

88G-GEN-011-P1

PROCUREMENT SPECIFICATION FOR  
ACID/BASE NEUTRALIZATION UNIT

FOR  
163-N ION EXCHANGE REGENERATION WASTE pH CONTROL

Work Order CR0520

Prepared By:

KAISER ENGINEERS HANFORD COMPANY  
Richland, Washington

For the US Department of Energy

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<u>[Signature]</u>	<u>6-21-88</u>	<u>Robert B Hoffmann</u>	<u>6-16-88</u>
Originator	Date	Specifications	Date
<u>[Signature]</u>	<u>6-16-88</u>	<u>[Signature]</u>	<u>6-16-88</u>
Safety	Date	Chief Design Engineer	Date
<u>J.E. Breed Jr</u>	<u>6/21/88</u>	<u>[Signature]</u>	<u>6/16/88</u>
Quality Assurance	Date	Project Manager	Date

Westinghouse Hanford Company

<u>[Signature]</u>	<u>6-20-88</u>
Project Manager	Date

Released for Construction:

<u>N/A</u>	<u>DEPARTMENT OF ENERGY</u>	<u>        </u>
		Date

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2.1.3	Federal Regulations	
	40 CFR 260.10	Definition of Elementary Neutralization Unit
2.1.4	Federal Specifications (FS)	
	RR-G-661E	Grating Metal, Bar Type (Floor, Except for Naval Vessels)
	TT-E-489G	Enamel, Alkyd Gloss (For Exterior and Interior Surfaces)
	TT-P-645A	Primer, Paint, Zinc Chromate, Alkyd Type
2.1.5	Instrument Society of America (ISA)	
	ISA-S20-1981	Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves
	ANSI/ISA-S5.1-1984 (Approved 1986)	Instrumentation Symbols and Identification
	ANSI/ISA-S5.2-1976 (Approved 1981)	Binary Logic Diagrams for Process Operations
2.1.6	Military Specifications (MS)	
	DOD-P-15328D, Including AMD 1	Primer (Wash), Pretreatment (Formula No. 117 for Metals)
2.1.7	National Electrical Manufacturers Association (NEMA)	
	Standard Publication/ No. ICS 6-1983 w/Rev through Oct 1985	Enclosures for Industrial Control and Systems
	Standard Publication/ No. KS 1-1983	Enclosed Switches
	Standards Publication/ No. MG 1-1978 (R 1981) w/Rev through Jan 1985	Motors and Generators
	Standards Publication/ No. MG 2-1983	Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors

- 2.1.8 National Fire Protection Association (NFPA)
  - NFPA 70-1987 National Electrical Code
- 2.1.9 Occupational Safety and Health Administration (OSHA)
  - 29 CFR 1910 OSHA Standards
- 2.1.10 Engineering Sketches
  - 88G-GEN-011-P1-1 Elementary Neutralization Unit  
Sheets 1 and 2 Schematic
  - 88G-GEN-011-P1-2 Elementary Neutralization Unit  
Equipment Configuration
  - 88G-GEN-011-P1-3 Elementary Neutralization Unit  
Elevations

### 3.0 TECHNICAL REQUIREMENTS

#### 3.1 GENERAL

3.1.1 The acid/base neutralization unit shall be an elementary neutralization unit as defined in 40 CFR 260.10.

3.1.2 The unit will be installed indoors in the 163-N Building at the 100-N Area of the Hanford site.

3.1.3 The unit shall be a fully self-contained, packaged assembly, and will include the control and monitoring instrumentation, the off-specification diverter valve, the agitation and other standard features discussed herein or shown in engineering sketches 88G-GEN-011-P1-1, Sheets 1 and 2.

3.1.4 The neutralization unit shall have a minimum of three chambers for pH control and a final stage for pH monitoring.

#### 3.2 FUNCTIONAL AND OPERATIONAL REQUIREMENTS

3.2.1 The neutralization unit will be used to automatically neutralize acidic and basic solutions consisting of dilute sulfuric acid and sodium hydroxide. The solutions are effluents from anion and cation ion exchange regeneration processes whose pH will vary from 1.4 to 12.8. There are infrequent, short duration pH spikes of less than 1.0 and greater than 13.5.

The cation exchange regeneration is performed batch-wise with a batch frequency of one regeneration every 16 hours producing 44,000 gallons of acidic waste. The anion exchange regeneration occurs every 24 hours producing 41,000 gallons of basic solution.

The acidic and basic solutions will be transferred from the regeneration tanks to a 125,000 gallon surge tank where partial self-

neutralization will occur. The partially neutralized solution will then be fed to the neutralization unit, either continuously at an approximate rate of 75 gpm, or intermittently at a rate of 175 gpm (maximum).

3.2.2 Process Fluid, Inlet: Average solution pH will be 3.4 but dilute solutions of  $H_2SO_4$  and NaOH with  $1.4 < pH < 12.8$  could occur from upsets, unequal batch frequencies, etc. Infrequent, short duration pH spikes occur as identified in paragraph 3.2.1.

3.2.3 Inlet Temperature: 120 F

3.2.4 Inlet Flowrate, Influent: 175 gpm (maximum)

3.2.5 Inlet Density: 63 lbm/ft<sup>3</sup>

3.2.6 Inlet Pressure: Atmospheric

3.2.7 Process Effluent, Outlet: Solution with  $6.0 < pH < 9.0$

3.2.8 Existing Chemical Reactants: 50% NaOH, 98%  $H_2SO_4$  (Available in Buyer's facility - to be used for the neutralization process.)

3.2.9 Ambient Air Temperature: 40 - 110 F

3.2.10 Seller shall furnish the following signals for use by Buyer in the 163-N Building Control Room located approximately 200 feet from the site proposed for installing the neutralization unit.

3.2.10.1 Analog signals, 4 - 20 mA dc, for remote readout of the pH of the batch in the 1st, 2nd, and 3rd stages.

3.2.10.2 Analog signal, 4 - 20 mA dc, for remote recording of the pH of the batch in the final stage.

3.2.10.3 Discrete signal (on-off), 120V ac, 60 Hz or 24V dc, for remote indication of an off-specification condition at the final stage.

3.2.10.4 Two discrete signals (on-off), 120V ac, 60 Hz or 24V dc, indicating status of neutralization unit. The signals will be utilized by Buyer for remote annunciation of system status and for regulation of neutralizer feed valve.

3.2.11 The neutralization system shall be capable of remote shutdown from the Buyer's control panel through a discrete signal, 120V ac, 60 Hz or 24V dc.

3.2.12 The Seller shall provide the required chemical transport and delivery system (pumps, eductors, injectors, etc.) for the neutralization unit.  $H_2SO_4$  (98% concentration) will be provided from the Buyer's 10,000 gallon storage tank through approximately 100 feet of 1 inch piping. NaOH (50% concentration) will be provided from the Buyer's 10,000 gallon storage tank through approximately 100 feet of 1 inch piping. The hydrostatic head

of both tanks will vary between 2- and 12-feet. The configuration of the chemical transport system is left to the discretion of the Seller, except that final introduction of reactants into the neutralization chambers shall be through injectors.

3.2.13 All valves shall have position indicators.

### 3.3 EQUIPMENT AND MATERIAL REQUIREMENTS

3.3.1 Materials, instrumentation, and equipment shall be new. Items used for similar applications shall be of the same type and manufacture.

3.3.2 Materials in contact with regenerative wastes or chemicals shall be corrosion resistant to various concentrations of  $H_2SO_4$  and NaOH according to paragraphs 3.2.1, 3.2.2, and 3.2.8.

3.3.3 Piping systems shall be designed, fabricated, examined, and tested in accordance with ANSI B31.3. (Category D service is not applicable for this system.)

3.3.4 All piping connections to and from the neutralization unit shall be flanged connections per ANSI B16.5-1981. Location and size of connections shall be as shown on engineering sketches 88G-GEN-011-P1-2 and 88G-GEN-011-P1-3.

3.3.5 The pH probes shall be easily accessible and removable for calibration and cleaning.

3.3.6 Electric motors shall meet the requirements of NEMA MG-1 and NEMA MG-2.

3.3.7 All motors 1/3 hp or larger shall be rated for operation at 480V ac 3-phase, 60 Hz. Motors shall have a service factor of 1.15, with class H insulation.

3.3.8 All wiring shall conform to the 1987 edition of the National Electrical Code.

3.3.9 All electrical and instrumentation connections to and from the neutralization unit shall be terminated on terminal strips and enclosed in a terminal box. Power and control wiring shall be separated from instrumentation wiring with a metal barrier or shall be enclosed in a separate terminal box.

3.3.10 All controls for power distribution and motor operation for the Seller's supplied equipment (i.e. starters, panelboards, transformers, protection, etc.) shall be furnished and mounted on a local control station.

3.3.11 Switches shall be horsepower rated and shall meet the requirements of NEMA KS 1.

3.3.12 Electrical and instrumentation system enclosures shall be type NEMA 1 and shall meet the requirements of NEMA ICS-6.

3.3.13 Where equipment cannot be easily reached from grade elevation, the Seller shall provide catwalks, ladders, and stairs to achieve easy access to equipment for maintenance and operations personnel. For these items, the following material and construction standards shall apply.

3.3.13.1 Steel grating: RR-G-661, Type 1, pressure locked (riveted not acceptable) with end bending bars.

3.3.13.2 Structural steel: Per AISC Manual of Steel Construction. Structural steel shall be pretreated, primed, and painted as specified below:

	<u>Applicable Standard</u>	<u>Minimum Dry Film</u>
Pretreatment	MS DOD-F1532B	0.5 mil
Prime	FS TT-P-684	1.5 mil
2nd coat	FS TT-E-489	1.5 mil
Finish coat	FS TT-E-489	1.5 mil

3.3.14 The neutralization unit shall be shipped in subassemblies and shall be installed by the Buyers craftsmen with supervision by the Sellers technical representative. Subassemblies must be no larger than 6-feet wide by 6-feet high by 12-feet long, as limited by access restrictions into the building.

3.3.15 Prior to fabrication, Seller shall submit to the Buyer for approval drawings showing the system design, system logic of operation and system configuration as specified in Section 4.0 of this specification. Drawings will meet the requirements of ANSI/ISA-S5.1 and ANSI/ISA-S5.2 as applicable.

#### 3.4 FABRICATION REQUIREMENTS

3.4.1 The neutralization unit shall be designed, fabricated, and installed to withstand, and operate during and after a Uniform Building Code Zone 2 seismic event, using a soil profile coefficient of 1.5 and an occupancy importance factor of 1.0.

3.4.2 The acid/base neutralization unit shall be designed for an operating life of 15 years. Components with an operating life expectancy of less than 15 years shall be easily accessible for maintenance and replacement, with minimum downtime of the system.

3.4.3 All components of the unit which contain or transport waste or process chemicals shall be fully enclosed.

3.4.4 The system shall comply with OSHA requirements for safe operation and maintenance.

3.4.5 Motors, instrumentation, and other applicable equipment shall be permanently stamped with the manufacturers name, model number, and serial number.

3.4.6 In addition to individual equipment tagging, Seller will affix one tag on the unit which will include the following information.

3.4.6.1 Elementary neutralization unit no. 1

3.4.6.2 Maximum rating: 175 gpm

3.4.6.3 Operating pressure

3.4.6.4 (Buyers) Contract Number

3.4.6.5 Vendor/manufacturer

3.4.6.6 Date of manufacture

3.4.6.7 Installed under Project 88G-GEN-011

3.5 SERVICES/UTILITIES AVAILABLE: The following services are available in the 163-N Building for operation of the neutralization unit.

3.5.1 Electrical Power

3.5.1.1 480V ac, 3-phase, 60 Hz, 4-wire.

3.5.1.2 120V ac, single-phase, 60 Hz.

Buyer will provide a single power supply at each of the above voltages and will terminate his services at the Seller's primary disconnect switches at the neutralization unit's control station.

If the operation of the unit requires power at other voltages, the Seller shall provide the necessary transformation/rectification equipment as part of his assembly.

3.5.2 Service Air

3.5.2.1 Operating pressure: 80 psig

3.5.2.2 Operating temperature: 85 F

Buyer will supply the air service to the boundary of the neutralization unit.

3.5.3 Filtered Water

3.5.3.1 Operating pressure: 100 psig

3.5.3.2 Operating temperature: 80 F

3.5.3.3 Acidity: pH 7 - 7.5

Buyer will supply the water services to the boundary of the neutralization unit.

4.0 QUALITY ASSURANCE REQUIREMENTS

4.1 QUALITY ASSURANCE PROGRAM

4.1.1 The Seller shall have in place a quality assurance program which meets the applicable criteria and intent of ANSI/ASME NQA-1. If the Seller has a program based on another standard, he shall furnish a matrix which cross-references that program with the corresponding NQA-1 requirements.

4.1.2 The manufacturer's standard quality assurance program shall be subject to approval, monitoring, and auditing by the Buyers Quality Assurance department.

4.2 QUALIFICATION REQUIREMENTS: The neutralization unit shall be the standard product of a firm engaged in the design and fabrication of such unit. The firm must have at least three years' experience in this field.

4.3 TESTS

4.3.1 The neutralization unit shall be performance tested at the Seller's facility to ensure that the unit meets all the design requirements.

4.3.2 The Seller shall submit to the Buyer for approval a detailed procedure indicating the test to be performed for system qualification.

4.3.3 The Buyer reserves the right to witness any test. The Seller shall notify the Buyer of all scheduled tests at least 7 days in advance.

4.3.4 The Seller shall maintain records of the results of performance tests. These records shall be made available to the Buyer on request.

4.4 SUBMITTALS

4.4.1 Bid Data: The Bidder shall submit 6 copies of the following items with his bid.

4.4.1.1 Block diagram showing system operation.

4.4.1.2 Catalog data on the neutralization unit, motors, valves, mixers, tanks, actuators, and instruments.

4.4.1.3 Materials description.

4.4.1.4 Dimensions and weight of sub-assemblies.

- 4.4.1.5 Dimensions and weight of fully assembled unit.
- 4.4.1.6 Quality Assurance Program, manual or procedure.
- 4.4.2 Approval Data: The Seller shall submit 8 copies of the following items for approval within 30 days after the award of the contract.
  - 4.4.2.1 Catalog data on neutralization unit, motors, valves, mixers, tanks, actuators, and instruments.
  - 4.4.2.2 Materials description (mechanical, electrical, etc).
  - 4.4.2.3 Dimensions and weight of subassemblies.
  - 4.4.2.4 Dimensions and weight of fully assembled unit.
  - 4.4.2.5 Electrical power requirements (voltage and kVA).
  - 4.4.2.6 Logic diagrams showing system operation.
  - 4.4.2.7 Schematic diagrams showing operation of electrical devices.
  - 4.4.2.8 Mixer stand assembly.
  - 4.4.2.9 Service air requirements and interface fittings.
  - 4.4.2.10 Water requirements and interface fittings.
  - 4.4.2.11 Detailed test procedure per 4.3.2.
  - 4.4.2.12 Installation drawings.
- 4.5 CERTIFIED VENDOR INFORMATION: Coincident with completion of system installation, the Seller shall submit 10 copies of the following to the Buyer.
  - 4.5.1 As-built drawings showing the final (as-built) configuration of the system. The as-built package will include (as a minimum):
    - 4.5.1.1 Physical arrangement of equipment-layout and dimensional data.
    - 4.5.1.2 Elementary diagrams for electrically operated devices.
    - 4.5.1.3 Interconnection diagrams including details of the Seller's local control panel and terminal block interface with Buyer's wiring.
  - 4.5.2 Recommended spare parts list.
  - 4.5.3 Operation and maintenance manuals: The manuals shall include instructions for operating, troubleshooting, assembly/disassembly, repair,

maintenance, and cleaning of the equipment. The manuals shall include parts layouts, drawings, and parts lists.

4.5.4 Certificate of performance for the test results required under section 4.3.

4.5.5 Data sheets for all instrument and control devices in accordance with ISA-S20-1981.

## 5.0 HANDLING, PACKAGING, AND DELIVERY

5.1 HANDLING: If special handling devices are needed for assembly or installation, those devices shall be identified as special equipment.

### 5.2 PACKAGING

5.2.1 Equipment shall be protected from dirt, soil, and moisture.

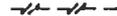
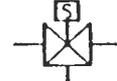
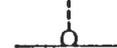
5.2.2 The equipment shall be boxed or crated in a manner to prevent damage during shipment.

5.2.3 All packages shall be suitably marked on the outside to facilitate identification of the purchase order, the procurement specification, the package contents, and any special handling instructions.

5.2.4 The system shall be designed to be shipped in subassemblies for installation at jobsite. Installation drawings shall be noted as to the location of the subassemblies and indicate lifting points for movement into the building.

5.3 DELIVERY: In accordance with the purchase order.

## LEGEND

	ELECTRIC SIGNAL
	BINARY SIGNAL (ON-OFF)
	PNEUMATIC SIGNAL
	PACKAGED EQUIPMENT FURNISHED BY SELLER
	DIAPHRAGM CONTROL VALVE (ROTARY TYPE)
	3-WAY DIAPHRAGM OPERATED VALVE (FURNISHED BY SELLER)
	3-WAY SOLENOID VALVE
	CURRENT TO PNEUMATIC CONVERTER
	MAGNETIC FLOWMETER
	TEMPERATURE ELEMENT INSIDE THERMOWELL
	PANEL MOUNTED INSTRUMENTS
	FIELD MOUNTED INSTRUMENTS
	PANEL MOUNTED STATUS LIGHT (R=RED, G=GREEN)

## NOTES

- \* INSTRUMENTS & CONTROL FURNISHED,  
INSTALLED AND WIRED BY BUYER

INSTRUMENT IDENTIFICATION LETTERS TABLE

SYMBOL	FIRST LETTER	SUCCEEDING LETTERS
A	ANALYSIS	ALARM
C		CONTROLLER
E		ELEMENT
F	FLOW	
H		HIGH
I		INDICATOR
L		LIGHT, LOW
Q		TOTALIZER
R		RECORDER
S		SWITCH
T	TEMPERATURE	TRANSMITTER
V		VALVE
Y	EVENT, STATUS	CONVERTER

ABBREVIATIONS OTHER THAN  
INSTRUMENT SYMBOL LETTERS

AS - AIR SUPPLY

EFFL - EFFLUENT

NE - NEUTRALIZED EFFLUENT

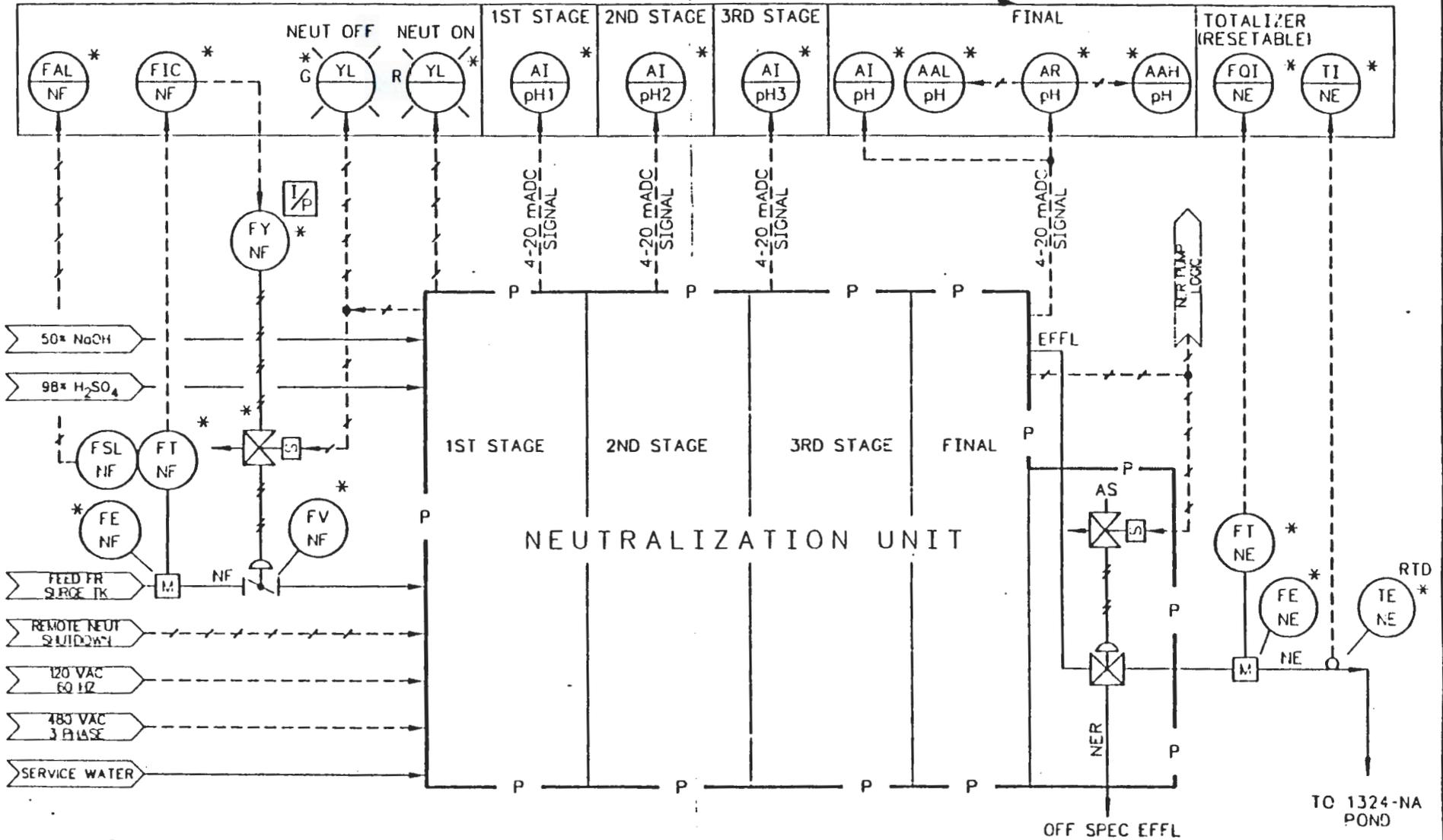
NER - NEUTRALIZATION EFFLUENT RECYCLE

NF - NEUTRALIZATION FEED

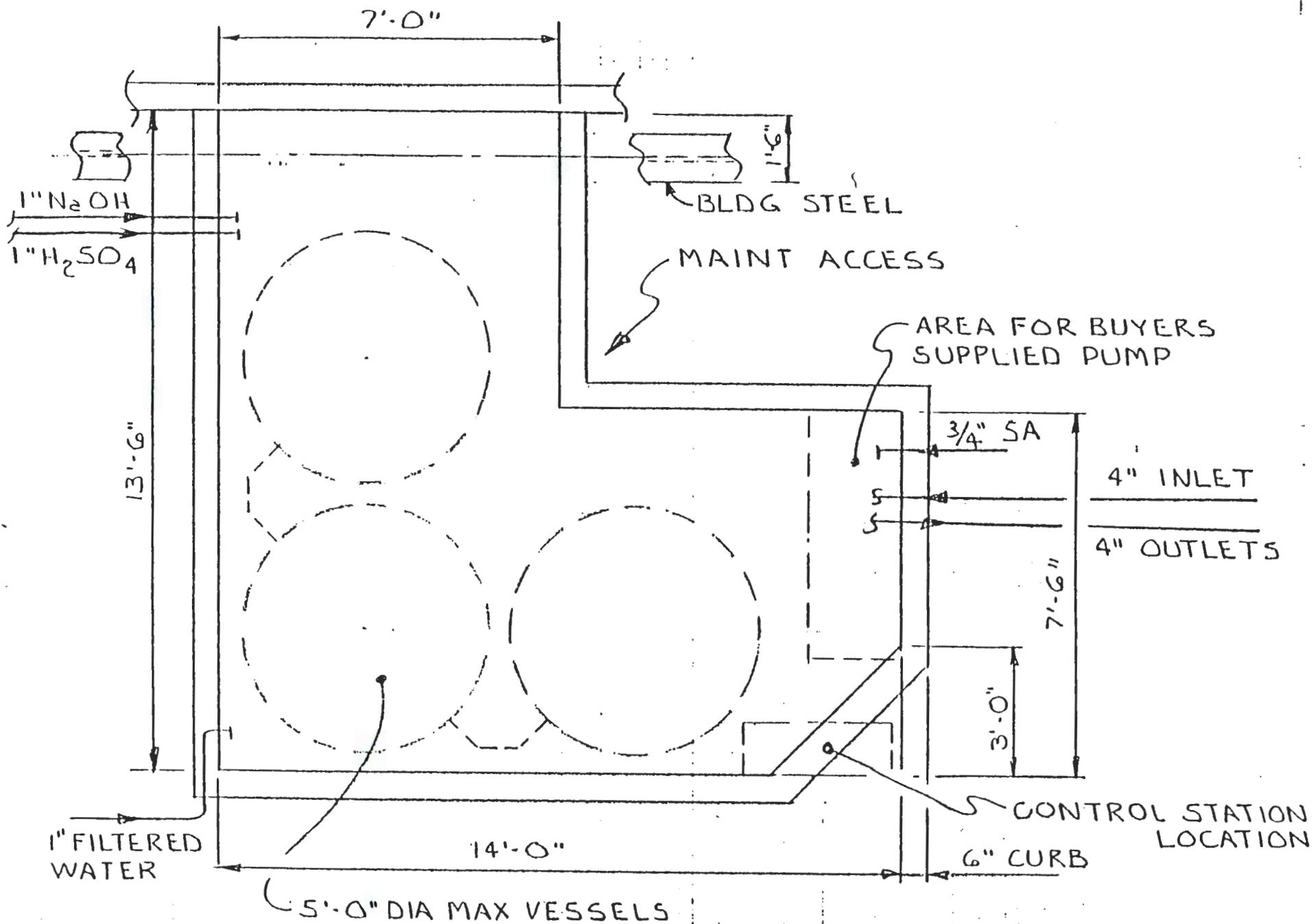
RTD - RESISTANCE TEMPERATURE DETECTOR

KAISER ENGINEERS HANFORD	Title ELEMENTARY NEUTRALIZATION UNIT SCHEMATIC
Prepared By PA SMTH/J SEN	Sketch No 88G-GEN-011-P1-1 SHEET 1

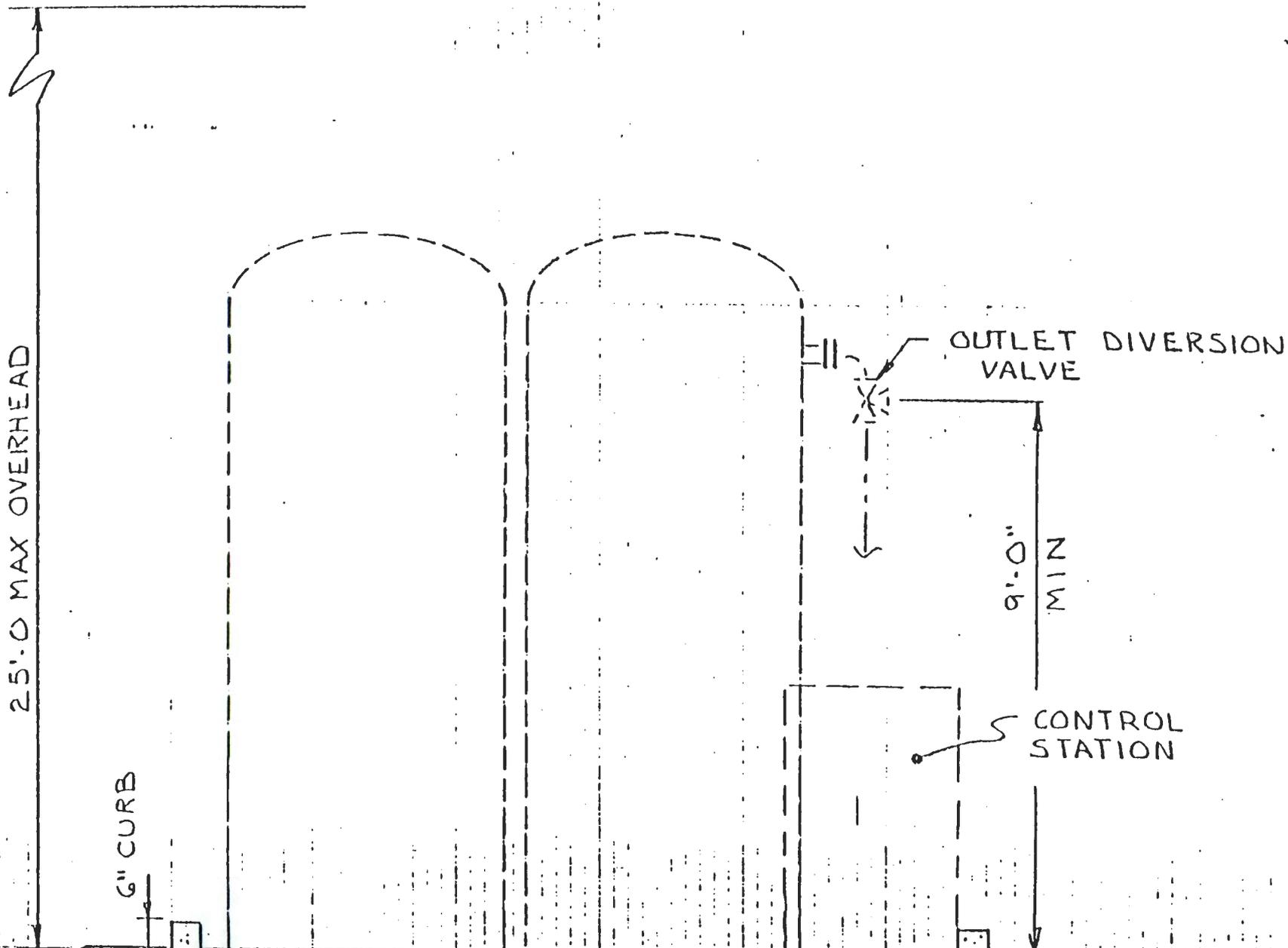
163N CONTROL PANEL BY BUYER



KAISER ENGINEERS HANFORD	Title ELEMENTARY NEUTRALIZATION UNIT SCHEMATIC
Prepared By PA SVTH/J SEN	Sketch No. 88G-GEN-011-P1-1 SHEET 2



ELEMENTARY NEUTRALIZATION UNIT - EQUIPMENT CONFIGURATION



ELEMENTARY NEUTRALIZATION UNIT  
ELEVATION

SKETCH 88G-GEN-011-PI-3