-S60 (switch) and ^(n.a. Jay) VGL-S60 (GP) off

OK 2/23/72 *Jay*

OK

3.5.35 Checkout of PIC-S61

3.5.35.1 Place switch VCS-S61 in the open position.

OK 2/23/72 Jay

3.5.35.1.1 Observe: Valve - MOV-S61 opens. Visual indication at valve.

OK 2/23/72 Jay

3.5.35.1.2 Observe: Indication of valve movement on valve position meter.

OK 2/23/72 Jay

3.5.35.1.3 Observe: If argon system has been enabled there will be a pressure indication of P.I. gage.

Not applicable - Jay

3.5.36 Checkout of VCS-S62-A

3.5.36.1 Observe (G) lights VGL-S63-A (GP) and VZL-S62-A (switch) on

OK FEB 11 1972 Jay

3.5.36.2 Place switch VCS-S62-A in the open position.

OK FEB 11 1972 Jay

3.5.36.2.1 Observe: (G) lights VGL-S62-A (GP) and VZL-S63-A (switch) off.

OK FEB 11 1972 Jay

3.5.36.2.2 Observe: (R) lights VZL-S60-A (switch) and VGL (GP) on

OK FEB 11 1972 Jay

OK

3.5.37 Checkout of VCS-S62-B

3.5.37.1 Observe (G) lights VGL-S62-B (GP) and VZL-S63-B (sw) on

OK 2/23/72 Jay

3.5.37.2 Place switch VCS-S62 B in the open position.

OK 2/23/72 Jay

3.5.37.2.1 Observe: (G) lights VGL-S62-B (GP) and VZL-S62-B (sw) off

OK 2/23/72 Jay

3.5.37.2.2. Observe: Red lights VGL-S62-B (GP) and VZL-S62 B (sw) on

OK 2/23/72 Jay

3.5.37.3 Place switch VCS-S62-B in the close position.

OK 2/23/72 Jay

3.5.37.3.1 Observe: (G) lights VZL-S62-B (switch) & VGL-S62-B (GP) on

OK 2/23/72 Jay

3.5.37.3.2 Observe: (R) Lights VZL-S62-B (sw) & VGL-S62-B (GP) off

OK 2/23/72 Jay

3.5.38 Checkout of PIC-S63. Note: With vacuum system enabled and valve SOV-S63 open - Gage PIC-S63 indicates

OK 2/23/72 Jay

OK

3.5.38.1 Adjust TS-S63 to enable relay VTY-S63

OK FEB 1 1972 Jay

3.5.38.1.1 Observe: When relay VTY-S63 is enabled flashing state of (G) light VZL-S63 changes to solid state.

OK FEB 1 1972 Jay

3.5.38.2 Open POV-S63 by depressing Switch VCS-S63 open

OK FEB 1 1972 Jay

3.5.38.2.1 Observe: POV-S63 opens - Visual indication at valve.

OK FEB 1 1972 Jay

3.5.38.2.2 Observe: (G) lights VZL-S63 (switch) and VGL-S63 (GP) off

OK FEB 1 1972 Jay

3.5.38.2.3 Observe: (R) lights VZL-S63 (switch) and VGL-S63 (GP) on

OK FEB 1 1972 Jay

3.5.38.2.4 Meter PIC-S63 indicates

OK FEB 1 1972 Jay

3.5.38.3 Close POV-S63 by depressing VCS-S63. Close

OK FEB 1 1972 Jay

3.5.38.3.1 Observe: Meter PIC-S65 indication returns to zero.

OK FEB 1 1972 Jay

JKS.

3.5.38.3.2 Observe: (R) light VGL-S63 (G.P.) and VZL-S63 (switch) off

OK FEB 17 1972 Jay

3.5.38.3.3 Observe: (G) light VGL-S63 (GP) and VZL-S63 (switch) on

OK FEB 17 1972 Jay

3.5.38.4 Reset TS-S63 to initial setting

OK FEB 17 1972 Jay

3.5.38.4.1 Observe: (G) light VZL-S63 resumes flashing state.

OK FEB 17 1972 Jay

3.5.39 Checkout of VCS-S64-A

3.5.39.1 Adjust TS-S64 A to enable VTY-S64-A

OK FEB 17 1972 Jay

3.5.39.1.1 Observe: When relay VTY-S64-A is enabled flashing state of (G) light VGL-S64-A changes to solid state.

OK FEB 17 1972 Jay

3.5.39.2 Open valve - SOV-S64-A by depressing switch PBS-S64-A2 (Note: if valve does not open disable LLY-S64-A - low level indicator

OK FEB 17 1972 Jay

3.5.39.2.1 Observe: (G) light VGL-S64-A (GP) off

OK FEB 17 1972 Jay

OK

3.5.39.2.2 Observe: (R) light VGL-S64 A (GP) on

LR FEB 1 1972 Jay

3.5.39.3 Close Valve SOV-S64-A by depressing switch PBS-S64-A1 close

LR FEB 1 1972 Jay

3.5.39.3.1 Observe: Valve SOV-S64 A closes

LR FEB 1 1972 Jay

3.5.39.3.2 Observe: (G) light VGL-S64 A (GP) on

LR FEB 1 1972 Jay

3.5.39.3.3 Observe: (R) light VGL-S64-A (GP) off

LR FEB 1 1972 Jay

3.5.39.4 Depress switch PBS-S64 A3 (Auto)

LR FEB 1 1972 Jay

3.5.39.4.1 Observe: (A) light VZL-S64-A (switch) on

LR FEB 1 1972 Jay

3.5.39.4.2 Observe: (G) light VGL-S64 A (GP) off

LR FEB 1 1972 Jay

3.5.39.4.3 Observe: (G) light VZL-S64 A (switch) off

LR FEB 1 1972 Jay

500-2K2

3.5.39.4.4 Observe: (R) light VAL-S64-A (switch) on

OK FEB 17 1972 Jay

3.5.39.4.5 Observe: (R) light VGL-S64-A (GP) on

OK FEB 17 1972 Jay

3.5.39.5 Close valve SOV-S64-A by depressing switch POS-S64-A1- close

OK FEB 17 1972 Jay

3.5.39.5.1 Observe: (G) light VGL-S64-A (GP) on

OK FEB 17 1972 Jay

3.5.39.5.2 Observe: (A) light VZL-S64-A (Auto) off

OK FEB 17 1972 Jay

3.5.39.5.3 (G) light VZL-S64-A (switch) on

OK FEB 17 1972 Jay

3.5.39.5.4 (R) light VZL-S64-A (switch) off

OK FEB 17 1972 Jay

3.5.39.5.5 (R) light VGL-S64-A (GP) off

OK FEB 17 1972 Jay

3.5.39.6 Reset TS-S64-A to initial position

OK FEB 17 1972 Jay

OK

3.5.39.6.1 Observe: Flashing state of (G) light VGL-S64 A resumes

allR FEB 17 1972 Jay

3.5.40 Checkout of VCS-S64-B

3.5.40.1 Adjust TS-S64-B to enable relay VTY-S64-B

allR FEB 17 1972 Jay

3.5.40.1.1 Observe: As relay VTY-S64-B is enabled the flashing state of VZL-S64 B (mod) and VGL-S64-B (GP) will change to a solid state.

allR FEB 17 1972 Jay

3.5.40.2 Open valve MOV-S64-B by placing switch VCS-S64-B in the open position.

allR FEB 17 1972 Jay

3.5.40.2.1 Observe: (G) light VZL-S64-B (closed) and VGL-S64-B (GP) off.

allR FEB 17 1972 Jay

3.5.40.2.2 Observe: (R) lights VZL-S64-B (GP) and VZL-S64-B (mod) on.

allR FEB 17 1972 Jay

3.5.40.2.3 Observe; Meter VZL-S64B shows pos. indication of valve position.

allR FEB 17 1972 Jay

3.5.40.2.4 Observe: Valve opens. Visual indication at valve.

allR FEB 17 1972 Jay

OK 8

3.5.40.3 Close valve MOV-S64-B by placing switch VCS-S64 B in the close position.

WR FEB 17 1972 Jay

3.5.40.3.1 Observe: (G) lights VZL-S64-B and VGL-S64 B (GP) on

WR FEB 17 1972 Jay

3.5.40.3.2 Observe: (R) lights VZL-S64-B (mod) and VGL-S64-B (GP) off

WR FEB 17 1972 Jay

3.5.40.3.3 Observe: Meter VZ1-S64-B decreases as valve closes.

WR FEB 17 1972 Jay

3.5.40.4 Reset TS-S64 B to initial setting.

WR FEB 17 1972 Jay

3.5.41 Checkout of BCS-S65

3.5.41.1 Enable blower S65 by depressing switch BCS-S65 to on position

WR FEB 17 1972 Jay

3.5.41.1.1 Observe: (G) light BSL-S65 (switch) off

WR FEB 17 1972 Jay

3.5.41.1.2 Observe: (R) light BSL-S65 (switch) on

WR FEB 17 1972 Jay

3.5.41.2 Turn off blower S65 by depressing switch BCS-S65 to off position

WR Jay
OK.

3.5.41.2.1 Observe: (G) light BSL-S65 (switch) on

WR FEB 1 1972 Jay

3.5.41.2.2 Observe: (R) light BSL-S65 (switch) off

WR FEB 1 1972 Jay

3.5.42 Checkout of VCS-S69 B

3.5.42.1 Adjust TS-S69-B to enable VTY-S69B

WR FEB 1 1972 Jay

3.5.42.1.1 Observe: When relay VTY-S69 B is enabled the flashing state of (G) light VAL-S69 B changes to a solid state.

WR FEB 1 1972 Jay

3.5.42.2 Close valve SOV-S69 B by depressing switch PBS S69 A2 (open

WR FEB 1 1972 Jay

3.5.42.2.1 Observe: Valve SOV-S69-B opens. Visual indication at valve.

WR FEB 1 1972 Jay

3.5.42.2.2 Observe: (G) light VZL-S69-B (GP) off

WR FEB 1 1972 Jay

3.5.42.2.3 Observe: (R) light VZL-S69 B on

WR FEB 1 1972 Jay

OK

3.5.42.3 Close valve SOV-S69-B by depressing PP-S69 B A1 close

WR FEB 17 1972

Jay

3.5.42.3.1 Observe: (G) light VZL-S69 B (GP) on

WR

FEB 17 1972

Jay

3.5.42.3.2 Observe: (R) light VZL-S69B (GP) off

WR

FEB 17 1972

Jay

3.5.42.3.3. Observe: (A) light VZL-S69 B (switch) off

WR

FEB 17 1972

Jay

3.5.42.3.4 Observe: (G) light ASL-S69B (switch) off

WR

FEB 17 1972

Jay

3.5.42.3.5 Observe: (R) light ASL-S69 B (switch) on

WR

FEB 17 1972

Jay

3.5.42.3.6 Observe: (R) light VZL-S69 B (GP) off

WR

FEB 17 1972

Jay

3.5.42.4 Open valve SOV-S69B by depressing Auto switch VZL-S69 B

WR

FEB 17 1972

Jay

3.5.42.4.1 Observe: (G) light VZL-S69 (GP) off

WR

FEB 17 1972

Jay

3.5.42.4.2 Observe: (A) light VZL-S69 B (switch) on

WR

FEB 17 1972

Jay

OK

3.5.42.4.3 Observe: (G) light ASL-S69-B (switch) on

OR FEB 17 1972 Jay

3.5.42.4.4 Observe: (R) light ASL-S69-B (switch) off

OR FEB 17 1972 Jay

3.5.42.4.5 Observe: (R) light VZL-S69 B (GP) on

OR FEB 17 1972 Jay

3.5.42.4.6 Observe: Valve SOV-S69-B open. Visual indication at Valve

OR FEB 17 1972 Jay

3.5.42.5 Close valve SOV-S69 B by depressing switch PBS69 B - A1 (close)

OR FEB 17 1972 Jay

3.5.42.5.1 Observe: (G) light VZL-S69 B on

OR FEB 17 1972 Jay

3.5.42.5.2 Observe: (A) light VZL-S69 B (Auto) off

OR FEB 17 1972 Jay

3.5.42.6 Reset TS-S69 B to initial setting.

OR FEB 17 1972 Jay

3.5.42.6.1 Observe: Flashing state of (G) light VZL-S69 B (GP) resumes.

OR FEB 17 1972 Jay

OK.

3-5-43 Checkout of VCS-S69-A

3.5.43.1 Adjust TS-S69 A to enable relay VTY-S69-A

WR FEB 1 1972 Jay

3.5.43.1.1 Observe: When relay VTY-S69A is enabled flashing state of (G) light VZL-S69-A changes to solid state.

WR FEB 1 1972 Jay

3.5.43.2 Open valve MOV-S69 A by placing switch VCS-S69 A to the open position.

WR FEB 1 1972 Jay

3.5.43.2.1 Observe: Valve MOV-S69 A opens. Visual indication at valve.

WR FEB 1 1972 Jay

3.5.43.2.2 Observe: Valve position meter VZ1-S69-A shows positive indication.

WR FEB 1 1972 Jay

3.5.43.2.3 Observe: (G) lights VZL-S69 A (switch) and VGL-S69 A (GP) off

WR FEB 1 1972 Jay

3.5.43.2.4 Observe: (R) light VGL-S69-A (GP) and VZL-S69 A (mod) on

WR FEB 1 1972 Jay

3.5.43.3 Close valve MOV-S69 A by placing switch VCS-S69 A in the close position.

WR FEB 1 1972 Jay
OK-A.

3.5.43.3.1 Observe: Meter VZ1-S69-A decreases

OK FEB 1 1972 Jay

3.5.43.3.2 Observe: (G) lights VZL-S69 A (mod) and VGL-S69 A (GP) on

OK FEB 1 1972 Jay

3.5.43.3.3 Observe: (R) lights VZL-S69 A (mod) and VGL-S69 A (GP) off

OK FEB 1 1972 Jay

3.5.43.4 Reset TS-S69 A to initial setting

OK FEB 1 1972 Jay

3.5.43.4.1 Observe: Flashing state of (G) lights VZL-S69 A &
VGL-S69 A resume

OK FEB 1 1972 Jay

3.5.44 Checkout of TIC-S68 transfer function

3.5.44.1 Set switch on TIC-S68 to enable relay HCY-S68

OK FEB 1 1972 Jay

3.5.44.1.1 Observe: (R) light TAL-S68 B (mod) off

OK FEB 1 1972 Jay

3.5.44.1.2 Observe: (R) light TAL-S68 A (mod) on

OK FEB 1 1972 Jay

3.5.44.2 Increase thumb wheel setting on TIC-S68 a small amount.

OK FEB 1 1972 Jay

3.5.44.2.1 Observe: A temp increase indication on TIC-S68 temp meter.

WR FEB 1 1972 Jey

3.5.44.2.2 Observe a temp increase indication on TC 60 S68 meter

WR FEB 1 1972 Jey

3.5.44.3 Return switch TIC-S68 to initial position.

WR FEB 15 1972 Jey

3.5.44.3.1 Observe: Temp decrease indication on TIC-S68 temp meter.

WR FEB 15 1972 Jey

3.5.44.3.2 Observe: Temp decrease indication on TC 60 S68

WR FEB 15 1972 Jey

3.5.44.3.3 Observe: (R) light TAL-S68 B (mod) on

WR FEB 15 1972 Jey

3.5.44.3.4 Observe: (R) light TAL-S68 A (mod) off

WR FEB 15 1972 Jey

JKH.

3.6 System Test of S 70 Flow Thru Tube Sampler

3.6.1 Light S 70-A1-on from Drawer S10 test.

3.6.2 Set M-O-A switch on TC 70 A1 to Auto

WR FEB 14 1972 Jay

3.6.2.1 Observe: (W) light S70-A1 on HTGP changes to (A)

WR FEB 14 1972 Jay

3.6.2.2 Observe: In 15 ± 10 min (A) light S 70-A1 on HTGP changes to (G)

WR FEB 14 1972 Jay

3.6.2.3 Observe: (W) light S 70-A2 on HTGP on

WR FEB 14 1972 Jay

3.6.2.4 Observe: (W) light on TC 70 A2 on

WR FEB 14 1972 Jay

3.6.3 Set M-O-A switch on TC 70 A2 to Auto

WR FEB 14 1972 Jay

3.6.3.1 Observe: (W) light S 70-A2 on HTGP changes to (A)

WR FEB 14 1972 Jay

3.6.3.2 Observe: At 15 ± 10 min (A) light S 70-A2 changes to (G)

WR FEB 14 1972 Jay

3.6.3.3 Observe: (W) light S 70-A3 on HTGP on

WR FEB 14 1972 Jay

JKH

3.6.3.4 Observe: (W) light on TC 70 A3 on

OR FEB 14 1972 Jay

3.6.4 Set M-O-A switch on TC 70 A3 to Auto

OR FEB 14 1972 Jay

3.6.4.1 Observe: (W) light S 70-A3 on HTGP changes to (A)

OR FEB 14 1972 Jay

3.6.4.2 Set temp switch TS 72 A (TS-1) to enable VTY-S72-A

OR FEB 14 1972 Jay

3.6.4.3 Observe: (A) light VZL-S72 A on VCS-S72 module changes from flashing to solid on

OR FEB 14 1972 Jay

3.6.4.4 In 15 ± 10 min (A) light S70A3 on HTGP changes to (G)

OR FEB 14 1972 Jay

3.6.5 Depress switch VCS-S72-A "open" located on VCS-S72 module

OR FEB 14 1972 Jay

3.6.5.1 Observe: (W) light S 70-A4 on HTG on

OR FEB 14 1972 Jay

3.6.5.2 Observe: (W) light on TC 70 A4 on

OR FEB 14 1972 Jay

3.6.6 Depress "close switch" VCS-S72-A

OR FEB 14 1972 Jay

JKA

3.6.7 Return TS S72-A to initial setting

OK FEB 14 1972 Jay

3.6.8 Set M-0-A switch on TC 70 A4 to Auto

OK FEB 14 1972 Jay

3.6.8.1 Observe: (W) light S 70-A4 on HTGP changes to (A)

OK FEB 14 1972 Jay

3.6.8.2 Observe: At 15 ± 10 min (W) light S 70-A4 changes to (G)

OK FEB 14 1972 Jay

3.6.9 Adjust TS-S72-C (TS-2) to enable VTY-S72-C

OK FEB 14 1972 Jay

3.6.10 Hold switch VCS-S72-C to open position until White light S 70 A5 on HTGP comes on.

OK FEB 14 1972 Jay

3.6.11 Hold switch VCS-S72 C in the close position until valve is closed.

OK FEB 14 1972 Jay

3.6.11.1 Observe: Valve closed indication on VCS-S72 module.

OK FEB 14 1972 Jay

3.6.12 Return TS, TS-S72-C to its initing setting.

OK FEB 14 1972 Jay

OKS

3.6.12.1 Observe: (W) light A 70-A5 on HTGP on

DR FEB 14 1972 Jay

3.6.12.2 Observe: (W) light on TC 70 A5 on

DR FEB 14 1972 Jay

3.6.13 Set M-O-A switch on TC 70 A5 to Auto.

DR FEB 14 1972 Jay

3.6.13.1 Observe: (W) light S 70-A5 on HTGP changes to (A)

DR FEB 14 1972 Jay

3.6.13.2 Observe: In 15 ± 10 min. (A) light S 70-A5 changes to (G)

DR FEB 14 1972 Jay

3.6.14 Note (W) light at S 70-B1 on HTGP on from a previous drawer test

DR FEB 14 1972 Jay

3.6.15 Set M-O-A switch on TC 70 B1 to Auto

DR FEB 14 1972 Jay

3.6.15.1 Observe: (W) light S 70-B1 on HTGP changes to (A)

DR FEB 14 1972 Jay

3.6.15.2 Observe: In 15 ± 10 min. (A) light S 70-B1 on HTGP changes to (G)

DR FEB 14 1972 Jay

3.6.15.3 Observe: (W) light S 70-B2 on HTGP on

DR FEB 14 1972 Jay

JK &

3.6.15.4 Observe: (W) light on TC 70 B2 on

OK FEB 14 1972 Jay

3.6.16 Set M-C-A switch on TC 70 B2 to Auto.

OK FEB 14 1972 Jay

3.6.16.1 Observe: (W) light S 70-B2 on HTGP changes to (A)

OK FEB 14 1972 Jay

3.6.16.2 Observe: In 15 ± 10 min (A) light S 70-B2 on HTGP changes to (G)

OK FEB 14 1972 Jay

3.6.17 Adjust temp switch TS-S75-B to enable VTY-S75-B

OK FEB 14 1972 Jay

3.6.17.1 Engage switch VCS-S75-B (open) located on VCS-S75 Module

OK FEB 14 1972 Jay

3.6.17.2 Observe (W) light S 70-B3 on HTGP on

OK FEB 14 1972 Jay

3.6.17.3 Disengage switch VCS-S75-B (close)

OK FEB 14 1972 Jay

3.6.17.4 Observe: (W) light on TC 70 B3 on

OK FEB 14 1972 Jay

3.6.18 Set M-0-A switch on TC 70 B3 to Auto

alR FEB 14 1972 Jay

3.6.18.1 Observe: (W) light S 70 B3 on HTGP changes to (A)

alR FEB 14 1972 Jay

3.6.18.2 Observe: In 15 ± 10 min (A) light S 70-B3 on HTGP changes to (G)

alR FEB 14 1972 Jay

3.6.19 Adjust temp switch TS-S75-A to enable VTY-S75 A

alR FEB 14 1972 Jay

3.6.20 Engage switch VCS-S75 A (open) on VCS-S75 module

alR FEB 14 1972 Jay

3.6.20.1 Observe: (W) light S 70-B4 on HTGP on

alR FEB 14 1972 Jay

3.6.20.2 Observe: (W) light on TC 70 B4 on

alR FEB 14 1972 Jay

3.6.21 Set M-0-A switch on TC 70 B4 to Auto

alR FEB 14 1972 Jay

3.6.21.1 Observe: (W) light S 70-B4 on HTGP changes to (A)

alR FEB 14 1972 Jay

3.6.21.2 Observe: In 15 ± 10 min (A) light S 70-B4 on HTGP changes to (G)

alR FEB 14 1972 Jay

3.6.22 Check of VCS-S72 control

3.6.22.1 Set TS-S72 A to enable relay VTY-S72-A

OK FEB 14 1972 Jay

3.6.22.1.1 Observe: As relay is enabled the flashing state of (A) light VZL-S72A will change to a solid state.

OK FEB 14 1972 Jay

3.6.22.1.2 Observe: (A) light VGL-S72-A on GP on

OK FEB 14 1972 Jay

3.6.22.1.3 Observe: Green lights VZL-S72-A and VGL-S72-A (on GP) off

OK FEB 14 1972 Jay

3.6.22.2 Engage switch VCS-S72-A (open) on VCS-S72 module

OK FEB 14 1972 Jay

3.6.22.2.1 Observe: Valve POV-S72-A opens. (Visual indication at valve)

OK FEB 14 1972 Jay

3.6.22.2.2 Observe: Amber lights VZL-S72 A (switch) and VGL-S72-A (G)) off

OK FEB 14 1972 Jay

3.6.22.2.3 Observe: (G) light VZL-S72-A (switch) and VGL-S72-A (GP) on.

OK FEB 14 1972 Jay

JKB

3.6.22.3 Disengage switch VCS-S72 A (close)

OR FEB 14 1972 Jay

3.6.22.3.1 Observe: (G) lights VZL-S72A (switch) and VGL-S72-A (GP) off.

OR Jay

3.6.22.3.2 Observe: (A) lights VZL-S72-A (switch) and VGL-S72-A (GP) on.

OR FEB 14 1972 Jay

3.6.22.4 Return TS-S72A to initial setting.

OR FEB 14 1972 Jay

3.6.22.4.1 Observe: (A) light VZL-S72-A (switch) flashes.

OR FEB 14 1972 Jay

3.6.22.5 Engage switch VCS-S72-B (open)

Jay 3-3-72

3.6.22.5.1 Observe: Valve SOV-S2-B opens (visual indication at valve)

Jay 3-3-72

3.6.22.5.2 Observe: (R) light VZL-S72-B (switch) labeled closed off

Jay 3-3-72

3.6.22.5.3 (G) light VZL-S72-B (switch) labeled open on

Jay 3-3-72

OK

3.6.22.6 Adjust TS-S72-C to enable relay VTY-S72-C

WR FEB 14 1972 Jay

3.6.22.6.1 Observe: As relay is enabled the flashing state of (A) light VZL-S72-C (on VCS-S72 module) will change to a solid state.

WR Jay

3.6.22.6.2 Observe: (A) light VGL-S72-C (GP) on

WR FEB 14 1972 Jay

3.6.22.6.3 Observe: (G) light VZL-S72-C (Valve open) off

WR FEB 14 1972 Jay

3.6.22.6.4 Observe: (G) light VGL-S72-C (GP) off

WR FEB 14 1972 Jay

3.6.22.7 Engage valve VCS-S72 open-close switch to open position.

WR FEB 14 1972 Jay

3.6.22.7.1 Observe: MOV-S72-C valve opens (check by visual indication)

WR FEB 14 1972 Jay

3.6.22.7.2 Observe: Valve position meter VZL-S72-C will indicate valve position.

WR FEB 14 1972 Jay

WR

3.6.22.7.3 Observe: (A) lights valve closed VZL-S72 (mod) & VGL-S72-C (GP) off

DR FEB 14 1972 Jay

3.6.22.7.4 Observe: (G) lights valve open - VZL-S72-C (mod) and VGL-S72-C (GP) on

DR FEB 14 1972 Jay

3.6.22.8 Engage valve VCS-S72 open-close switch to close position. Hold until valve closes.

DR FEB 14 1972 Jay

3.6.22.8.1 Observe: (A) lights valve closed on

DR FEB 14 1972 Jay

3.6.22.8.2 Observe: (G) lights valve open off

DR FEB 14 1972 Jay

3.6.22.8.3 Observe: Valve position meter decreases to zero as valve MOV S72-C closes.

3.6.22.9 Reset TS-S72-C to its initial setting

DR FEB 14 1972 Jay

3.6.22.9.1 Observe: (A) light VZL-S72-C returns to flashing state.

DR FEB 14 1972 Jay

(100) DR.

3.6.23 VCS-S75 checkout

3.6.23.1 Adjust TS-S75-A to enable relay VTY-S75-A

DR FEB 14 1972

Jay

3.6.23.1.1 Observe: As relay is enabled the flashing state of (A) light VZL-S75-A (switch) (on VCS-S75 module) will change to a solid state.

DR FEB 14 1972

Jay

3.6.23.1.2 Observe: (A) light VGL-S75-A (GP) valve closed on

DR FEB 14 1972

Jay

3.6.23.1.3 Observe: (G) lights VZL-S75-A (switch) open and VGL-S75-A (GP) off

DR FEB 14 1972

Jay

3.6.23.2 Engage valve POV-S75-A open-close switch VCS-S75-A to open position.

DR FEB 14 1972

Jay

3.6.23.2.1 Observe: (A) lights VZL-S75-A (switch) and VGL-S75-A (GP) off

DR FEB 14 1972

Jay

3.6.23.2.2 Observe: (G) lights VZL-S75-A (switch) and VGL-S75-A (GP) on

DR FEB 14 1972

Jay

OK-4.

3.6.23.2.3 Observe: Valve opens (visual indication at valve)

DR FEB 14 1972 Jay

3.6.23.3 Engage valve POV-S75-A open-close switch VCS-S75-A to close position

DR FEB 14 1972 Jay

3.6.23.3.1 Observe: Valve POV-S75-A closes.

DR FEB 14 1972 Jay

3.6.23.3.2 Observe: (G) lights VZL-S75-A (switch) and VGL-S75-A (GP) off

DR FEB 14 1972 Jay

3.6.23.3.3 Observe: (A) lights VZL-S75-A (switch) and VGL-S75-A (GP) on.

DR FEB 14 1972 Jay

3.6.23.4 Reset TS-S75-A to original setting.

DR FEB 14 1972 Jay

3.6.23.4.1 Observe: (A) light VZL-S75-A resumes its flashing state

DR FEB 14 1972 Jay

3.6.23.5 Adjust TS-S75-B to enable relay VTY-S75-B

DR FEB 14 1972 Jay

3.6.23.5.1 Observe: As relay is enabled the flashing state of (A) light VZL-S75-B (switch) (on VCS-S75 module) will change to a solid state

DR FEB 14 1972 Jay

3.6.23.5.2 Observe: (A) light VGL-S75-B (GP) on

OR FEB 14 1972 Jay

3.6.23.6 Engage POV-S75-B valve by depressing open-close switch
VCS-S75-B to the open position

OR FEB 14 1972 Jay

3.6.23.6.1 Observe: (A) lights VZL-S75-B (switch) and VGL-S75-B (GP)
on.

OR FEB 14 1972 Jay

3.6.23.6.2 Observe: (G) lights VZL-S75-B (switch) and VGL-S75-B (GP)
on.

OR FEB 14 1972 Jay

3.6.23.7 Engage POV-S75-B valve by depressing open-close switch VCS-S75-B
to the close position.

OR FEB 14 1972 Jay

3.6.23.7.1 Observe: (G) lights VZL-S75-B (switch) and VGL-S75-B (GP)
off.

OR FEB 14 1972 Jay

3.6.23.7.2 Observe: (A) lights VZL-S75-B (switch) and VGL-S75-B (GP)
on.

OR FEB 14 1972 Jay

3.6.23.8 Reset TS-S75-B to initial setting

OR FEB 14 1972 Jay

3.6.23.8.1 Observe: (A) light BZL-S75-B resumes its flashing state.

OR FEB 14 1972 Jay

() OK.

APPENDIX I

PAL AND PAL SCS
ACCEPTANCE TEST PROCEDURES

THE PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURES

Index

Procedure No.

1. Electrical Distribution Panels & Power Supply
2. Trace Heater Resistances
3. Thermocouple Resistances
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6. Trace Heater Heatup Rate
7. Electric Valve Operator System
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9. EM Pump #2 & Control Circuit
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20. NaK Pressure Transducer Checkout

PROTOTYPE APPLICATIONS LOOP

ACCEPTANCE TEST PROCEDURE #1

Distribution Panels & Power Supply

The purpose of this procedure is to verify the wiring is connected as per Print H-3-32162.

Procedure

1. Check that all the circuit breakers in Panels A, B, C are off, and that the fused disconnects on the primaries of the loops transformer are off.

by A. J. Pritchard

Date 11/12/71

2. Check that all circuit breakers are of the value as shown on Print H-3-32162, Sheet 1.

3. Turn on power to loops fused disconnect L.O. #1 at MCC #1 compartment A-4,

by A. J. Pritchard

Date 11/12/71

4. Turn on power to Loop Transformer #1 at fused disconnect #1. This should bring power to one side of K-1 contactor and fire up distribution panel B,

by A. J. Pritchard

Date 11/12/71

5. Open the access doors to the loops distribution panels, turn on power to circuit #1 on B panel, the annunciator panel should have power.

by A. J. Pritchard

Date 11/12/71

6. Turn on circuit #2 on panel B and check voltages across wire numbers B-2-1 B-2-N should be 110 VAC to 125 VAC.

by A. J. Pritchard

Date 11/12/71

7. Turn on circuits #3 on Panel B, this provides power to the metrascope, cold trap cooler controller, liquid level power supply, and the recorders FR-1 & TR-1.
8. Turn on circuit #4 on Panel B, this should provide power for the cold trap cooler blower. Turn on cold trap blower controller and verify power is available. Turn off blower.

By *H. S. Rutledge*
Date 11/19/71

9. Turn on circuits #6, 8, 10, these are power for the loops lighting system, verify power is available.

By *H. S. Rutledge*
Date 11/12/71

10. Turn on circuit #9 and 11, this provides power to the smoke detector unit, open smoke detector controller door and check voltage across terminals #1, 2, 3, - should read 120 volts on each side or 220 to 240 VAC across terminals #1 & 3.

By *H. S. Rutledge*
Date 11/12/71

Panels A & C are energized by K-1 contactor. Panel A should not be energized until the EM pump #1 and the reservoir heater ATP's are to be done.

11. Check to assure that all of the circuit breakers are in the off position in Panel A and Panel B.

By *H. S. Rutledge*
Date 11/12/71

12. Turn on power to K-1 by depressing Loop Power Control on switch.

By *J. D. E.*
Date 11-15-71

13. Check that all of the trace heater controllers are in the "off" position.

By *J. D. E.*
Date 11-15-71

MATL	QTY	PT	NO	DESCRIPTION	285	MATL	HEAT	NO.	ITEM NO.	SEC
WELD	1	8-1	8-1	ASSEMBLY		304 SST				
	1	8-2	8-2	WIRE CLOTH, 50 MESH 20% OPEN 1/2" O.D.						
	1	8-3	8-3	TUBE, 1" O.D. x .055 WALL						
	1	8-4	8-4	TUBE, 1 1/2" O.D. x 20 GA. x 6 7/8" LG						
	1	8-5	8-5	RING, 1 1/2" O.D. x 1/8" D x 20 GA. (.055)						
	1	8-6	8-6	TUBE, 3/8" O.D. x 20 GA. x 8" LG						
	1	8-7	8-7	FUNNEL, 20 GA. (.055)						
	1	8-8	8-8	1/8" DIA ROD x 2" LG						
	1	8-9	8-9							
	1	8-10	8-10							

WELD NO.	PART NO.	WELD ROD	WELD PROCEDURE	UT.	QTY.
8-1	8-1	304			
8-2	8-2	304			
8-3	8-3	304			
8-4	8-4	304			
8-5	8-5	304			
8-6	8-6	304			
8-7	8-7	304			
8-8	8-8	304			
8-9	8-9	304			
8-10	8-10	304			
8-11	8-11	304			
8-12	8-12	304			
8-13	8-13	304			
8-14	8-14	304			

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

1. TOLERANCES: FRACTIONAL: ±1/64, DECIMAL: .005, ANGULAR: ±1/4°
2. ALL MACHINED SURFACES $\sqrt{\text{V}}$ IN ACCORDANCE WITH AMS 1001 (LATEST REV.)
3. MACHINING TOOL RADIUS 0.005 MAX.
4. BREAK ALL SHARP EDGES AND REMOVE ALL BURRS.

DATA TYPE 2

U. S. ATOMIC ENERGY COMMISSION
RICHMOND OPERATIONS OFFICE
Batford Engineering Development Laboratory

MULTIPURPOSE SAMPLER
EQUILIBRATION INSERT
ASSEMBLY & DETAILS

PAL SCS

335

8554

H-3-37215

111

WHAN IR-28-X-7-5 END USE

REFERENCE DRAWINGS

COMMITTEE ISSUE NO.

CHECK ISSUE NO.

DRAWING STATUS

NONE

13-2 SPACER

13-3 CAP

SECTION A-A

MATL. SUPPLY	QTY	PT. NO.	DESCRIPTION	REF. MATL.	HEAT NO.	D.O. E. ITEM NO.	REC. USE/INSP.
13-1	1	13-1	ASSEMBLY				
13-2	1	13-2	SPACER, 1/2 O.D. x .035 WALL x 5' LG. 10 MICRON (NOM.)	504 SST			
13-3	1	13-3	CAP, 1/2 O.D. x 25GA (.020)	SEE DETAIL			
13-4	1	13-4	RING, 1/2 O.D. x 25GA (.020)	SEE DETAIL			
13-5	1	13-5	RING, 1/2 O.D. x 25GA (.020)	SEE DETAIL			
13-6	1	13-6	RING, 1/2 O.D. x 25GA (.020)	SEE DETAIL			
13-7	1	13-7	PIN				
13-8	1	13-8					
13-9	1	13-9					

WELD RECORD									
WELD NO.	DART NO.	WELD ROD	WELD	WELD	WELD	WELD	WELD	WELD	WELD
			TYPE	HEAT NO.	SIZE	MFR.	PROCEDURE	REQD.	U.T.
F-1	5-1, 5-2, 5-3								
F-2	5-4, 5-5, 5-6								
F-3	5-7								
F-4	5-8								
F-5	5-9								
F-6	5-10								
F-7	5-11								
F-8	5-12								
F-9	5-13								

U. S. ATOMIC ENERGY COMMISSION
 RICHLAND OPERATIONS OFFICE
 Hanford Engineering Development Laboratory
 Westinghouse Hanford Company

MULTIPURPOSE SAMPLER
 FILTRATION INSERT
 ASSEMBLY & DETAILS

SCALE: 2" = 1'-0"

DATE: 1-23-64

BY: J. J. OWEN

CHKD: J. J. OWEN

APP'D: J. J. OWEN

REVISIONS:

WHAN IR-28-X-7-5 END USE

REFERENCE DRAWINGS:

NEXT USED ON:

DRAWING STATUS:

CLASSIFICATION:

NONE

H-3-37216

1-1