



The Parker THM Analyzer

A drinking water disinfection by-product monitoring system

Catalog 4251-THM

October 2011

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.

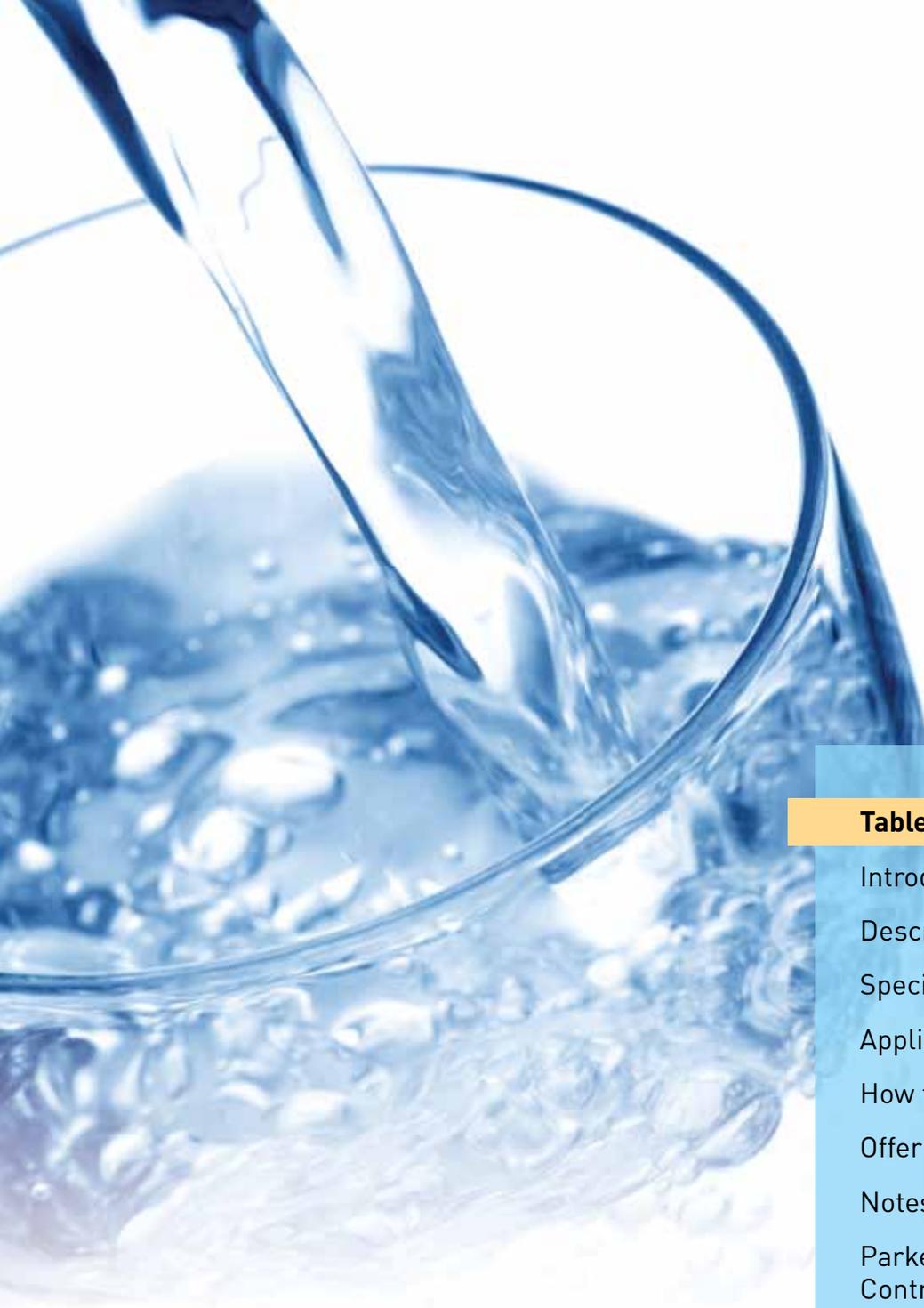


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WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the detailed "Offer of Sale" elsewhere in this document or available at www.parker.com/ipdus.

THM ANALYSIS –

VITAL FOR DRINKING WATER SAFETY AND COMPLIANCE

The demand for clean, reliable drinking water has and will continue to be of primary concern for consumers in the U.S. and around the world. In the U.S., 90% of people receive their drinking water through a public water system, where contaminants are regulated by the Safe Drinking Water Act (SDWA), as regulated by the U.S. EPA.

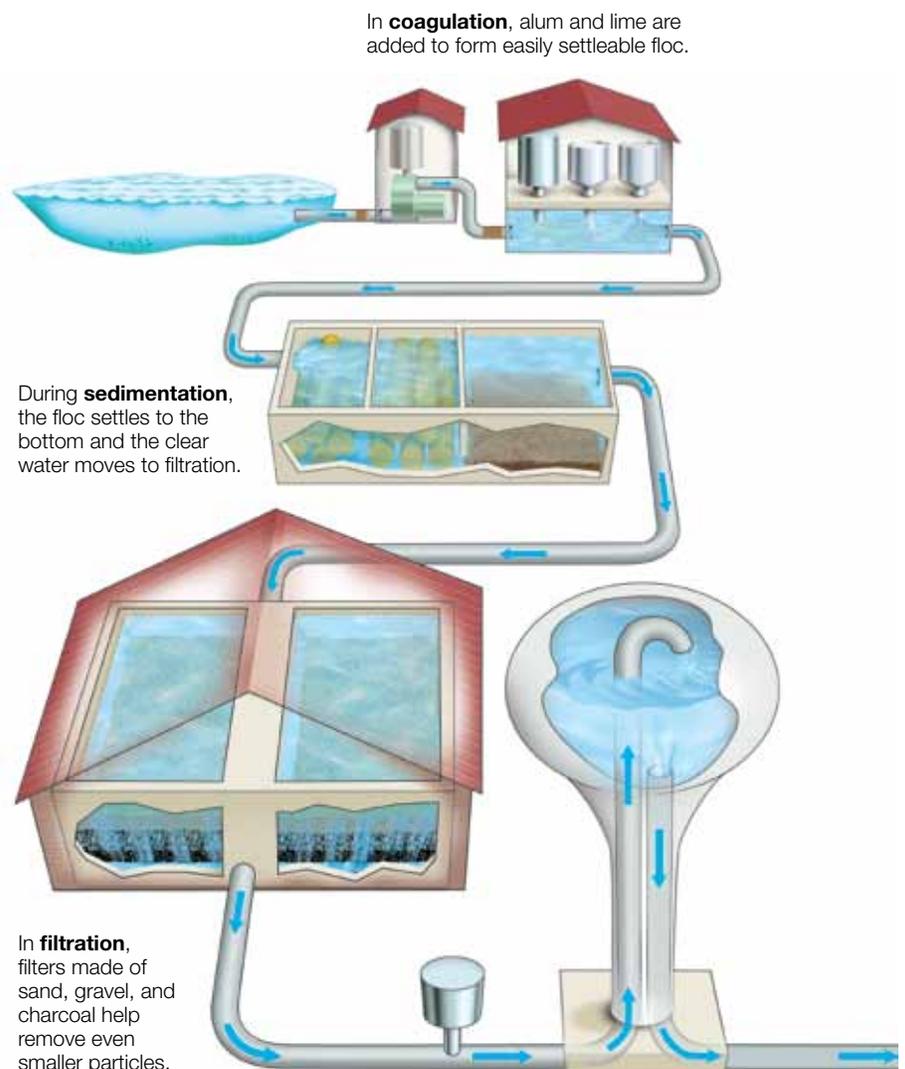
Regulations

One such set of regulations – Stage 1 and Stage 2 Disinfectant By-Product Rules (DBPR) – regulate the contaminants formed by disinfecting water with chlorine or chloramine: most notably, Trihalomethanes (THMs) and Haloacetic Acids (HAAs). Effective in 2012, the Stage 2 DBP rule regulates THMs (chloroform, dichlorobromomethane, dibromochloromethane, and bromoform) to 80ug/L (80ppb) total concentration. Water treatment plants and distribution systems are required to implement this rule and meet THM levels at each monitoring site in the distribution system. **To reach this level, water plants must monitor THM levels to optimize their treatment process.**

Current Practices

Today, many drinking water facilities rely on outside laboratory analysis for THM monitoring. Although this data is reliable and accurate, the time it takes to receive THM data and the high cost per sample make outside lab analysis impractical for real-time optimization of water treatment processes. Plant operators require immediate data to adjust the pH, coagulant, and disinfectant dosage that impact THM formation. Reliable and timely THM data is essential for water treatment process optimization.

The Drinking Water Treatment Process



THE PARKER THM ANALYZER

Rapid measurement of THMs when, where, and as often as you want – with immediate results.



Helium gas supply hardware not shown.

Parker's new THM Analyzer is an easy to operate, integrated Purge-and-Trap Gas Chromatograph (GC) that measures THM concentration at ppb levels in less than 30 minutes right at your own facility without tedious sample preparation.

This integrated system is a powerful new tool that can help operators optimize water treatment at the plant and evaluate water age in the distribution system for improved control over the formation of THMs.

Push-button Operation with No Sample Prep

Simply collect a sample and connect it to the analyzer sparging system. Then push the start button to begin the measurement cycle. Individual and total THM information is displayed clearly on the analyzer touchscreen and laptop display. Analytical results, including measured concentration and detailed chromatography data are automatically archived for future review. The data may also be transferred to other software packages for more detailed trending analysis of THM information.

FEATURES:

30-minute analysis

Integrated Purge-and-Trap

Rapid operator feedback

Push-button simplicity

Dedicated instrument

BENEFITS:

Eliminates expensive and time-consuming off-site analysis for process control

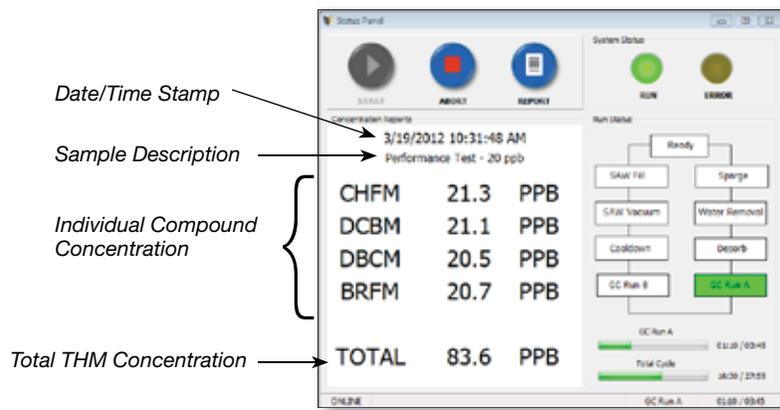
No sample preparation required

Allows for immediate process adjustment capability

Fast and easy operation; all-in-one sample sparging component separation, and data analysis

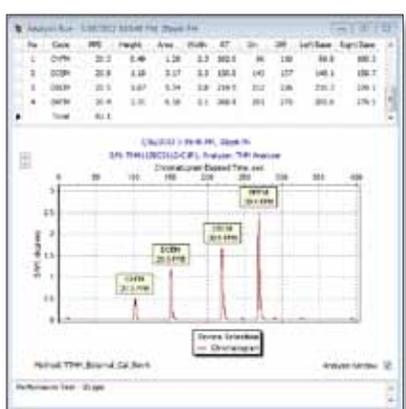
Helps ensure the safety of public drinking water

POWERFUL SOFTWARE PROVIDES CRITICAL ADVANTAGES FOR THM MEASUREMENT AND DATA ANALYSIS.



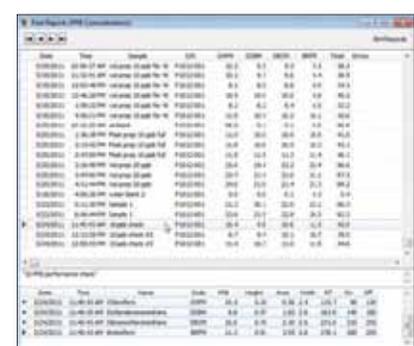
Status Panel Operator Interface

The Status Panel interface is displayed in both the Analyzer unit touchscreen display and laptop program window. A simple click on the start button begins the measurement process. The panel displays measurement progress during an analysis run and then displays the measured concentration levels for individual and total THM.



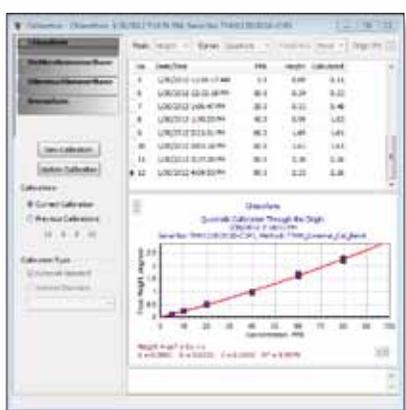
Annotated Chromatogram

After an analysis run is completed, the laptop software displays the processed chromatogram showing the compound signal peaks with the corresponding chromatography data listed. Also included is key sample identification data. Right clicking on the chromatogram permits additional data display, including carrier gas pressure profile, GC column, and preconcentrator temperature profiles, plus other options for more in-depth data analysis and review.



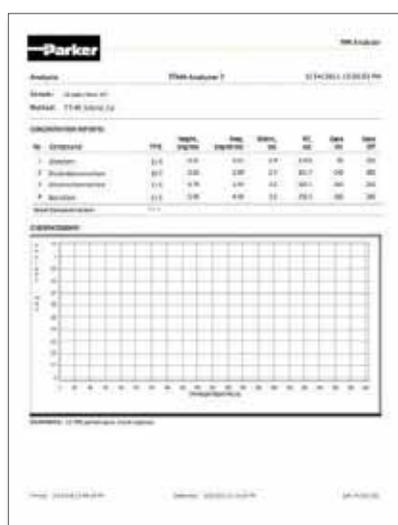
Viewing Previous Analysis Runs

In-depth review of any previous analysis run is made simple with the Past Reports window. The powerful software stores a complete data set of each analysis run, permitting a complete review of all the measurement parameters and data results.



Calibration

A fully featured, but simple-to-use calibration routine allows users to maintain the accuracy of the THM Analyzer. Calibrations used for previous analysis are stored and can be reviewed with past analysis run data.



THM Analysis Report

A formal report of any analysis run can be quickly generated with a click of the mouse button. The report includes the processed chromatogram, key chromatography data, and sample identification information.

Specifications



THM ANALYZER SPECIFICATIONS

| | |
|---|--|
| Size | 15.8"l x 15.3"h x 9.4"w (401 mm x 389 mm x 239 mm) |
| Weight | 16.5 lbs (7.5 kg) |
| Power | Universal AC input, 24 VDC internal |
| Power Consumption (Analyzer without laptop) | 150 W (peak), 120 VAC input, 24 VDC internal |
| Certifications | ETL 61010 / FCC part 15 Class A, ETL _C , CE |

PERFORMANCE SPECIFICATIONS

| | |
|----------------------------|---|
| Measured Compounds | Chloroform, Dichlorobromomethane, Dibromochloromethane, Bromoform |
| Accuracy | Total THM: 10%* |
| Precision | Total THM: ±5% RSD |
| Calibration | External calibration |
| Factory Calibration Range | 2ppb to 80ppb for each compound |
| Sampling and Analysis Time | Approximately 30 minutes |
| Detector Type | Surface Acoustic Wave (SAW) sensor |

REQUIREMENTS

| | |
|-----------------------|---------------------------------------|
| Carrier Gas | Helium, UHP grade |
| Supply Pressure | 55 – 60 psig (3.8 – 4.1 bar) |
| Gas Volume per Sample | Approximately 0.04 ft ³ ** |
| Water Sample Volume | 40 ml |

ENVIRONMENTAL

Operating the Analyzer within the recommended ranges ensures optimum instrument performance.

| | |
|---|-----------------------------|
| Recommended Operating Temperature Range | 68°F to 85°F (20°C to 30°C) |
| Storage Temperature Range | 5°C to 40°C (41°F to 104°F) |
| Relative Humidity | < 90% (non-condensing) |

*Standard factory calibration

**Up to 4,000 cycles from a single 300 cu. ft. high pressure cylinder (DOT 3AA2400)

THM ANALYSIS – APPLICATION OPPORTUNITIES

The quick, accurate, and inexpensive measurement of THMs using the Parker THM Analyzer creates numerous opportunities to improve the water treatment process.

THM levels can be lowered throughout the distribution system and chemical usage can be optimized to save money. What's more, quick process adjustments can be made to control THM formation when surface water Total Organic Carbon (TOC) characteristics alter due to seasonal or unusual weather conditions.

Where before you might have had limited THM data, you can now greatly expand the sampling frequency and monitoring locations to help you better understand the THM formation characteristics of your water source, treatment process, and distribution system.



Surface Water Supply Matrix Changes

Both human activities and seasonal changes can affect source water, altering the mineral characteristics of the water as well as the reactivity of its dissolved organic carbon. A water plant may observe no significant changes in the quantity of TOC due to seasonal events, but they may find their THM level has changed.

Frequent measurements of THM can help operators better understand the reactivity changes of their source water.

THM ANALYSIS – APPLICATION OPPORTUNITIES

Coagulant Evaluation Test

A successful coagulation process depends on identifying the correct coagulant type and optimum dosage under suitable environmental conditions of pH and alkalinity such that the coagulant will remove the maximum TOC, UV_{254} , and turbidity, and form easily settleable floc.

However, without the ability to measure THM concentration of the finished water in real time, the plant operator will not know if the coagulation process has been optimized to also remove the maximum amount of THM precursors. **With the ability to easily measure THM concentration in finished water, the plant operator can adjust the coagulation process to achieve minimal THM formation potential. Additionally, this allows the treatment plant to supply safe drinking water with the required level of disinfectant concentration while also maintaining lower DBP levels throughout the entire distribution system.**



Real-Time Monitoring of THM Sampling Locations

Trihalomethane formation in water distribution systems is a function of water travel time, temperature, and physiochemical and biological characteristics of pipe deposits within the distribution system. **The real-time monitoring of THM at different sampling locations will help water distribution operators to identify problematic inorganic/organic pipe deposits that cause increased levels of THM formation.**



Water Quality Model Evaluation/Water Quality Trend

Hydraulic modeling of a water distribution system is an important tool for water quality management. In addition to basic hydraulic characteristics, modeling identifies water aging and predicts disinfectant decay and DBP formation. **Incorporating new data from frequent THM analysis in combination with disinfectant level data will help plant operators build an improved hydraulic model for water quality trend analysis, providing critical information for more targeted and efficient water plant operation.**



Flushing Program

Water quality levels throughout the distribution system are maintained by systematic flushing programs designed to reduce stationary water in dead end lines and increase flow volume to minimize water age. The distance of water from the water plant, dead ends in the pipe, and low water usage may cause water quality deterioration. Lower residual disinfectant levels indicate the need to flush, which can cause a significant water loss. **By measuring THM concentration in addition to disinfectant levels, operators can better decide on the location and length of flushing to minimize treated water loss.**

Water Age Evaluation

Water age is emerging as an important issue due to increased THM formation in water distribution systems. Excessive contact time caused by dampened peak-hour demands, distribution piping configurations, areas of reduced water requirements, and fire protection storage can result in elevated THM concentration. Identifying and then reducing dead spaces and stagnation in water storage tanks and looping pipe configurations in water distribution systems will reduce water age. **These actions can be triggered appropriately by monitoring THM levels in storage tanks and key locations in the distribution system.**

HOW TO ORDER



Part Number: PH-THM-1000

Description: THM Analyzer, 110V

Includes:

- THM Analyzer unit [Purge-and-Trap Gas Chromatograph (GC) system integrated with Surface Acoustic Wave (SAW) based detector for Trihalomethane (THM) measurement]
- Laptop computer with preloaded THM Analyzer software
- Quick start guide
- Certificate of calibration from factory
- Glass sample holder (2)
- Spare preconcentrator (1)
- Preconcentrator extraction tool (1)
- 1/8" diameter Teflon tubing (25')
- 1/8" A-LOK® fittings (6)

The Analyzer and laptop include one-year parts and labor warranty

Note: RoHS compliant lead-free chassis



INSTRUMENT ACCESSORIES

WAR-THM-1

Extended Warranty and Service Plan

One-year plan.

- Must be purchased within 90 days ARO instrument
- Excludes laptop computer and consumables

INS-THM-CGK

Factory Installation, Performance Check, and User Training

An all-in-one package.

Includes:

- INS-THM (Factory installation and user training)
- KIT-THM-CGK (Carrier gas connection kit)
- STD-THM-PERF-100UG (Concentrated standard solution for performance test)

INS-THM

Installation and User Training

Includes factory installation and user training.

KIT-THM-CGK

Carrier Gas Connection Kit

For connection to a standard 300 ft³ high pressure gas cylinder (DOT3AA2400) with a CGA 580 connector.

Includes:

- Veriflo IR6000 two-stage regulator (1); 5 port w/pressure relief and shutoff valve; 0-60 psi range; 0-100 psi gauge
- 1/4" NPT to 1/8" compression fitting (1)
- 1/8" A-LOK® nuts and ferrules (6)
- 1/8" OD x 1/16" ID Teflon tubing (25')

KIT-THM-TOOLS-PERF

Tool Kit for Performance Test

Glassware and syringes required to prepare standard solutions for routine instrument calibration validation.

Includes:

- Syringe, 2.5 ml gas tight (1)
- Syringe, 100 ul gas tight (1)
- Volumetric flask, 100 ml, Class A, (1)
- 40 ml EPA bottles w/Septa caps (2)

KIT-THM-TOOLS-XCAL

Tool Kit for Calibration

A complete set of glassware and syringes required for preparing six standard solutions for routine instrument calibration.

Includes:

- Syringe, 10 ul gas tight (1)
- Syringe, 100 ul gas tight (1)
- Syringe, 2.5 ml gas tight (1)
- Volumetric flask, 100 ml, Class A, (6)
- 40 ml EPA bottles w/Septa caps (12)

STD-THM-PERF-100UG

Concentrated Standard Solution for Performance Test

Certified stock standard solution containing all four THM compounds. Required for preparing standards for routine instrument calibration validation.

Includes:

- THM calibration/performance ampoule 100 ug/ml, 1 ml (1)
- Micro vial 1 ml w/Septa cap (1)

STD-THM-XCAL-100UG

Concentrated Standard Solution for Calibration

Certified stock standard solution containing all four THM compounds. Required for preparing the range of solution standards used for routine instrument calibration.

Includes:

- THM calibration/performance ampoule 100 ug/ml, 1 ml (1)
- Micro vial 1 ml w/Septa cap (1)

THM-SAMPLE-JAR-GL32

Replacement Glass Sample Bottle

THM-SPARGER-SS-2-ASY

Replacement Sparger

THM-PC-TNXTA-2-5

Replacement Preconcentrator

OFFER OF SALE

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is expressly conditioned on Buyer's assent to these Terms and Conditions and to the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional term or condition of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on the reverse side or preceding pages of this document are valid for 30 days. After 30 days, Seller may change prices to reflect any increase in its costs resulting from state, federal or local legislation, price increases from its suppliers, or any change in the rate, charge, or classification of any carrier. The prices stated on the reverse or preceding pages of this document do not include any sales, use, or other taxes unless so stated specifically. Unless otherwise specified by Seller, all prices are F.O.B. Seller's facility, and payment is due 30 days from the date of invoice. After 30 days, Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon tender to the carrier at Seller's facility (i.e., when it's on the truck, it's yours). Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.

4. Warranty. Seller warrants that the Products sold here-under shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. This warranty is made only to Buyer and does not extend to anyone to whom Products are sold after purchased from Seller. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 60 days after delivery or, in the case of an alleged breach of warranty, within 30 days after the date within the warranty period on which the defect is or should have

been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for any amount due to Seller from Buyer) must be commenced within thirteen months from the date of tender of delivery by Seller or, for a cause of action based upon an alleged breach of warranty, within thirteen months from the date within the warranty period on which the defect is or should have been discovered by Buyer.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. Contingencies. Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

10. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes

Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

13. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

14. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

15. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

17. Termination. This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.

18. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not

be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.

19. Indemnity for Infringement of Intellectual Property Rights.

Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. Taxes. Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. Equal Opportunity Clause. For the performance of government contracts and where dollar value of the Products exceed \$10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.

01/09

Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product, and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 1-800-C-Parker.



AEROSPACE

Key Markets

- Aircraft engines
- Business & general aviation
- Commercial transports
- Land-based weapons systems
- Military aircraft
- Missiles & launch vehicles
- Regional transports
- Unmanned aerial vehicles

Key Products

- Flight control systems & components
- Fluid conveyance systems
- Fluid metering delivery & atomization devices
- Fuel systems & components
- Hydraulic systems & components
- Inert nitrogen generating systems
- Pneumatic systems & components
- Wheels & brakes



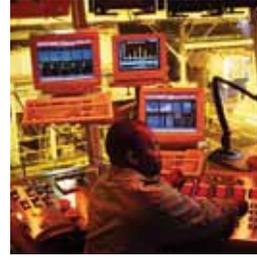
CLIMATE CONTROL

Key Markets

- Agriculture
- Air conditioning
- Food, beverage & dairy
- Life sciences & medical
- Precision cooling
- Processing
- Transportation

Key Products

- CO² controls
- Electronic controllers
- Filter driers
- Hand shut-off valves
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Solenoid valves
- Thermostatic expansion valves



ELECTROMECHANICAL

Key Markets

- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastics machinery & converting
- Primary metals
- Semiconductor & electronics
- Textile
- Wire & cable

Key Products

- AC/DC drives & systems
- Electric actuators, gantry robots & slides
- Electrohydrostatic actuation systems
- Electromechanical actuation systems
- Human machine interface
- Linear motors
- Stepper motors, servo motors, drives & controls
- Structural extrusions



FILTRATION

Key Markets

- Food & beverage
- Industrial machinery
- Life sciences
- Marine
- Mobile equipment
- Oil & gas
- Power generation
- Process
- Transportation

Key Products

- Analytical gas generators
- Compressed air & gas filters
- Condition monitoring
- Engine air, fuel & oil filtration & systems
- Hydraulic, lubrication & coolant filters
- Process, chemical, water & microfiltration filters
- Nitrogen, hydrogen & zero air generators



FLUID & GAS HANDLING

Key Markets

- Aerospace
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Mobile
- Oil & gas
- Transportation
- Welding

Key Products

- Brass fittings & valves
- Diagnostic equipment
- Fluid conveyance systems
- Industrial hose
- PTFE & PFA hose, tubing & plastic fittings
- Rubber & thermoplastic hose & couplings
- Tube fittings & adapters
- Quick disconnects



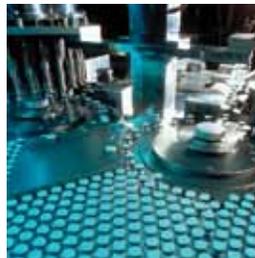
HYDRAULICS

Key Markets

- Aerospace
- Aerial lift
- Agriculture
- Construction machinery
- Forestry
- Industrial machinery
- Mining
- Oil & gas
- Power generation & energy
- Truck hydraulics

Key Products

- Diagnostic equipment
- Hydraulic cylinders & accumulators
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Power take-offs
- Rubber & thermoplastic hose & couplings
- Tube fittings & adapters
- Quick disconnects



PNEUMATICS

Key Markets

- Aerospace
- Conveyor & material handling
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Transportation & automotive

Key Products

- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grippers
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generators, cups & sensors



PROCESS CONTROL

Key Markets

- Chemical & refining
- Food, beverage & dairy
- Medical & dental
- Microelectronics
- Oil & gas
- Power generation

Key Products

- Analytical sample conditioning products & systems
- Fluoropolymer chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves & regulators
- Instrumentation fittings, valves & regulators
- Medium pressure fittings & valves
- Process control manifolds



SEALING & SHIELDING

Key Markets

- Aerospace
- Chemical processing
- Consumer
- Energy, oil & gas
- Fluid power
- General industrial
- Information technology
- Life sciences
- Military
- Semiconductor
- Telecommunications
- Transportation

Key Products

- Dynamic seals
- Elastomeric o-rings
- EMI shielding
- Extruded & precision-cut, fabricated elastomeric seals
- Homogeneous & inserted elastomeric shapes
- High temperature metal seals
- Metal & plastic retained composite seals
- Thermal management

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