Series 5000 Analyzers
Low Range Phosphate—*Model 60005*
and High Range Phosphate—*Model 60001*

Depending upon your analysis needs, you can choose from two continuous-reading process analyzers to measure phosphate. The new Series 5000 Low Range Phosphate Analyzer is ideally suited for monitoring wastewater, drinking water, boiler water and can be used in other situations where trace amounts of phosphate must be carefully tracked. The Series 5000 High Range Phosphate Analyzer provides best results when used in applications involving boiler water, cooling water, and other processes where phosphate-containing additives are used to treat industrial water. Both instruments feature the same superior electronics found in all Series 5000 Analyzers and require minimal maintenance to achieve reliable performance.

Low Range Phosphate Analyzer

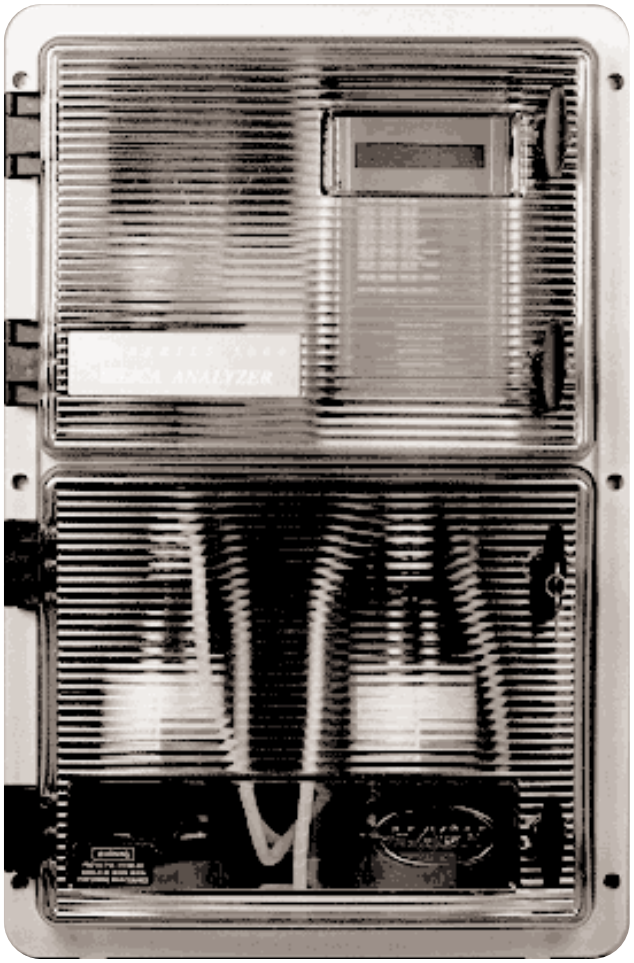
Overview

This new analyzer is a continuous-reading instrument using the ascorbic acid method of analysis for colorimetric measurement of phosphate at a wavelength of 880 nm. The measurement range is 0 to 5000 µg/L (ug/L or parts per billion) as orthophosphate (PO_4). In the setup menu, a choice is available for concentration readout, either µg/L PO_4, or µg/L P. Accuracy is 4 µg/L or ±4% of reading. The minimum detection limit is less than 4 µg/L. The analyzer provides a digital display of concentration and is autocalibrating.

Method of Analysis

The ascorbic acid method is used to measure low levels of orthophosphate. A surfactant is added to minimize bubble formation on the sample cell walls. Light absorbance through this solution is measured to serve as the reference absorbance. This compensates for any background color and turbidity inherent in the sample, changes in colorimeter lamp output, or contamination of the sample cell walls.

The molybdate reagent is then added, reacting with any orthophosphate present to form a heteropoly acid. Finally, the ascorbic acid reagent is added, reducing the heteropoly acid to an intensely colored molybdenum blue. After the reaction has gone to completion, the absorbance is measured again. The increase in absorbance over the reference is proportional to the amount of orthophosphate present. The analyzer utilizes the most recent calibration curve to calculate and display the amount of orthophosphate present in the sample.



The Series 5000 Phosphate Analyzer is housed in a NEMA 4X/IP65 corrosion-resistant industrial enclosure.

High Range Phosphate Analyzer

Overview

The patented* Series 5000 High Range Phosphate Analyzer is a continuous-reading instrument using the molybdovanadate method of analysis for colorimetric measurement of ortho-phosphate at a wavelength of 480 nm. The measurement range is 0.0 to 50.0 milligrams/liter (mg/L or parts per million) as phosphate (PO_4). In the setup menu, a choice is available for the concentration readout, either mg/L PO_4, or mg/L P. Accuracy is 0.5 mg/L or ± 5% of reading. The minimum detection limit is less than 0.2 mg/L. The analyzer provides a digital display of concentration and is autocalibrating.

 *U.S. patent number 4,865,992

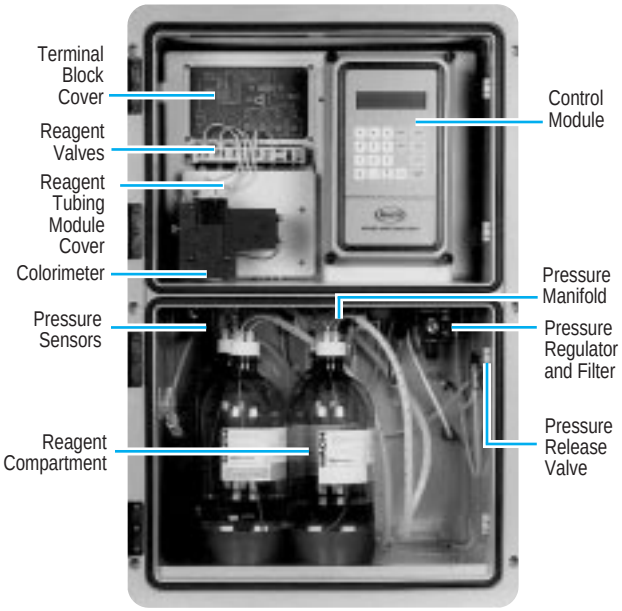


FIGURE 1. ANALYZER COMPONENTS

Method of Analysis

The molybdovanadate method is used to measure orthophosphate in water. Sulfuric Acid Solution, 5.25 N, and Anionic Surfactant Solution are added to the sample to dissolve particulate matter and minimize bubble formation on the sample cell walls.

Light absorbance through this solution is measured to provide a zero reference measurement for each sample. Then Molybdovanadate Reagent is added to react with orthophosphate to form a yellow-colored vanadomolybdophosphoric acid complex. Light absorbance through the solution is measured at 480 nm and compared to the zero reference measurement. The phosphate concentration as PO_4 is calculated based on the difference between the two measurements and is displayed directly in mg/L PO_4 or mg/L P as selected in the setup menu.

Low Range Phosphate and High Range Phosphate Analyzers

Performance Features

- Designed to meet UL 1262, CSA C22.2 No. 142 and IEC 1010-1 safety standards. Also complies with Class A limits for radio and noise emission as specified by the FCC and CISPR.
- Shielded from any electromagnetic interference caused by pumps, valves or radio transmitters in the work area.
- Sample failure alarm automatically shuts down operation when no sample is available and restarts analyzer when sample flow is restored.
- Continuous auto-zero on each sample analysis prevents turbid and colored samples from interfering with the analysis.
- Self diagnostics alert the operator to any abnormal conditions in the instrument.
- Operators can make grab sample measurements without interrupting normal sample flow.
- Low reagent consumption and pressurized reagent delivery system reduce maintenance requirements.
- Three choices for calibration, including programmable autocalibration.
- Multi-language menu selectable for English, German, French and Spanish.
- Outputs include 4-20 mA or selectable voltage, Standard RS-232 and four unpowered contact relays.

Operation

A sample conditioning kit is provided which controls sample pressure to the analyzer at 5 ± 3 psig. Adjustable sample bypass flow to drain is also provided in this kit to ensure continuously fresh sample to the analyzer. A two-way pinch valve controls sample flow to the measurement cell.

At the beginning of each analysis cycle, the measurement cell is flushed thoroughly with fresh sample. Pressurized reagents are added in a controlled sequence through the use of solenoid valves. An initial sample blank absorbance reading, taken for each sample to provide a zero reference, is compared to the final absorbance reading to calculate sample phosphate concentration. Sample also can be introduced manually without interrupting the normal sample flow when the analyzer is used to measure grab samples.

Outputs and Controls

A selectable output of 0-10 mV, 0-100 mV, 0-1 V or 4-20 mA is included to drive an external strip chart recorder or provide proportional control. Output, linearly proportional to sample phosphate concentration, can be programmed by the operator to span any portion of the appropriate phosphate range.

Two independent fully adjustable sample concentration set-point alarms are provided. Each alarm is equipped with an unpowered SPDT relay. Set points can be programmed by the operator over the entire range. Each alarm can be programmed for high, low or rate of change. The analyzer also has system warning and system shut-down alarm relays.

Automatic, self-testing diagnostics can detect a number of possible malfunctions and provide separate alarm relay closures indicating a need for operator attention.

A serial input/output interface is available for sending data from the analyzer to an external printer or computer using a standard RS-232 or current loop configuration. Connection with an external computer enables the computer to compile and store phosphate concentration data and control analyzer programming and operation from a remote location.

Certification

The Series 5000 Analyzer is designed to meet UL 1262, CSA C22.2 No. 142 and IEC 1010-1 safety standards. The instrument also complies with Class A limits for radio and noise emissions as specified by the (FCC) and CISPR. (All approvals pending.) The molded ABS plastic enclosure meets NEMA 4X/IP65 industrial ratings.

Maintenance Requirements

Reagents are replaced monthly. The standard solution is sufficient for 10 calibrations. Reagent tubing and the colorimeter lamp are replaced annually. No other regular maintenance is required.

Construction and Installation

Analyzer components are assembled to a NEMA 4X/IP65 ABS plastic cabinet suitable for bench- or panel-mounting. Gasketed doors create an airtight seal that keeps water and dust out. The electronic control module is also isolated in a gasketed enclosure.

Electrical and plumbing connections are made at the back of the analyzer. Sample inlet is a stainless steel compression fitting for 1/4-inch OD tubing. A 3/4-inch plastic hose barb elbow fitting is provided for drain connection. Four electrical access holes sized for 1/2-inch conduit fittings accommodate power and signal wiring. The required external reagent pressure source filter and filter cartridge are is built into the analyzer.

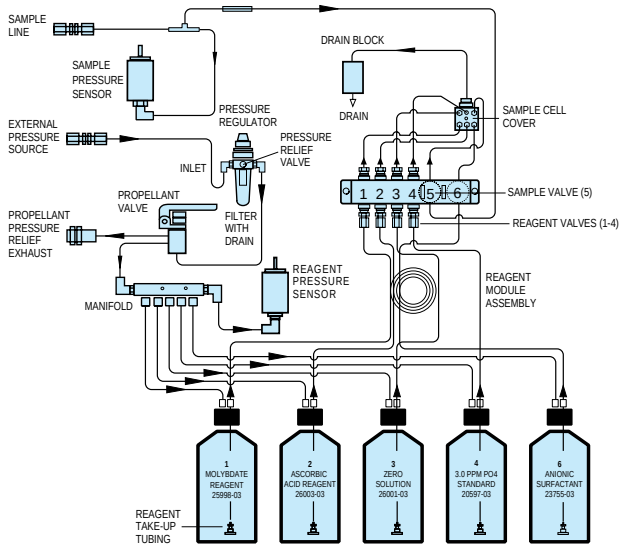


FIGURE 2A.
LOW RANGE PHOSPHATE ANALYZER FLOW DIAGRAM

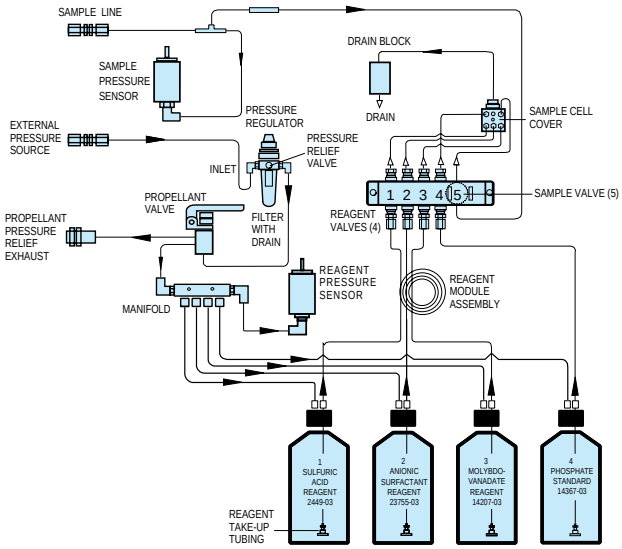


FIGURE 2B.
HIGH RANGE PHOSPHATE ANALYZER FLOW DIAGRAM

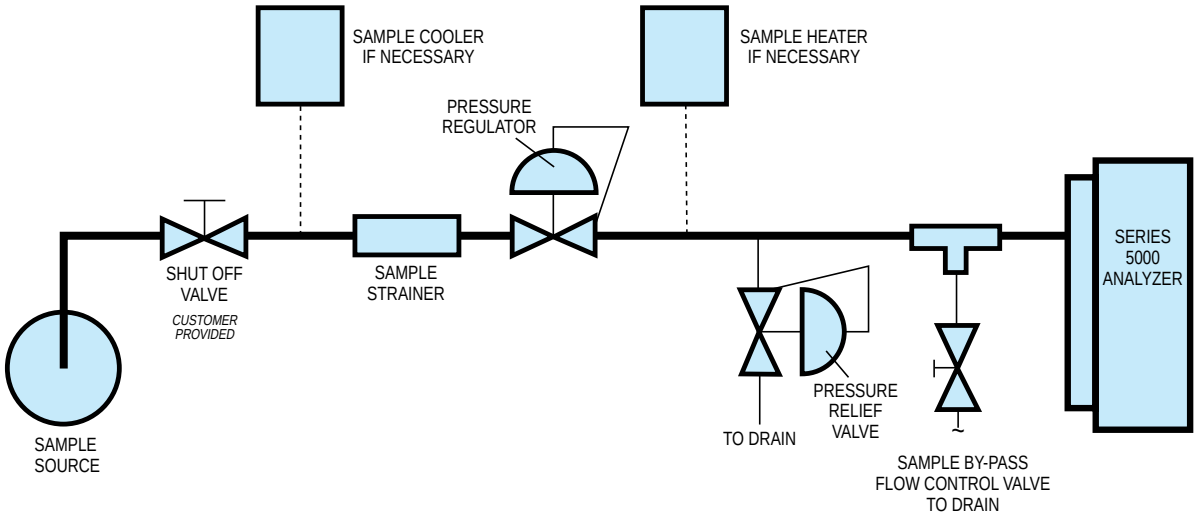


FIGURE 3. RECOMMENDED SAMPLE CONDITIONING SYSTEM

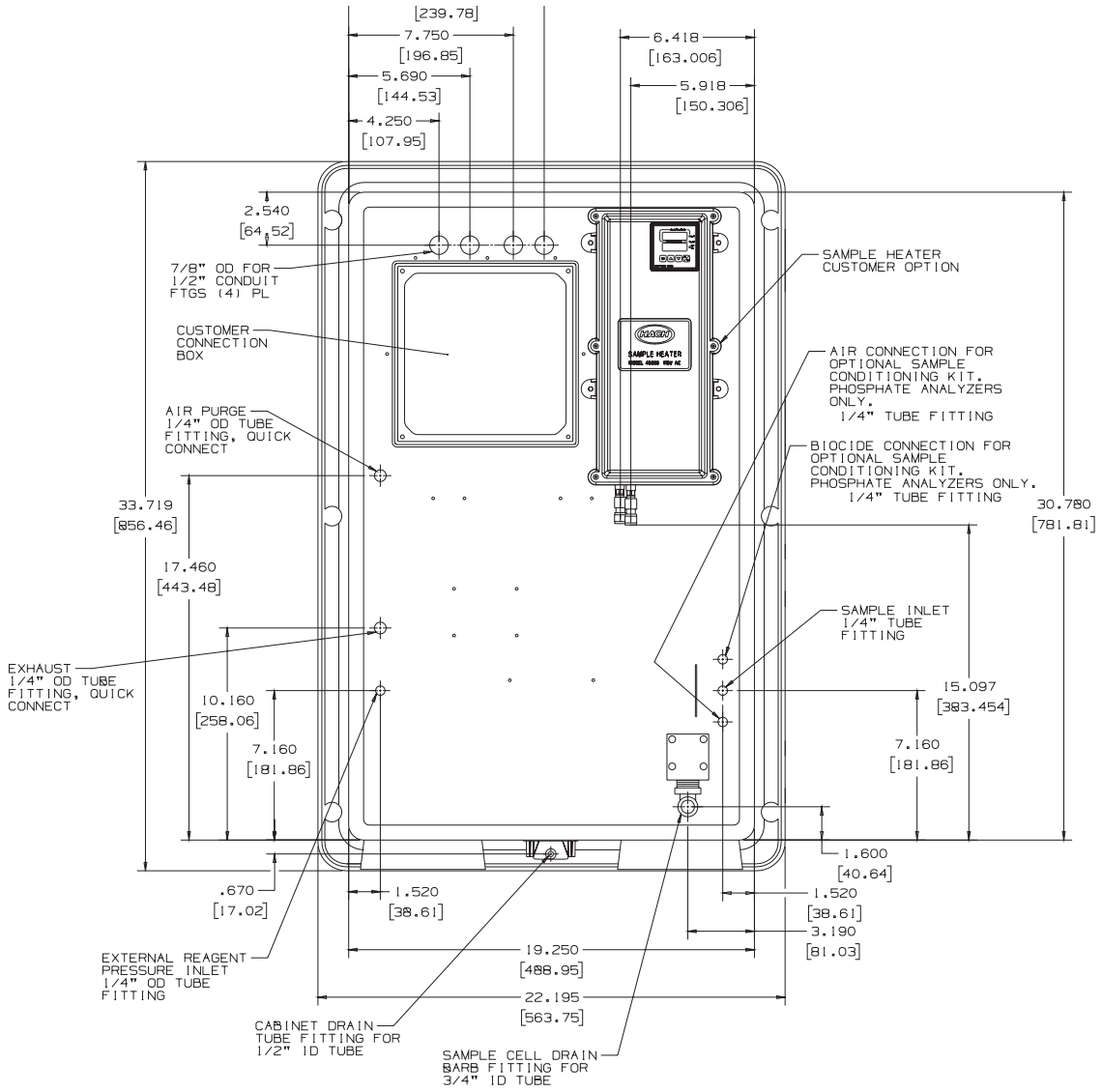


FIGURE 4. REAR VIEW

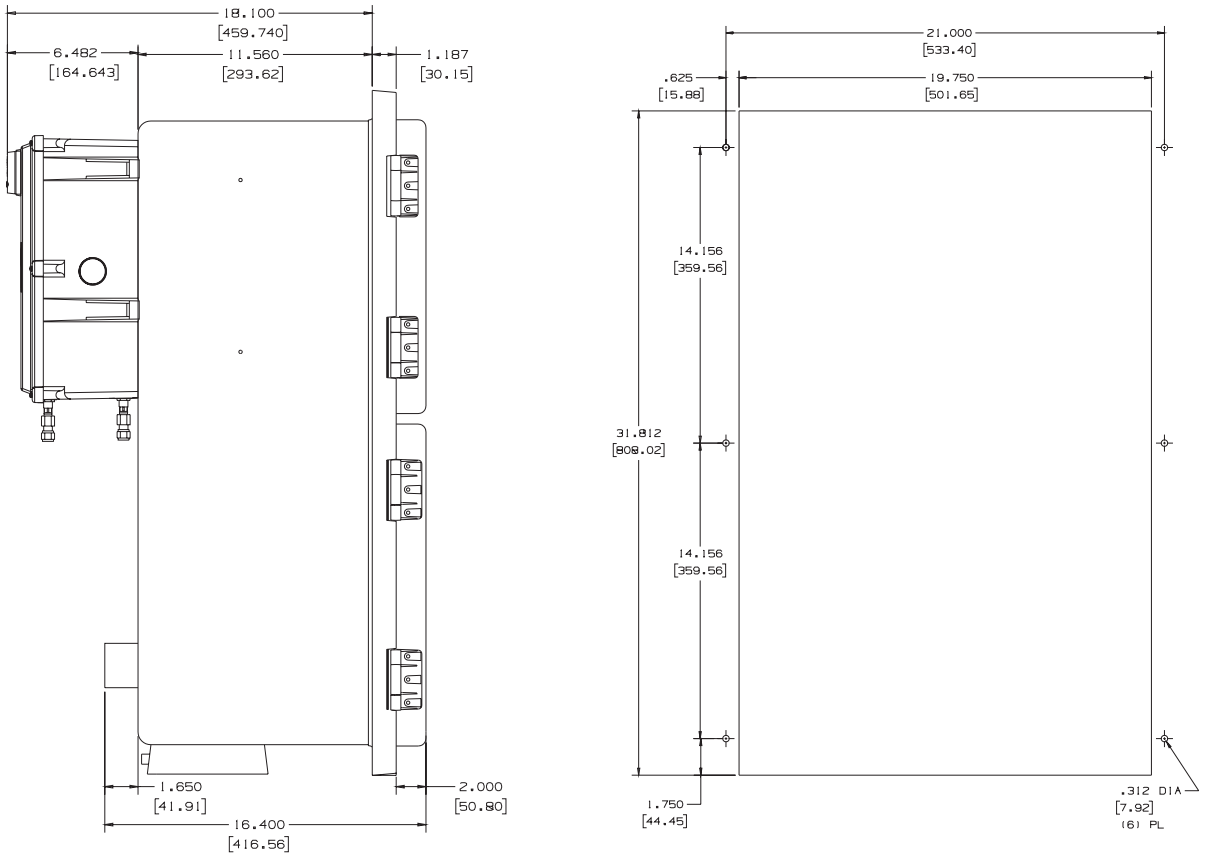


FIGURE 5. SIDE VIEW AND PANEL CUT-OUT

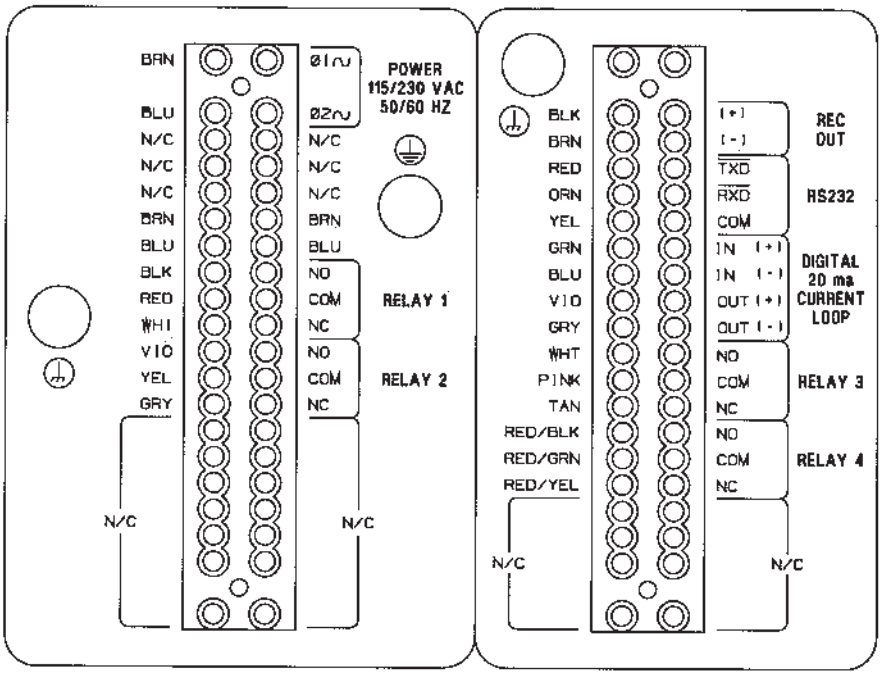


FIGURE 6. WIRING CUSTOMER CONNECTION BOX

Specifications: Series 5000 Low Range Phosphate Analyzer (Model 60005)

Range: 0 to 5000 µg/L as PO_4

Accuracy (typical): ± 4 µg/L or ± 4% of reading whichever is greater

Minimum Detection Limit: Less than 4 µg/L

Precision: ± 1% of reading

Step Response Time: 15 minutes

Ambient Operating Conditions: 10 to 50 °C, 5 to 95% noncondensing humidity, suitable for general-purpose, clean, indoor environments. (Not suitable for outdoor use.)

Analyzer Sample Requirements: Regulated to 5 ± 3 psig (34.5 ± 20.7 kPa). Flow rate between 100 to 300 mL/minute. Sample temperature between 10 to 50 °C.

Recorder Outputs: Selectable for 0-10 mV, 0-100 mV, 0-1 V or 4-20 mA. Output span programmable over any portion of the 0 to 5000 µg/L range

Serial I/O: RS-232 and 20 mA current loop

Alarms: Four programmable relays are built in for sample concentration alarms, analyzer system warning and analyzer system shutdown alarms are each equipped with an unpowered SPDT relay. Two relay contacts are rated for 5A resistive load @ 240 Vac. Two relay contacts are rated for 1A resistive load @ 30 Vac or 42 Vdc.

Power Requirements: 115/230 Vac, 50/60 Hz, switch selectable; 52 VA, 32 W maximum

External Reagent Pressure Source: 20 to 120 psig regulated (137.9 to 827.4 kPa); nitrogen, instrument-quality air or compressed air. Filter and regulator supplied with analyzer. If the analyzer is to be operated at elevated temperatures (>35 °C), nitrogen is recommended as the external pressure source.

External Reagent Pressure Inlet: 1/4-inch OD stainless steel compression tubing fitting

Sample Inlet Fitting: 1/4-inch OD stainless steel compression tubing fitting

Sample Drain Fitting: Elbow barb fitting for 3/4-inch ID tubing

Air Purge (optional): 15-scfh (standard cubic feet per hour) instrument quality air, 1/4-inch OD quick connect compression tubing fitting

Reagents:
2.9-L Anionic Surfactant Solution (Cat. No. 23755-03)
2.9-L Molybdate Reagent (Cat. No. 25998-03)
2.9-L Ascorbic Acid Solution (Cat. No. 26003-03)
2.9-L Water, Standard Zero (Cat. No. 26001-03)
2.9-L Phosphate Standard, 3000 µg/L (Cat. No. 20597-03)

Reagent Consumption: 2.9-L of each reagent per month. The phosphate standard is consumed during the calibration cycle. (Monthly reagent replacement is recommended.)

Enclosure: Molded ABS plastic NEMA 4X/IP65 cabinet with gasketed doors

Dimensions: 856 mm (33.75") H x 563 mm (22.2") W x 419 mm (16.5") D

Mounting: Bench top or panel mounting only

Shipping Weight: 36.7 kg (81 lb)

Cabinet Drain Fitting: 1/2-inch ID tubing

Specifications are subject to change without notice.

Typical Proposal Specification: Series 5000 Low Range Phosphate Analyzer

The Phosphate Analyzer shall be a semicontinuous reading instrument using the ascorbic acid method of analysis for colorimetric measurement of phosphate at a wavelength of 880 nm. The measurement range shall be 0 to 5000 µg/L (parts per billion) as phosphate (PO_4). The detection limit shall be less than 4 µg/L. The precision shall be ± 1% of reading. The accuracy shall be 4 µg/L or ± 4% of reading, whichever is greater in the measurement range. The analyzer shall provide digital display and be capable of autocalibration.

The analyzer shall provide for continuous purge of sample to drain to assure fresh sample to the analyzer and reduce analysis lag time. Metering and mixing of sample and reagent shall be via solenoid valves. Sample shall be delivered to the analyzer at the pressure of 5 ± 3 psig. Reagents shall be pressurized by use of an inert propellant. No internal pumps shall be required to meter sample or reagents.

Every sample measurement shall be preceded by a measurement of a sample blank. The analyzer shall compare the measured sample value with the blank value and display the corrected concentration. The analyzer also shall be capable of grab sample analysis without interrupting continuous sample flow to the analyzer.

User selectable recorder outputs of 0-10 mV, 0-100 mV, 0-1 V or 4-20 mA shall be provided. Recorder output span shall be user adjustable over the entire span of the instrument. Two independent, fully adjustable sample concentration set-point alarms also shall be provided. The analyzer shall include four built-in programmable relays for sample concentration alarms, analyzer system warning and analyzer system shutdown. Each alarm shall be equipped with unpowered SPDT relays. Two relay contacts shall be rated for 5A resistive load at 240 Vac. The other two shall be rated for 1A resistive load at 30 Vac or 42 Vdc. The manufacturer shall provide RS-232 and 20 mA current loop outputs.

The analyzer components shall be assembled to a NEMA 4X/IP65 ABS plastic cabinet designed for bench- or panel-mounting. The control unit shall be isolated from other analyzer components by a gasketed enclosure. Power requirement shall be 115/230 Vac, 50/60 Hz, 32 W max. The analyzer shall be warranted for one full year against defects in materials and workmanship and shall include a one-month supply of reagents.

The analyzer shall be designed to meet UL 1262, CSA C22.2 No. 142 and IEC 1010-1 safety standards. The instrument shall also comply with Class A limits for radio and noise emission as specified by the FCC and CISPR.

Specifications: Series 5000 High Range Phosphate Analyzer (Model 60001)

Range: 0.0 to 50.0 mg/L as PO_4

Accuracy (typical): ± 0.5 mg/L or ± 5% of reading whichever is greater

Minimum Detection Limit: Less than 0.2 mg/L

Precision: ± 0.5 mg/L or ± 5% of reading whichever is greater

Step Response Time: 11 minutes

Ambient Operating Conditions: 5 to 50 °C, 5 to 95% noncondensing humidity, suitable for general-purpose, clean, indoor environments. (Not suitable for outdoor use.)

Analyzer Sample Requirements: Regulated to 5 ± 3 psig (34.5 ± 20.7 kPa). Flow rate between 100 to 300 mL/minute. Sample temperature between 5 to 50 °C.

Recorder Outputs: Selectable for 0-10 mV, 0-100 mV, 0-1 V or 4-20 mA. Output span programmable over any portion of the 0.0 to 50.0 mg/L range

Serial I/O: RS-232 and 20 mA current loop

Alarms: Four programmable relays are built in for sample concentration alarms, analyzer system warning and analyzer system shutdown alarms are each equipped with an unpowered SPDT relay. Two relay contacts are rated for 5A resistive load @ 240 Vac. Two relay contacts are rated for 1A resistive load @ 30 Vac or 42 Vdc.

Power Requirements: 115/230 Vac, 50/60 Hz, switch selectable; 52 VA, 32 W maximum

External Reagent Pressure Source: 20 to 120 psig regulated (137.9 to 827.4 kPa); nitrogen, instrument-quality air or compressed air. Filter and regulator supplied with analyzer.

External Reagent Pressure Inlet: 1/4-inch OD stainless steel compression tubing fitting

Sample Inlet Fitting: 1/4-inch OD stainless steel compression tubing fitting

Sample Drain Fitting: Elbow barb fitting for 3/4-inch ID tubing

Air Purge (optional): 15-scfh (standard cubic feet per hour) instrument quality air, 1/4-inch OD quick connect compression tubing fitting

Reagents:
2.9-L Sulfuric Acid Solution, 5.25 N (Cat. No. 2449-03)
2.9-L Molybdovanadate Reagent (Cat. No. 14207-03)
2.9-L Anionic Surfactant Solution (Cat. No. 23755-03)
2.9-L Phosphate Standard Solution, 30.0 mg/L
(Cat. No. 14367-03) (250 mL required for each calibration.)

Reagent Consumption: 2.9-L of each reagent per month. The phosphate standard is consumed during the calibration cycle. (Monthly reagent replacement is recommended.)

Enclosure: Molded ABS plastic NEMA 4X/IP65 cabinet with gasketed doors

Dimensions: 856 mm (33.75") H x 563 mm (22.2") W x 419 mm (16.5") D

Mounting: Bench top or panel mounting only

Shipping Weight: 36.7 kg (81 lb)

Cabinet Drain Fitting: 1/2-inch ID tubing

Specifications are subject to change without notice.

Typical Proposal Specification: Series 5000 High Range Phosphate Analyzer

The Phosphate Analyzer shall be a semicontinuous reading instrument using the molybdovanadate method of analysis for colorimetric measurement of phosphate at a wavelength of 480 nm. The measurement range shall be 0.0 to 50.0 mg/L (parts per million) as phosphate (PO_4). The detection limit shall be less than 0.2 mg/L. The precision shall be ± 0.5 mg/L or ± 5% of reading whichever is greater. The accuracy shall be ± 5% of reading in the measurement range. The analyzer shall provide digital display and be capable of autocalibration.

The analyzer shall provide for continuous purge of sample to drain to assure fresh sample to the analyzer and reduce analysis lag time. Metering and mixing of sample and reagent shall be via solenoid valves. Sample shall be delivered to the analyzer at the pressure of 5 ± 3 psig. Reagents shall be pressurized by use of an inert propellant. No internal pumps shall be required to meter sample or reagents.

Every sample measurement shall be preceded by a measurement of a sample blank. The analyzer shall compare the measured sample value with the blank value and display the corrected concentration. The analyzer also shall be capable of grab sample analysis without interrupting continuous sample flow to the analyzer.

User selectable recorder outputs of 0-10 mV, 0-100 mV, 0-1 V or 4-20 mA shall be provided. Recorder output span shall be user adjustable over the entire span of the instrument. Two independent, fully adjustable sample concentration set-point alarms also shall be provided. The analyzer shall include four built-in programmable relays for sample concentration alarms, analyzer system warning and analyzer system shutdown. Each alarm shall be equipped with unpowered SPDT relays. Two relay contacts shall be rated for 5A resistive load at 240 Vac. The other two shall be rated for 1A resistive load at 30 Vac or 42 Vdc. The manufacturer shall provide RS-232 and 20 mA current loop outputs.

The analyzer components shall be assembled to a NEMA 4X/IP65 ABS plastic cabinet designed for bench- or panel-mounting. The control unit shall be isolated from other analyzer components by a gasketed enclosure. Power requirement shall be 115/230 Vac, 50/60 Hz, 32 W max. The analyzer shall be warranted for one full year against defects in materials and workmanship and shall include a one-month supply of reagents.

The analyzer shall be designed to meet UL 1262, CSA C22.2 No. 142, IEC 1010-1 safety standards. The instrument shall also comply with Class A limits for radio and noise emission as specified by the FCC and CISPR.

How to Order

Analyzers are shipped with a one-month supply of reagents, an annual maintenance kit, an instruction manual and a sample conditioning kit. Power cord ordered separately.

Cat. No.	Description
60005-00	Series 5000 Low Range Phosphate Analyzer
60001-00	Series 5000 High Range Phosphate Analyzer
45983-00	Stainless Steel Sample Conditioning Kit (optional)
46981-33	Annual Maintenance Kit (for Low Range Phosphate Analyzer)
46981-00	Annual Maintenance Kit (for High Range Phosphate Analyzer)
46964-00	Power Cord, 125V, 10A, 1.83 m (6')
47439-00	Power Cord, 250V, 10A, 1.83 m (6') Continental European plug

Additional Reagents

One unit each of the reagents is sufficient for 30 days of operation. The Standard Solution is sufficient for 10 calibrations.

For the Series 5000 Low Range Phosphate Analyzer

23755-03	Anionic Surfactant Solution, (2.9 L)
26003-03	Ascorbic Acid Reagent Package (2.9 L)
25998-03	Molybdate Reagent Solution (2.9 L)
26001-03	Water, Standard Zero (2.9 L)
20597-03	Phosphate Standard Solution 3 mg/L PO_4 (2.9 L)

For the Series 5000 High Range Phosphate Analyzer

2449-03	Sulfuric Acid Solution, 5.25 N (2.9 L)
14207-03	Molybdovanadate Reagent (2.9 L)
23755-03	Anionic Surfactant Solution (2.9 L)
14367-03	Phosphate Standard Solution, 30.0 mg/L (2.9 L)

Comprehensive Service Support Available

Hach offers a variety of service and support options to keep your analyzer operating at peak performance. Within the United States, customers can take advantage of the User Service Agreement, a preventive maintenance program, and the SIR plan, an inventory replacement option that entitles customers to a discount on reagents. Contact Hach for details.

In the United States, call 800-227-4224 toll-free for current prices or technical assistance.

Outside the United States, contact the Hach office or distributor serving you.

HACH *Systems for Analysis*

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