The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.


OASIS
Procurement
Budgeting
Accounts Receivable
Accounts Payable
General Information
Contact
Default Values
Discount
Document Information
Clarification Request
List View
Procurement Folder: 1004258
Procurement Type: Central Purchase Order
Legal Name: MALVERN PANALYTICAL INC
Alias/DBA:
Total Bid: $200,695.83
Response Date: 03/26/2025
Response Time: 10:00
First Name: Sally
Last Name: Ma
Phone: 6087360673
SO Doc Code: CRFQ
SO Dept: 0803
Published Date: 3/24/25
Close Date: 3/27/25
Close Time: 13:30
Status: Closed
Solicitation Description: Wavelength dispersive X-Ray Fluorescence (XRF) Machine
Total of Header Attachments: 7
Total of All Attachments: 7

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Solicitation Response

Proc Folder:	1604258
Solicitation Description:	Wavelength dispersive X-Ray Fluorescence (XRF) Machine
Proc Type:	Central Purchase Order

Solicitation Closes	Solicitation Response	Version
2025-03-27 13:30	SR 0803 ESR03262500000005739	1

VENDOR

000000186102
MALVERN PANALYTICAL INC

Solicitation Number: CRFQ 0803 DOT2500000042

Total Bid: 209695.8299999999871943145990 **Response Date:** 2025-03-26 **Response Time:** 18:09:04

Comments: We have offered 31% discount on our instrument. Early payment discount is not applicable.

FOR INFORMATION CONTACT THE BUYER
John W Estep
304-558-2566
john.w.estep@wv.gov

Vendor
Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Wavelength Dispersive X-Ray Fluorescence Sequential Spectrom	1.00000	EA	209695.830000	209695.83

Comm Code	Manufacturer	Specification	Model #
41100000			

Commodity Line Comments: Please refer to our quotation proposal Q-185545-3 for details.
Freight is included in the unit price.
Delivery time is 22-24 weeks after receipt of a valid order.
Malvern Panalytical Zetium XRF system is supplied as standard with a fully comprehensive parts and labor for first 12-month warranty, and 2-year warranty on x-ray tube.

Extended Description:

Wavelength Dispersive X-Ray Fluorescence Sequential Spectrom

	Department of Administration **Purchasing Division** **2019 Washington Street East** **Post Office Box 50130** **Charleston, WV 25305-0130**	**State of West Virginia** **Centralized Request for Quote** **Miscellaneous**

Proc Folder: 1604258 **Doc Description:** Wavelength dispersive X-Ray Fluorescence (XRF) Machine **Proc Type:** Central Purchase Order			**Reason for Modification:** Addendum No_1 Vendor Questions and Responses
Date Issued	**Solicitation Closes**	**Solicitation No**	**Version**
2025-03-24	2025-03-27 13:30	CRFQ 0803 DOT2500000042	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code: 000000186102
Vendor Name : Malvern Panalytical, Inc.
Address :
Street : 2400 Computer Dr.
City : Westborough
State : MA **Country :** USA **Zip :** 01581
Principal Contact : Ryan Edelen
Vendor Contact Phone: 984-833-7817 ***Extension:***

FOR INFORMATION CONTACT THE BUYER
John W Estep
304-558-2566
john.w.estep@wv.gov

Ryan Edelen

Vendor Signature X Malvern Panalytical, Inc. **FEIN#** 04-2850945 **DATE** March 27,2025

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

ADDENDUM NO_1

Addendum No_1 issued to publish and distribute the attached information to the Vendor Community

REQUEST FOR QUOTATION:
The West Virginia Purchasing Division is soliciting bids on behalf of West Virginia Department of Transportation, Division of Highways, Materials, Control, Soil & Testing Division, to establish a contract for the one time purchase of the supply, delivery, and *installation of a wavelength-dispersive X-Ray Fluorescence (XRF) Sequential Spectrometer for analysis of major, minor, and trace* elements in cement, fly ash, and related materials/samples. Per the Bid Requirements, Specifications, Terms and Conditions attached to this solicitation.

INVOICE TO		SHIP TO	
DIVISION OF HIGHWAYS		DIVISION OF HIGHWAYS	
MATERIALS, CONTROL, SOILS, & TESTING		MATERIALS, CONTROL, SOILS, & TESTING	
190 DRY BRANCH DR		190 DRY BRANCH DR	
CHARLESTON	WV	CHARLESTON	WV
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Wavelength Dispersive X-Ray Fluorescence Sequential Spectrom	1.00000	EA	209,695.83	209,695.83

Comm Code	Manufacturer	Specification	Model #
41100000	Malvern Panalytical	Meet RFQ spections and addendium No.1	Zetium 1KW

Extended Description:
Wavelength Dispersive X-Ray Fluorescence Sequential Spectrom

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Tech Questions due by 10:00am	2025-03-19

SOLICITATION NUMBER: CRFQ DOT2500000042
Addendum Number: 1

The purpose of this addendum is to modify the solicitation identified as CRFQ DOT25000000042 ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[X] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[ ] Other

Additional Documentation:

Vendor Questions and Response

Bid Opening remains 03/27/2025 at 1:30pm

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

CRFQ DOT2500000042
Wavelength Dispersive X-Ray Fluorescence (XRF) Machine for MCS&T

Question 1 – 3.1.1.4 / 3.1.2.1 – An internal chiller coupled with a 1500 W generator power may be specific to a single vendor. Would WV DOH consider an instrument a 1 kW instrument with an internal chiller if analytical performance can be met? If not, would WV DOH consider an instrument at a higher power (2.4 kW) with an external air-cooled chiller?

Answer 1 – Yes, we might consider an instrument with a 1 kW power and internal chiller, provided that the analytical performance requirements are met.

- Alternatively, a 2.4 kW instrument with an external air-cooled chiller could also be acceptable if it meets the necessary performance criteria and does not introduce excessive energy consumption or instability issues.

Question 2 – 3.1.1.5 – Is a maximum sample diameter of 51.5 mm acceptable?

Answer 2 – Yes, For XRF analysis, glass beads are typically prepared with the following dimensions:

- Diameter: 30–40 mm (to allow for adequate interaction with the X-ray beam).
- Thickness: 3–5 mm (to ensure sufficient penetration of X-rays and maintain the quality of the analysis).

- These dimensions help create a uniform and homogeneous sample that ensures accurate, reproducible results when using XRF for analysis.

Question 3 – 3.1.1.6 – Malvern Panalytical normally supplies 4 filters using *a heavy brass filter to protect detectors rather than a beam stop. Are* 4 filters with a heavy bass filter, or 3 filters plus a beam stop acceptable if analytical performance criteria are met?

Answer 3 – Yes, both configurations (4 filters with a heavy brass filter or 3 filters plus a beam stop) could be acceptable if the analytical performance criteria are met.

- If the system is achieving the required accuracy, precision, and detection limits, and the signal-to-noise ratio is within acceptable limits, either configuration can work.

- The key factor here is that the system must perform as expected for the type of analysis we are conducting, and both setups should allow for this as long as the detector protection and radiation filtering are properly handled.

Question 4 – 3.1.2.3 – Is 60 kV / 50 mA maximum acceptable if analytical performance criteria are met (kV-mA combination to be less than or equal to 1000 W)?

Answer 4 – Yes, we would consider the 60 kv / 50 mA, as long as it does not compromise the system's ability to meet the analytical performance criteria. It's important to verify that the system still meets the required sensitivity, accuracy, and precision, and that the additional collimators don't interfere with the instrument's functionality or data quality.

Question 5 – 3.1.3.1 Would 3 primary collimators be acceptable if analytical performance criteria are met?

Answer 5 – Yes, 3 primary collimators can be acceptable, as long as they do not compromise the system's ability to meet the analytical performance criteria. It's important to verify that the system still meets the required sensitivity, accuracy, and precision, and that the additional collimators don't interfere with the instrument's functionality or data quality. If these criteria are still being met, the use of multiple collimators should be fine.

Question 6 – 3.1.3.2 – Would an 8-position crystal holder with 4 crystals fitted be acceptable if analytical performance criteria are met?

Answer 6 – Yes, An 8-position crystal holder with 4 crystals fitted is acceptable, as long as the system meets the analytical performance criteria. The number of crystals being used does not necessarily need to match the number of available positions, as long as the crystals that are installed provide accurate, precise, and reliable measurements. The key point is that the system must be able to meet the necessary performance specifications with the 4 crystals in place.

Question 7 – 3.1.6.1 – Would turnkey calibration standards for Cement prepared as glass beads be acceptable rather than pressed pellets?

Answer 7 – Yes, turnkey calibration standards for cement prepared as glass beads can be acceptable in place of pressed pellets, provided that they meet the required analytical performance criteria. Glass beads, with their more homogeneous and consistent nature, could even provide enhanced analytical performance in some cases. The key factor is ensuring that the standards used allow the instrument to achieve accurate and reproducible results that meet the specific needs of the analysis.

Question 8 – 3.1.6.3 –The calibrated values specified (considering the Fe range) appear to be for white cement, which is not very common. Is a

standard and a modified Portland cement calibration acceptable rather than one for white cement?

Answer 8 - Yes, it is generally acceptable to use a standard Portland cement calibration instead of one specifically for white cement, as long as the properties of interest are well within the expected range for Portland cement.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ DOT2500000042

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	*Addendum No. 1*	[ ]	*Addendum No. 6*
[ ]	Addendum No. 2	[ ]	Addendum No. 7
[ ]	Addendum No. 3	[ ]	Addendum No. 8
[ ]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Malvern Panalytical Inc.
Company

Ryan Edelen Ryan Edelen
Authorized Signature

March 27, 2025
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

Pricing Page

RFQ#:

Kanawha County: WV, DOH, Materials, Controls, and Soil Testing Division

190 Dry Branch Drive, Charleston, WV 25306

Line Number	Item Description	Purchase Rate	Total Amount
1	Wavelength dispersive X-Ray Fluorescence (XRF) Sequential Spectrometer		$189,672.51
2	Operational Supplies (ie sample cups, any consumable products necessary for operation)	included	$0.00
3	Installation / Maintenance Calibration	included in the system	$0.00
4	Training / Instruction / Support		$9923.32
5	Warranty	included in the system	$0.00
			$
			$
			$
		Grand Total:	$199,595.83

*The estimated purchase volume for each item represents the approcimate volume of the anticipated purchases only. No future use of the Contract or any individual item is guaranteed or implied.

Vendor Name:	Malvern Panalytical, Inc.
Contanct Name:	Ryan Edelen Ryan Edelen
Phone:	984-833-7817
Fax #:	508-768-6403
Email:	ryan.edelen@malvernpanalytical.com
# Years in Business:	41 years

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Quotation

Zetium 1kW

John Estep - West Virginia DOH

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

West Virginia DOH
John Estep

180 Dry Branch Road
Charleston, West Virginia 25306
United States

Malvern Panalytical Inc.
2400 Computer Drive
Westborough
Massachusetts
United States
01581

Quotation contact:

Ryan Edelen
Sales Engineer
Sales
@: ryan.edelen@malvernpanalytical.com
M: 984-833-7817

CRFQ 0803 DOT2500000042

Hello,

Please find your quotation for the Zetium WDXRF below. Your configuration includes the following:

- Zetium WDXRF (1 kW) with Rh tube, including Zero Evaporation Technology Advantage (ZETA) to prevent coating of tungsten on the window over time.
- Continuous loading feature enabling a second sample to be loaded into the airlock during measurement period of the first sample
- Internal water chiller (no external chiller required)
- 4 beam filters including heavy brass filter to protect detectors
- PX-1, PE002, LiF200, LiF220, and Ge111 crystals
- 3 primary collimators (150 um , 300 um, 700 um) optimized for cement applications and WROXI turnkey calibration.
- Flow and scintillation detectors
- PC and monitor
- Analysis software for qualitative and quantitative analysis
- 12 sample holders and centering rings (spring loaded sample holders
- XYZ autosampler
- are not required for this application but may be purchased if desired).
- WROXI cement turnkey calibration standards and software for cement samples. Analytical ranges may be found in the descriptions for Part 10 and 11.
- On-site installation by Malvern Panalytical service engineer
- 2 days on-site training by Malvern Panalytical application scientist
- 2 hours (complementary) remote training by Malvern Panalytical application scientist
- 2 seats (complementary) for courses at Malvern Panalytical offices or online.
- 1-year warranty on XRF instrument, 2 year warranty on x-ray tube
- **OPTIONAL** Omnian 'standardless' standards and software
- **OPTIONAL** Uninterruptible power supply (you may also supply your own as long as it can support electrical requirements)

Please let me know of any questions. Thank you very much.

Ryan Edelen

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Quotation Summary

Description	Amount ($)
List Price	283,776.33
Discount	84,180.50
Net Price	199,595.83
Freight	10,100.00
Grand Total	**209,695.83**

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Included items

Zetium 1 kW

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
1	1	10032384		0	
Zetium 1kW					
Zetium 1kW					
2	1	9430 654 00011	204,000.00	31	140,760.00
ZETIUM SPECTROMETER					
This, the starting point for any Zetium configuration, includes but is not limited to the following: · spectrometer cabinet with thermal stability control system · integrated X-Y-Z sample changer for unattended batch analysis · turret-style sample loading mechanism with an airlock chamber allows the tube to remain at full power while samples are changed, maximizing stability and minimizing the risk of tube window damage · sophisticated vacuum system which, in combination with the sample airlock, eliminates the need to evacuate the entire optical chamber before each measurement · sample spinner minimizes the effects of sample surface inconsistencies · Malvern Panalytical-made, 1 kW, Super Sharp X-ray Tube (SST) and a high-quality programmable generator for optimal excitation of the sample · soft power down functionality when UPS systems take over power supply · 4 filters to maximize the sensitivity of the spectrometer to the elements of interest · fixed collimator mask to match the size of the sample · one collimator included to match the analytical requirements · 3 crystals for the analysis of elements across the periodic table o PX-1 crystal for the analysis of O to Mg o PE002 crystal for the analysis of Al to Cl o LiF200 crystal for the analysis of K to Am · integrated flow detector · digital Dual Multi-Channel Analyzer (DMCA) counting electronics deliver exceptional performance at high count rates · high-precision goniometer positioning with DOPS2 (Direct Optical Position Sensor) eliminates drift associated with wear and tear · Malvern Panalytical's SuperQ Analytical Software with integrated Statistical Process Control · Remote Assistance Suite for easy, quick and secure hardware, software and applications support · two 37 mm aperture sample holders with 41 mm centering inserts · heavy-duty wheels for easy mobility and an umbilical cord for power, gasses and water supplies interfacing with a wall unit for easy installation and maintenance · pre-installation kit, which can be shipped in advance					
3	1	9430 654 80011	12,400.00	31	8,556.00
CONTINUOS LOADING					
This item enables a second sample to be loaded into the airlock during the measurement period of the first sample, thereby significantly improving sample throughput.					

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

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Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
4	1	9430 655 18101	1.00	0	1.00
BEAMFILTER BRASS 100UM					
This beam filter is optimized to improve the lower limit of detection in the energy range of 20-30 keV.					
5	1	9430 655 18201	1.00	0	1.00
BEAMFILTER AL 200UM					
This beam filter is optimized to improve the lower limit of detection in the energy range of 6-10 keV.					
6	1	9430 655 18401	1.00	0	1.00
BEAMFILTER BRASS 400UM					
This beam filter is optimized to suppress the Rh K tube lines.					
7	1	9430 655 18751	1.00	0	1.00
BEAMFILTER AL 750UM					
This beam filter is optimized to improve the lower limit of detection in the energy range of 13-17 keV.					
8	1	9430 655 20271	0.01	0	0.01
SINGLE COLL MASK 27MM					
Fixed collimator mask with 27 mm diameter sample viewing aperture. For use with single sample diameter.					
9	1	9430 654 14001	23,200.00	31	16,008.00
PERFORM ENHANCE PLUS					
The Performance Enhancement Plus package improves the sensitivity of the Zetium spectrometer to elements across the periodic table with the integration of optical path components. The package includes: · a second collimator for improvements in resolution or measurement times · a Ge111 crystal for enhanced sensitivity to P to Cl · a LiF220 crystal for enhanced resolution to V to Am · a scintillation detector for enhanced sensitivity to elements > Mn					
10	1	9430 654 63011	16,000.00	31	11,040.00
WROXI-CRM BASE MODULE					
WROXI CERTIFIED REFERENCE MATERIALS BASE MODULE FOR WD XRF WROXI Base is a set of Certified Reference Materials (CRM) that will handle fused glass disk major element analysis of many of the elements required by the mining and mineral industries. WROXI can be used as a primary fused bead calibration or to verify customer in-house standards for pressed powder applications. Each CRM is produced under our ISO 17034 accreditation which guarantees their traceability. A Malvern Panalytical Zetium spectrometer combined with WROXI CRMs makes up a unique system that consistently produces very high quality major and minor element analyses in a wide variety of raw materials from many different industries, including cement, gypsum, ceramics, bricks, glass, iron and manganese and some heavy mineral ores.					

Malvern Panalytical Inc.
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Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
The WROXI CRM material set comprises fifteen multielement standards made from high purity chemicals. The standards are delivered as powders to be prepared as fused beads by the customer, using the included Lithium borate flux. XRF application templates and monitors are also included. They are suited and applicable to every relevant industry laboratory. WROXI Base oxides and their concentration ranges (wt%): Na2O 0-50, MgO 0-80, Al2O3 0-80, SiO2 0-90, P2O5 0-50, SO3 0-59, K2O 0-40, CaO 0-80, TiO2 0-80, Mn3O4 0-80, Fe2O3 0-80					
11	1	9430 654 63041	2,510.00	31	1,731.90
WROXI-CRM CEMENT MODULE WROXI CERTIFIED REFERENCE MATERIAL CEMENT EXTENSION FOR WD XRF WROXI-CRM Cement is an extension to the WROXI Base set of CRMs. It contains high-quality, synthetic Certified Reference Materials (CRM) produced under our ISO 17034 accreditation. This extension set provides 9 multi-element standards for the analysis of 10 additional analytes in a variety of cements and the raw materials used in its manufacture, including limestone, clay/ shale, gypsum clinker, raw meal fly ash, slags and iron ore. It is shipped with monitors and templates suitable for the Zetium spectrometer. WROXI-CRM provides a unique solution to resolve unavailable, wrong mineralogy or expensive CRMs. These synthetic standards are traceable to pure compounds and are shipped with certificates stating quantities and uncertainties. This set is packaged under nitrogen and ready to use. The standards are delivered as powders to be prepared as fused beads by the customer, using the included Lithium borate flux. WROXI-CRM Cement Extension analytes and their concentration ranges (wt%): Al2O3 0-10, SiO2 0-32, CaO 50-63, ZnO, 0-1, Cr2O3 0-1, Fe2O3 0 - 7, F 0-1, Cl 0-1, SrO 0-1, BaO 0-1, SO3 0-0.5					
12	1	9430 655 78151	1.00	0	1.00
COLLIMATOR PRIM 150 UM This collimator is optimized for high resolution and is particularly suited to handle line overlaps.					
13	1	9430 655 78301	1.00	0	1.00
COLLIMATOR PRIM 300 UM This collimator is intended for general purpose use and is optimized for medium resolution.					
14	1	9430 654 78701	7,250.00	31	5,002.50
COLLIMATOR PRIM 700 UM This collimator is optimized to increase sensitivity of longer wavelengths in the elemental range O - Cl.					
15	1	9430 654 17111	812.00	31	560.28
FC WINDOW 1 UM (5X) A set of 5 high transmission flow detector windows with a thickness of 1 micron that may be used for the element range B - U. This window is optimal for the elements C, N, O, F, Na & Mg.					
16	1	9430 098 71993	2,030.00	0	2,030.00

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Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
Computer DELL OPTIPLEX XE3					
State-of-the-art industrial grade PC with current Microsoft Windows operating system 64-bit version.					
17	1	9430 500 74151	264.00	0	264.00
Monitor					
A full HD widescreen PC monitor to provide sufficient, high-resolution work space for displaying the Instrument User Software.					
18	1	9430 655 75121	1.00	0	1.00
Smart Manager XRF					
Free Trial of Smart Manager Service Agreement. Valid for 12 months. - Access to our cloud-based to Smart Manager Portal for real-time insights and key performance parameters of your connected Smart Instrument - Remote monitoring by our technical team of your connected instrument during normal business hours & days - A status report of your connected instrument emailed to you on a quarterly basis - Access to the Customer Portal, Knowledge Base, and Malvern Panalytical MyStore					
19	1	9430 655 28081	1.00	0	1.00
TRAY FOR 8 SAMPLEHOLDERS					
8 position sample tray for solid or liquid sample holders					
20	3	9430 654 29431	4,110.00	31	2,835.90
SAMP HOLDER 27MM ST 4X					
A set of 4 stainless steel sample holders with a 27 mm sample viewing aperture					
21	2	9430 654 22331	600.00	31	414.00
INSERT 33MM OPENING 8X					
Set of 8 plastic universal sample holder inserts for centering samples with approximately a 33mm diameter					
22	1	9430 655 02301	1.00	0	1.00
CONNECTION TO 230V					
CONNECTION TO 230V					
23	1	9425 011 91000	668.00	31	460.92
AIR PREPARATION KIT					
Wall mounted air filtration kit designed to prevent dirt and water from entering into the compressed air lines of the XRF and XRD in strumentation.					
24	2	CTI2000	2.20	0	2.20
Classroom Training Included - 1 Seat					
Classroom Training Included - 1 Seat					

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)

A voucher for a single seat at one of our regularly scheduled training courses are included with your system purchase.

Several courses are offered at regularly scheduled times throughout the year in different regions of the world in multiple languages. These courses provide a unique opportunity to better understand the techniques, theory and practical applications of your Malvern Panalytical Instrument and/or associated Software. Please check the Malvern Panalytical website for available user training events and inquire with our team for which course(s) would be most beneficial to you.

Courses can be offered in remote (virtual) or “MP-Site” formats. For courses offered remotely, internet access is required with audio and visual capability for the best experience. For “MP-Site” courses offered at Malvern Panalytical application labs or partner locations, travel expenses are not included. Some meals may be provided during MP-Site course days.

Course duration varies based on product, subject and format. The number quoted will be translated to a voucher with the number of seats at the course(s) of interest. The number quoted here is typical for a seat at courses relevant to the system offered.

Additional seats to any one of Malvern Panalytical courses can be purchased separately referencing the associated CTA#000 part number.

We reserve the right to cancel courses due to insufficient enrollment or unforeseen circumstances. Vouchers remain valid for 1 year after the date of installation. PLEASE NOTE: This item has no cash value and cannot be exchanged, refunded or returned.

25	1	ATS0000	1.10	0	1.10

Initial System Operational Overview

Initial System Operational Overview

This comprises a brief basic operational overview of the system and how to maintain the hardware and would be delivered during the time the installer is visiting. This is not applicable for Self-Installed systems.

Malvern Panalytical offer a range of training opportunities based on the end user's requirements. These additional training options are based on a customer's specific requirements and could include e-learning (if available), classroom training, existing SOP-method training, new method development or consultative applications solution development.

While these training opportunities are additional, a Malvern Panalytical customer will always have access to the high-quality Helpdesk technical support department that provides troubleshooting and/or general system/application guidance.

26	2	CSMD0015	9,920.00	0	9,920.00

XRF FS CUSTsite Method Dev Training

XRF Floorstanding CUSTsite Method Dev Training

CUSTOMER-SITE Method Development training comprising of in-depth theory, hardware, and/or software training, application setup, method development, deployment of application modules and solutions or combinations of the above that takes place at the Customer-site. This could cover Validating methods and/or method transfer from one

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)

instrument model to another. This is not applicable for specifically tailored and separately offered Application Packages and/or Modules.

The training will be provided by Malvern Panalytical Subject Matter Expert.

Travel and associated travel expenses (T&E) are not included in this price and will be based on regional zone pricing for T&E.

CUSTOMER-SITE Method Development training purchases are valid for 2 years from date of purchase. PLEASE NOTE: If left unused this item has no cash value and cannot be exchanged, refunded or returned.

Malvern Panalytical recommends a maximum of up to 4 attendees.

This item can be purchased in one day increments.

27	2	RIAT0015	0.02	0	0.02

XRF FS REMOTE Included App Training

XRF Floorstanding REMOTE Included App Training

This REMOTE Included Application Training comprises a Subject Matter Expert delivering an extended overview of the system's software and hardware that aims to provide best practice guidance. The specialist will also direct to the best resources available and how to use those resources to gain further confidence in utilizing your system towards meeting your needs. This is not applicable for Self-Installed systems.

The training will be provided by Malvern Panalytical Subject Matter Expert. Internet access is required for the training, with audio and visual capability. A video camera directed at the sample/instrument is recommended to support guided practical sessions (course dependent). Requires internet access to the instrument PC to allow remote access for a Malvern Panalytical employee to conduct the training. During the training session(s), control of the software and desktop applications can be handed back and forth between the user and instructor to allow a truly interactive training session.

REMOTE Initial Application Training purchases are valid for 6 months from installation. PLEASE NOTE: If left unused this item has no cash value and cannot be exchanged, refunded or returned.

Malvern Panalytical offer a range of training opportunities based on the end user's requirements. These additional training options are based on a customer's specific requirements and could include e-learning (if available), classroom training, existing SOP-method training, new method development or consultative applications solution development.

While these training opportunities are additional, a Malvern Panalytical customer will always have access to the high-quality Helpdesk technical support department that provides troubleshooting and/or general system/application guidance.

This item is offered in one hour increments.

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)

Malvern Panalytical Inc.
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Westborough, MA 01581

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Optional items, not included in the total price

Omnian Standardless Package

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
1	1.00	9430 654 52991	11,800.00	31	8,142.00

OMNIAN PACKAGE

Omnian is the market-leading "standardless" analysis package for the characterization of unknown samples or in situations where certified standards that match specific sample characteristics are not available. Important applications include sample quantification, screening, failure analysis as well as the comparison of different materials. The Omnian "standardless" analysis package includes:
· Omnian setup samples
· Omnian Software and license
· Omnian Drift Monitor
Omnian makes no compromises in data quality by using scan based data collection, allowing:
· both qualitative and quantitative analysis for a quick visual screening and/or full quantification of all elements present
· an accurate background profile, superior to the estimations obtained from fixed background positions
· a view of all peaks and backgrounds across the periodic table, reducing the chance of incorrect element identification
· advanced determination of background profiles
· search and match of all peaks
· line overlap corrections
· Scan based programs can be augmented with peak measurements for higher precision and lower detection limits for key elements.
With Omnian, standardless analysis is brought to the next level by incorporating the latest innovations of Malvern Panalytical's advanced FP algorithm:
· finite thickness and Fluorescence Volume Geometry (FVG) corrections for the accurate analysis of deeper layers in light matrix samples
· calculation of unmeasured “Dark Matrix” compounds by using the Compton scatter for an accurate quantification of the total sample composition
Another unique feature is Adaptive Sample Characterization (ASC), which automatically selects the calibration line that best corrects for sample-specific effects.

Omnian Standardless Package Subtotal:	USD 11,800.00
Omnian Standardless Package Discount:	USD 3,658.00
Omnian Standardless Package Total:	USD 8,142.00

UPS

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
1	1.00	9200 130 09611	17,700.00	0	17,700.00

UPS 10KVA-9KW LIEBERT APS SYSTEM

Malvern Panalytical Inc.
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Ref.: Q-185545-3
Date: 3/26/2025

Pos.	Quant.	Product Code	Total list price ($)	Disc. (%)	Total net price ($)
The Liebert AS5BONCVG4NX605 10KVA Uninterruptible Power Supply includes modular batteries, controls and power components to help reduce maintenance costs with user replacement. Efficicency and availability in one box: power modules, batteries, maintenance bypass and distribution in a single, small-footprint cabinet. The system delivers 10KVA (9KW). Installation is the client's responsibility and must be performed by a certified electrician.					

UPS Subtotal: USD 17,700.00

UPS Total: USD 17,700.00

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Commercial conditions

Delivery time
Shipment from factory will be approximately (status at the moment of generating the quotation): 22-24 weeks after receipt of a valid order.

Payment terms
30 Days From Invoice Date.

INCOTERMS
FOB - Freight on board
Charleston

Quotation currency
Prices on the quotation are in U.S. Dollar, unless stated otherwise.

Quotation validity
The validity of this quotation expires on 5/23/2025.

Tax
Unless stated otherwise, taxes are not included

Billing address
West Virginia DOH
180 Dry Branch Road
Charleston West Virginia 25306
United States

Additional terms and conditions
Payment Terms:

60% upon order
30% upon shipment
10% upon installation
Each invoice due within net 30 days of receipt

TO PLACE ORDER PLEASE HAVE PO EMAILED TO RYAN.EDELEN@MALVERNPANALYTICAL.COM

Please send tax exempt information and certificate (if applicable) with PO to expedite order processing

Intellectual property
Regardless of any provisions stating the contrary, the performance of a contract or any delivery of any products or performance of any services shall in no event imply any transfer of intellectual property. All intellectual property related to and vested in the delivered products, accompanying items and documents as well in the provided services (whether or not created, produced or developed under or in the course of the execution of a contract) will be and remain the property of Supplier (or its suppliers, as the case may be).

Liability Limitation

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Date: 3/26/2025

To the maximum extent allowed by applicable law, in no event shall Supplier's liability for any claims arising out of or related to this Order, exceed the purchase price of the goods or services in respect of which damages are claimed or shall Supplier be liable for any regulatory fines, or punitive, exemplary, special, indirect, incidental, consequential, losses or damages, such as without limitation loss of profit, loss of production and loss of use.

Export control
Delivery is subject to strict compliance with export control laws and regulations. Supplier shall be relieved from its obligations to deliver any items or perform any services, to the extent that applications for permits or licenses related thereto are refused by a relevant governmental authority.

Buyer shall not sell, export or re-export, directly or indirectly, to the Russian Federation and/or to the Republic of Belarus or for use in these countries, any products supplied under any contract that falls under the respective scope of Article 12g of Council Regulation (EU) No 833/2014 or Article 8g Regulation (EU) 765/2006. Buyer shall establish and maintain an adequate monitoring mechanism to ensure that this Regulation is not frustrated by any third parties in the commercial chain. Upon supplier's request, buyer shall share compliance information. Buyer shall inform supplier of any breach of this section, which shall constitute a material breach of the contract and supplier shall be entitled to seek remedies.

Credit check
All our quotations are subject to approval based on the outcome of a risk assessment which includes a credit check

Tube warranty
The following conditions apply for the Malvern Panalytical X-ray tubes:

Zetium 1 kW

With exchange of an X-ray tube during the warranty period, the remaining warranty time on the new tube is applied, with a minimum of 6 months. Next to this, the general Malvern Panalytical Payment and Delivery conditions apply as well as the general Conditions of Sale.

Terms and Conditions
The General Terms and Conditions of Malvern Panalytical (as sent with our quotation) or any other agreement signed by the parties, shall apply to and are part of all our offers, agreements, sales, services, deliveries and all other dealings. The applicability of any other terms and conditions is explicitly rejected and superseded by our General Terms and Conditions or any other agreement signed by the parties.

The Connected Services Requirements (as sent with our quotation) shall take effect and become binding on Buyer, together with all rights and obligations from Buyer's commencement of trade using Malvern Panalytical's Connected Services, which can be consulted on ***https://www.malvernpanalytical.com/en/about-us/terms-of-sale-and-service***

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1. INTERPRETATION
For the purposes of these Terms and Conditions of Sale and Supply ("Conditions"):
"Buyer" the person, firm or company which places an order for purchase of Products and/or Services as identified in any such order or Quotation as the case may be.
"Conditions" these terms and conditions of sale and supply as from time to time varied by Supplier.
"Contract" the agreement between Supplier and Buyer arising as a result of Buyer's submission of an order for Supplier's Products and Supplier's written acceptance and/or, in the case of Services, an agreement between such parties for the provision of Services by Supplier, as initiated by a Quotation. Such Contract shall be deemed to incorporate and be governed by these Conditions.
"Products" goods as agreed to be supplied by Supplier to Buyer under any Contract including, Software if any.
"Quotation" a document provided by Supplier describing Products and/or Services offered to Buyer, subject to these Conditions.
"Services" means any services which Supplier has agreed to provide using reasonable care and skill under any Quotation or Contract, as applicable.
"Supplier" Malvern Panalytical Inc. or any of its Affiliates as named in any Quotation. In this context, an "Affiliate" means any other entity directly or indirectly controlled by Spectris Plc.

2. BASIS OF SALE
THESE CONDITIONS SHALL TAKE PRECEDENCE OVER ANY TERMS AND CONDITIONS WHICH APPEAR IN BUYER'S ORDER OR IN ANY DOCUMENTS INCORPORATED BY REFERENCE IN BUYER'S ORDER. No term or condition of Buyer's order additional to or different from these Conditions shall become part of any Contract unless explicitly agreed to in writing by Supplier. Retention by Buyer of any Products delivered by Supplier, receipt by Buyer of any Services performed by Supplier or payment by Buyer of any invoice rendered hereunder, shall be conclusively deemed acceptance of these Conditions. Supplier's failure to object to any provision contained in any communication from Buyer shall not be construed as a waiver of these Conditions nor as an acceptance of any such provision.

3. QUOTATIONS
Prices, specifications and delivery date referenced in Supplier's Quotations are for information only and shall not be binding on Supplier until all technical requirements have been agreed and Supplier has accepted Buyer's order. Quotations terminate if Buyer does not place an order with Supplier within any express period indicated by Supplier or after 60 days, whichever comes first.

4. ORDERS
By submitting an order to Supplier, Buyer agrees to be subject to these Conditions in their entirety. No order, whether or not submitted in response to a quotation by Supplier, shall be binding upon Supplier until accepted in writing by Supplier.

5. PRICES AND TAXES
The prices for Products and Services will be as set out in the Quotation or as otherwise agreed between the parties in writing. As and when applicable to the Products sold and/or Services supplied under any Contract, prices do not include taxes, transport charges, insurance and export and/or import charges or duties, including without limitation sales, value added tax, use or excise taxes, which taxes and other charges may, in Supplier's discretion, be added by Supplier to the price or billed separately and which taxes and other charges shall be paid by Buyer unless Buyer provides Supplier with any necessary tax exemption certificate. Buyer shall pay for taxes, transport charges, insurance, export/import charges and duties unless agreed otherwise in writing.

6. SHIPMENT AND DELIVERY
6.1 Unless otherwise agreed by both parties in writing, Supplier shall arrange for delivery of Products Free Carrier (FCA Incoterms 2010) to Supplier's manufacturing facility (or an (international) airport close to Supplier's manufacturing facility) as agreed between the parties. Any dates quoted or agreed for delivery of Products or provision of Services are approximate only and Supplier shall not be liable for any delay howsoever caused and time is not of the essence.
6.2 Supplier reserves the right to make delivery of Products and provision of Services by instalments and to issue a separate invoice in respect of each instalment. When delivery is to be by instalments or Supplier exercises its right to deliver by instalments or if there is delay in the delivery of any one or more instalments for whatever reason Buyer shall not be entitled to treat the Contract as a whole as repudiated.
6.3 If Products are ready to be delivered to Buyer but Buyer has requested a change to the agreed delivery date, then Supplier shall have the right to charge the Buyer reasonable storage costs. Such storage costs will be charged from the first day after the original delivery date until the new agreed delivery date. The costs shall be invoiced and payment due in accordance with 9.3.

7. RISK AND PASSING OF TITLE
Title to, and risk of loss and damage to the Products shall pass to Buyer on delivery in accordance with Section 6 unless agreed otherwise by the parties in writing. Any claims for loss, damage or misdelivery shall be filed with the carrier and notified to Supplier within 5 days of the date of delivery. If installation is a requirement of the Contract and such installation is delayed by more than 30 days from the agreed delivery date for reasons not attributable to Supplier, then, to the extent allowed by applicable law, the Products shall be deemed accepted and Supplier shall be entitled to invoice the remaining balance of the Contract in full. In the absence of an installation date being agreed between the parties, Buyer shall agree to a reasonable installation date with the Supplier, such installation date to be not more than 10 days after delivery. Such final invoice shall be paid within fifteen (15) calendar days of the invoice date. Invoicing the remaining balance does not relieve Supplier from its installation obligations in accordance with the applicable term in the Contract.

8. SERVICES
8.1 Supplier shall provide Services in accordance with these Conditions and the terms of the relevant Contract.
8.2 Buyer shall, upon Supplier's reasonable request and otherwise as required, provide Supplier with all necessary information and materials to enable Supplier to provide Services in accordance with the terms of any relevant contract. Buyer will be responsible for the completeness and accuracy of all such information and materials provided and will ensure that it is and remains entitled to provide the same to Supplier for use in connection with provision of the Services.

9. TERMS OF PAYMENT
9.1 Each shipment of Products shall be a separate transaction and Buyer will be invoiced on delivery. Notwithstanding the foregoing, if the Products are to be installed by Supplier or a third party acting on its behalf, unless agreed otherwise, Buyer may (at Supplier's discretion) be invoiced in accordance with the following payment scheme:
- 60% of the price upon Buyer's receipt of Supplier's order confirmation;
- 30% of the price upon delivery of the Products in accordance with Section 6;
- 10% of the price after acceptance of the Products in accordance with Section 11.

9.2 In the event of a delay in the delivery or acceptance that is not attributable to Supplier, the payment scheme shall not be affected, and Buyer shall pay the instalments based upon the initially agreed upon delivery or acceptance date.
9.3 Supplier shall be entitled to invoice Buyer, in respect of Services, yearly or monthly in advance. Terms of payment shall be net thirty (30) days from date of invoice for Products and Services unless agreed otherwise.
9.4 All amounts due under a Contract shall be paid in full by Buyer without deduction, withholding, set-off or counterclaim for any reason whatsoever, whether arising in contract, tort (including negligence), breach of statutory duty or otherwise, save as may be required by law.
9.5 Supplier may, in its sole discretion, determine at any time that Buyer's financial condition requires full or partial payment in advance or the provision of security for payment by Buyer in a form satisfactory to Supplier.
9.6 If Buyer fails to make any payment when due then, without prejudice to any other rights and remedies available to Supplier, Supplier shall (at its option) be entitled: (i) to treat the Contract as repudiated by Buyer, to suspend or cancel further delivery of Products and/or the provision of Services or any part thereof under that Contract or any other Contract between them and claim damages and/or receive reasonable cancellation fees; (ii) to affirm the Contract and claim damages from Buyer; and (iii) to recover, in addition to the payment, interest on the unpaid amount (both before and after judgement) at the rate of 6% per annum above the Royal Bank of Scotland's prevailing base lending rate from time to time, until payment in full is made. Such interest shall be calculated daily.

10. PRODUCTS
10.1 Supplier may modify specifications provided the modifications do not adversely affect the performance of the Products. In addition, Supplier may furnish suitable substitutes for materials used.
10.2 All descriptions, illustrations and any other information relating to the Products contained in Supplier's catalogues, brochures, price lists, advertising material and any sales or other particulars or literature are made by way of general description, are approximate only and for the general guidance and information of Buyer. They shall not constitute warranties or representations by Supplier nor shall they form part of any Contract.

11. INSTALLATION AND MAINTENANCE OF THE PRODUCTS
11.1 In the event of installation of the Products or the provision of maintenance, where applicable, the following conditions shall apply, and Supplier's price and provision of installation or maintenance are subject to the fulfilment of the following conditions at the expense and responsibility of Buyer:
i. In the absence of an installation date being agreed between the parties, Buyer shall agree to a reasonable installation date with the Supplier, such installation date to be not more than 10 days after delivery.
ii. safe and secure climate controlled on-site storage so that Products and Supplier's tools (as applicable) are protected against theft and any damage or deterioration; any item lost or damaged during the storage period shall be repaired or replaced at Buyer's sole expense;
iii. the timely and sufficient execution and completion of the preparatory works in accordance with all applicable safety, electrical and building codes as well as with Supplier's requirements;
iv. the availability of Buyer's site to Supplier without obstacles in due time to enable Supplier to start installation or maintenance at the scheduled date;
v. the availability of the manpower and equipment necessary to place the Products in their final location or to provide the scheduled maintenance. For the avoidance of doubt, this includes any third party equipment that is required but which the Buyer has decided to purchase themselves;
vi. the acquisition of all permits, licenses, rights of way, etc. of the pertinent authorities required for or in connection with installation or maintenance to be performed; and

vii. the availability of all visas or any other permits necessary for Supplier's personnel and for the import and export of tools, equipment, and materials necessary for installation or maintenance to be performed.
11.2 In case any or all of the above conditions are, not properly or not timely complied with, or Supplier arrives on site but the Buyer delays such installation or maintenance or Supplier has to interrupt its installation or maintenance works, subsequent testing for reasons not attributable to Supplier, the period of completion shall be extended accordingly and any and all additional costs resulting therefrom shall be for Buyer's account. Such costs will be invoiced and payment due in accordance with 9.3.
11.3 Supplier neither assumes liability nor offers any warranty for the fitness or adequacy of the premises or the utilities available at the premises in which the Products are to be installed, used or stored.

12. ACCEPTANCE OF INSTALLATION
12.1 In case of installation of the Products, Supplier shall notify Buyer when the Products installed will be ready for testing and acceptance, inviting Buyer to attend Supplier's standard tests or such tests as may have been agreed upon in the Contract to demonstrate compliance with the agreed specifications and/or to inspect the installation work.
12.2 If Buyer fails to attend the testing on the date notified, Supplier will commence with the tests according to Supplier's standard test procedures and these tests shall be considered performed in the presence of Buyer and acceptance shall in such case take place on the basis of the results stated in the test certificate signed by Supplier.
12.3 In case Buyer rejects the Products installed it should submit to Supplier the reasons for such rejection in detail and in writing within 10 days after completion of the acceptance tests concerned. If, within Supplier's reasonable opinion, the rejection is justified, Supplier shall as a sole remedy correct the shortcomings as soon as possible and the relevant parts of the acceptance test shall be repeated within a reasonable period of time in conformity which the procedures outlined above.
12.4 Upon acceptance of the Products, Buyer will sign the acceptance certificate. If within 10 days after completion of the acceptance test Supplier shall not have received the acceptance certificate signed by Buyer or a report with a justified rejection, the Products installed shall then be considered as having been accepted by Buyer.
12.5 Minor defects or deviations not affecting the operational use of the Products installed shall be stated in the acceptance certificate, but shall not obstruct or suspend acceptance. Supplier undertakes to remedy such defects as soon as reasonably possible.

13. WARRANTIES
13.1 Supplier warrants that all Products shall be free from defects in material and workmanship under normal use for a period of (twelve) 12 months from delivery. In the event of installation this warranty period shall be for (twelve) 12 months from installation or fifteen (15) months from dispatch, whichever comes first, save that Supplier does not warrant that operation of the Software (defined in Section 15) will be uninterrupted or error free or that all program errors will be corrected. In the case where the Product delivery is delayed by the Buyer, then Supplier will start the warranty period from original delivery date. Any repair or replacement of a Product does not extend the period of warranty. Notwithstanding the foregoing, unless specified otherwise, the warranty period for any spare or replacement parts shall be one (1) month from the date of delivery of such parts. This warranty does not include any consumables such as filaments, lamps, fuses or other parts, which fail as a result of normal usage. Buyer shall be responsible for determining that the Product is suitable for Buyer's use and that such use complies with any applicable law. Provided that Buyer notifies Supplier in writing of any claimed defect in the Product immediately upon discovery and any such Product is returned at Buyer's risk to Supplier, transportation charges prepaid, within the warranty period in accordance with Section 13.1 and upon examination Supplier determines to its satisfaction, after a reasonable period to inspect such Products, that such Product is defective in material or workmanship, Supplier shall, at its option, repair or replace the Products, shipment to Buyer prepaid. INSTALLATION OF ANY PRODUCT PERFORMED BY A THIRD PARTY WILL VOID THE WARRANTIES PROVIDED UNDER SECTION 13 AND SUPPLIER SHALL HAVE NO LIABILITY TO BUYER FOR REPAIR, REPLACEMENT, OR REFUND OF ANY PRODUCT SO INSTALLED EVEN IF SUPPLIER KNEW ABOUT BUYER'S ELECTION TO USE THE THIRD PARTY BEFORE SUPPLIER RECEIVED BUYER'S ORDER.
13.2 Supplier shall have a reasonable time to make such repairs or to replace such Product. Any repair or replacement of Products shall not extend the period of warranty. The warranty is limited to a period in accordance with Section 13.1, without regard to whether any claimed defects were discoverable or latent on delivery.
13.3 Supplier shall not be liable for any breach of the warranty or payment of damages in respect of Products supplied if: (i) Buyer makes further use of such Products after giving the notice required in Section 13.1; (ii) the defect or failure arises from Buyer's own fault; (iii) the defect arises from any drawing, design or specification supplied by Buyer or from other materials or other property supplied by Buyer or from any parts or items that have not been completely manufactured by Supplier; (iv) the defect arises other than out of manufacture, including without limitation improper installation, sample spillage, misuse by Buyer or a third party, neglect or accident; (v) the defect arises out of the use of the Products in conjunction with products or materials not reasonably contemplated by Supplier; (vi) the failure or defect results from Buyer's unauthorised addition to or modification of, or failure to comply with Supplier's written instructions relating to, the Products or Services; and (vii) the failure or defect arises out of any breach by Buyer of its obligations to provide information to Supplier under these Conditions or Contract.
13.4 If Buyer fails to pay when due any portion of any payment due from Buyer to Supplier under a Contract or otherwise, all warranties and remedies granted under this Section may, at Supplier's option, be terminated.
13.5 The foregoing warranties are exclusive and exclude all other warranties, terms and conditions, express or implied by statute or otherwise, to the extent permitted by law, including without limitation warranties of quality or fitness for a particular purpose. Supplier's sole and exclusive liability, and Buyer's sole and exclusive remedy for breach of the warranties in this Section 13 shall be as set forth in Section 13.1.

14. LIABILITY
14.1 Nothing in these Conditions or Contract shall exclude or limit Supplier's liability for fraud or death or personal injury caused by its negligence or any other liability to the extent that the same may not be excluded or limited as a matter of law.
14.2 Subject to Section 14.1, in relation to Products, Supplier's maximum aggregate liability under or arising out of any Contract, whether arising in contract, tort (including negligence) or otherwise, shall in no event exceed 100% of the total amount payable by Buyer in respect of Products under that Contract.
14.3 Subject to Section 14.1 in relation to Services, Supplier's maximum aggregate liability under or in connection with the supply, non-supply or purported supply of Services under any Contract, whether arising in contract, tort (including negligence) or otherwise, shall in no event exceed 100% of the total amount payable by Buyer in respect of Services under that Contract and in respect of Services continuing beyond one year, shall in no event exceed in any year 100% of the total amount payable by Buyer in respect of Services in that year.
14.4 Subject to Section 14.1, Supplier shall be under no liability to Buyer for any loss of profit, loss of income, loss of use, loss of business, loss of revenue, loss of goodwill, loss of data, or for any indirect or consequential loss or damage of any kind, in each case, howsoever arising, whether such loss or damage was foreseeable or in the contemplation of the parties and whether arising in tort (including negligence), contract or otherwise.
14.5 Any claim arising out of or in connection with a Contract must be commenced against Supplier within one year from the date upon which Buyer became aware of or should have become aware of Supplier's infringement of Buyer's rights, unless otherwise specified under applicable law.

15. SOFTWARE
Supplier or its suppliers (as the case may be) shall at all times have and retain title and full ownership of all software, firmware, programming routines, and documentation relating to such software supplied by Supplier for use with the Products, and of all copies made by Buyer or the end user of the Products (collectively "Software"). A non-exclusive, non-transferable and non-sublicensable licence to use such Software will be granted to the end user solely for use with the Products.

16. INTELLECTUAL PROPERTY RIGHTS
16.1 Notwithstanding delivery of and the passing of title in any Products and subject to section 15 and 16.3, nothing in these Conditions or any Contract shall have the effect of granting or transferring to, or vesting in, Buyer any intellectual property rights in or to any Products and/or Services.
16.2 Buyer acknowledges and agrees that all property, copyright and other intellectual property rights in any work or tangible deliverable item arising from or created, produced or developed by Supplier under or in the course of provision of any Services (the "Works"), wherever in the world enforceable, including without limitations all right title and interest in and to the Services and all documents, data, drawings, specifications, articles, sketches, drawings, reports, inventions, improvements, modifications, discoveries, tools, scripts and other items relating thereto shall immediately upon creation or performance vest in and shall be and remain the sole and exclusive property of Supplier and Buyer shall acquire no right, title or interest in or to the same except as expressly stated in these Conditions.
16.3 The Supplier grants to the Buyer a non-exclusive, non-transferable and non-sublicensable licence to use such of the Works as are necessary, and to the extent necessary, for the end user to obtain and utilise the intended benefit of the Services.
16.4 If any claim is made against Buyer that the Products or Services infringe the patent, copyright or other intellectual property rights of any third party, Supplier shall indemnify Buyer against all losses, damages, costs and expenses awarded against, or incurred by, Buyer in connection with the claim or paid, or agreed to be paid, by Buyer in settlement of the claim provided that: (i) Supplier is given full control of any proceedings or negotiations in connection with any such claim; (ii) Buyer shall not make any admission of liability and shall give Supplier all reasonable assistance for the purposes of any such proceedings or negotiations; (iii) except pursuant to a final award, Buyer shall not pay or accept any such claim, or compromise any such proceedings without the consent of Supplier; (iv) Buyer shall do nothing which would or might vitiate any insurance policy or cover which Buyer may have in relation to such infringement and shall use its best endeavours to recover any sums due thereunder and this indemnity shall not apply to the extent that Buyer recovers any sums under any such policy or cover; (v) Supplier shall be entitled to the benefit of, and Buyer shall accordingly account to Supplier for, all damages and costs (if any) awarded in favour of Buyer which are payable by, or agreed with the consent of Buyer (which consent shall not be unreasonably withheld) to be paid by, any other party in respect of any such claim; and (vi) without prejudice to any duty of Buyer, Supplier shall be entitled to require Buyer to take such steps as Supplier may reasonably require to mitigate or reduce any such loss, damages, costs or expenses for which Supplier is liable to indemnify Buyer under this section 16.4, which steps may include (at Supplier's option) terminating use of the Product or Service, accepting from Supplier non-infringing, modified or replacement Products or Services.
16.5 Supplier shall have no obligation or liability under Section 16.4 insofar as the infringement arises from: (i) any additions or modifications made to the Products and/or Services in question, otherwise than by Supplier or with its prior written consent; (ii) any information provided by Buyer to Supplier including without limitation any specification; (iii) performance by Supplier of any work required to any Products, or performance of any Services, in compliance with Buyer's requirements or specification; (iv) a combination with or an addition to equipment not manufactured or developed by Supplier; or (v) the use of Products beyond that scope established by Supplier or approved in writing by Supplier.
16.6 Without prejudice to Section 14.1, this Section 16 states the entire liability of Supplier and the exclusive remedy of Buyer with respect to any alleged infringement of intellectual property rights belonging to a third party arising out of or in connection with the performance of any Contract. This Section 16 shall be subject to the limits of liability in Sections 14.2.

17. FORCE MAJEURE

Malvern Panalytical Inc.
2400 Computer Drive
Westborough, MA 01581

Ref.: Q-185545-3
Date: 3/26/2025

Notwithstanding anything to the contrary in these Conditions, Supplier shall not be liable to Buyer for any loss or damage which may be suffered by Buyer as a direct or indirect result of the supply of Products or Services being prevented, delayed or rendered uneconomic by reason of circumstances or events beyond Supplier's reasonable control. If due to such circumstances or events Supplier has insufficient stocks to meet all its commitments Supplier may apportion available stocks between its customers at its sole discretion.

18. CONFIDENTIAL INFORMATION
Each party undertakes to keep confidential, not use for its own purposes outside the agreed scope and not without the prior written consent of the other party disclose to any third party, any information of a confidential nature belonging or relating to the other party which may become known to it unless such information is or becomes public knowledge (other than by breach of this Section) or is required to be disclosed by order of a competent authority.

19. CANCELLATION, RESCHEDULING AND TERMINATION
19.1 Orders for Products accepted by Supplier may be cancelled or rescheduled by Buyer only with the written consent of Supplier (which consent Supplier may withhold for any reason) and Buyer shall indemnify Supplier against the cost of all labour and materials used in connection with the order so cancelled or varied and against all loss, damage cost, charges and expenses suffered or incurred by Supplier as a result of that cancellation or variation. Contracts for Services shall commence on the commencement date identified in the relevant Contract and, subject to earlier termination in accordance with Section 19.2, shall continue in force for the initial term as prescribed in such Contract and thereafter for any renewal period (if any) set out in the Contract and thereafter without limit of period unless or until terminated by either party in accordance with 19.2.
19.2 Either party may terminate a Contract for Services immediately at any time by written notice to the other party if the other party commits a material breach of the Contract for Services which is incapable of remedy or which fails to be remedied. Notwithstanding the foregoing, either party may terminate a Contract for Services by giving ninety (90) days written notice to the other party.
19.3 Upon termination or expiry of any Contract, for Services, each party shall except to the extent permitted or required to exercise or perform its continuing rights, or obligations hereunder, return to the other party all property of the other party then in its possession, custody or control and shall not retain any copies of the same.
19.4 Termination of any Contract in accordance with these Conditions shall not affect the accrued rights or liabilities of the parties at the date of termination.

20. INSOLVENCY OF BUYER
If: (i) Buyer becomes insolvent, has a receiver, administrative receiver, administrator or manager appointed of the whole or any part of its assets or business, makes any composition or arrangement with its creditors, takes or suffers any similar action in consequence of debt or an order or resolution is made for its dissolution or liquidation (other than for the purpose of solvent amalgamation or reconstruction) or carries out or undergoes any analogous act or proceedings under an applicable foreign law; or (ii) Buyer ceases, or threatens to cease to carry on business then, without prejudice to any other right or remedy available to Supplier, Supplier may treat any Contract as repudiated and/or withhold any further supply of Products and/or Services without any liability to Buyer and, if any Products and/or Services have been supplied but not paid for, the price or fees shall become immediately due and payable notwithstanding any previous agreement or arrangement to the contrary.

21. EXPORT CONTROL
21.1 Buyer understands that where Supplier's obligations under the Contract to supply any Products or Services are subject to governmental export control laws and regulations, the performance of this Contract and Buyer's use or export of any Products delivered by Supplier shall be conditional upon the grant of all necessary permits or licences. Buyer shall provide all information and documentation, including where necessary end user certification, not in Supplier's possession and required by the relevant application procedure to enable Supplier to make the necessary applications for permits or licences required for deliveries to Buyer. Supplier shall be relieved from its obligations to Buyer to supply any Products or Services to the extent that applications for permits or licenses for the same are refused by a relevant governmental authority. To the fullest extent permitted by law, Buyer shall have no right to claim compensation for damages, loss of business or otherwise arising from such a refusal or Contract termination.
21.2 Buyer shall not, directly or indirectly, sell, provide access to, export, re-export, transfer, divert, loan, lease, consign, tranship (including stop in port), transport, or otherwise dispose of any Supplier's Product, material, Software (including source code) or technology to, via, or for: (i) any entity known to be headquartered in, or owned or controlled by a national of, any country or region subject to comprehensive sanctions at any time; (ii) any other individual or entity identified on a denied or restricted party list; or (iii) any activity or end-use restricted by applicable laws without first obtaining all required government authorisations.
21.3 Supplier shall have the right, at its option, to suspend performance under or terminate any Contract if: (i) applicable comprehensive sanctions are imposed; (ii) the Buyer is designated as or determined to be a denied or restricted party under applicable law; or (iii) where the Supplier's obligations under these Conditions or any Contract to supply items or Services are subject to governmental export control laws and regulations, the performance of any Contract and Buyer's use or export of any item delivered by Supplier shall be conditional upon the grant of all necessary permits or licences.

22. DATA PROTECTION
22.1 The Buyer represents, warrants and undertakes that it has complied and shall continue to comply at all times with the EU General Data Protection Regulation 2016/679, the Regulation (the "GDPR"), the Electronic Communications Data Protection Directive (2002/58/EC), the Privacy and Electronic Communications (EC Directive) Regulations 2003 (SI 2426/2003) and any applicable laws in any jurisdiction relating to the processing or protection of personal data and privacy, including where applicable the guidance and codes issued by any relevant supervisory authority from time to time (collectively the "Data Protection Laws").
22.2 The Supplier shall at all times, where personal data is being processed, supply the Products in accordance with an appropriate data processing agreement (the 'DPA') containing suitable safeguards for the protection of personal data disclosed by the Buyer and both parties shall at all times comply with obligations contained therein. The Buyer hereby acknowledges and confirms that any breach of the DPA by the Buyer or its representatives of this Section 22 entitles the Supplier to terminate any Contract in force between the parties immediately and with no liability.
22.3 The Buyer shall indemnify and hold the Supplier harmless from and against all losses, costs, claims, expenses or damages howsoever arising which the Supplier may incur or for which it may become liable as a result of or in connection with any breach or failure by the Buyer or its representatives to comply with this Section 22 including, but not limited to, all claims, proceedings or actions brought by a competent public authority and/or a data subject against the Supplier and for all claims, proceedings or actions brought against the Supplier and/or its sub-contractors of its data protection obligations (including its data security obligations) under applicable Data Protection Laws.

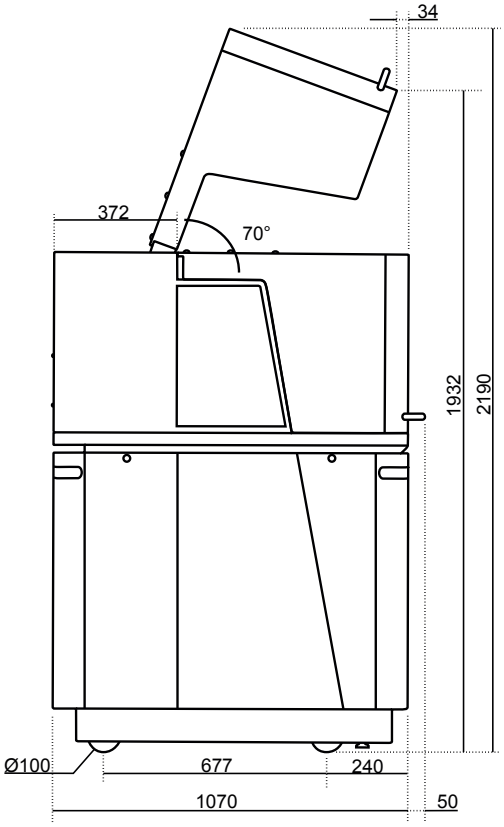
23. GENERAL
23.1 These Conditions and any Contract shall be governed by the laws of the commonwealth of Massachusetts, USA. The parties agree that the United Nations Convention on Contracts for the International Sale of Goods is specifically excluded from application to these Conditions. The parties shall agree to settle any claims or disputes arising out of or in connection with these Conditions or any Contract by amicable negotiations. If no settlement can be reached through negotiations within sixty (60) days after either party has served written notice to the other requesting such negotiations, then the dispute shall be resolved by arbitration under the American Arbitration Association ("AAA") which rules are deemed to be incorporated by reference into this clause. The number of arbitrators shall be one (1). The seat or legal place of arbitration shall be Boston, Massachusetts. The language to be used in the arbitral proceedings shall be English.
23.2 Failure by Supplier to exercise or enforce any rights hereunder shall not be deemed to be a waiver of any such right.
23.3 If any Conditions are found to be invalid, this shall not affect the rest of the Contract, which shall remain in full force and effect.
23.4 Buyer may not assign, transfer, novate or otherwise dispose of all or any of its rights or obligations, in whole or in part without the written consent of Supplier.
23.5 These Conditions constitutes the entire agreement and supersedes any prior agreement, understanding, representations or arrangements between the parties with respect to its subject matter.
23.6 Variation to any Contract must be in writing and signed by the parties.
23.7 All notices given under these Conditions shall be sent to the address of the other party set forth in the Quotation or in Contract. Notice shall be regarded as properly given if sent in writing and shall be deemed to have been served on the next working day from delivery if sent by email or fax, and on the day of receipt if sent by express courier or by registered mail.

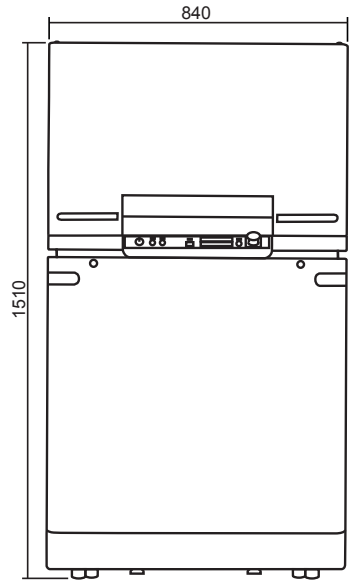
May 2019 US Edition

Malvern Panalytical
a spectris company

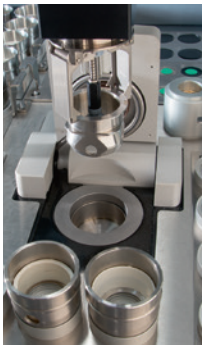
Zetium
Technical specifications

Wavelength dispersive X-ray fluorescence spectrometer for the elemental analysis range from Be to Am and the concentration range from ppm to 100%.

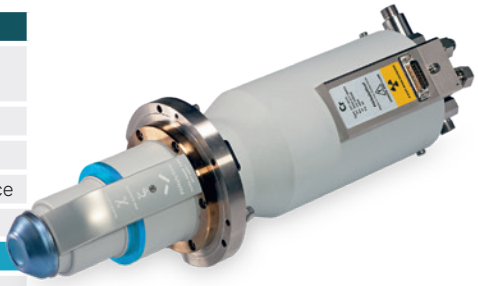


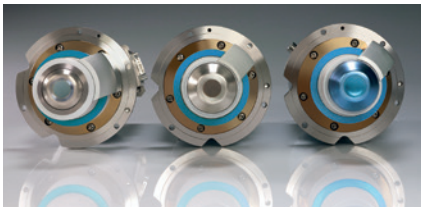


Sample handling	Basic Zetium configuration	Power upgrades and optional items
Types	Solid, fused beads, filters, pressed/loose powders and liquids	
Handling	All samples are fitted in sample holders during measurement. Liquids and loose powders in disposable (P2) liquid cells, which are fitted in liquid sample holders	
Dimensions	51.5 mm Ø x 40 mm height, maximum	
Weight	Max. 400 g including sample holder	
Sample changer	Standard sample bed; X-Y changer with priority position for 1 sample (detected) and 2 empty holders with capacity for 8 trays for 8 sample holders and 1 tray for 4 sample holders.	High-capacity changer up to 209 uncupped samples of 32 mm or 140 samples of 40 mm
Changer trays	2 Trays (1 free choice, 8 cup tray included)	For: 8 sample holders, 8 flex positions, 8 steel rings (Ø 51.5 mm), 21 samples (Ø 25 mm), 12 samples (Ø 32 mm), 10 samples (Ø 41 mm), or 4 sample holders (SPC/monitor tray)
Loading	• Single loading • Air lock with programmable pumping time, one position turret mechanism, sample surface-down	Direct loading of unmounted samples in holder loading; continuous loading
Spinner	0.5 rev/s	

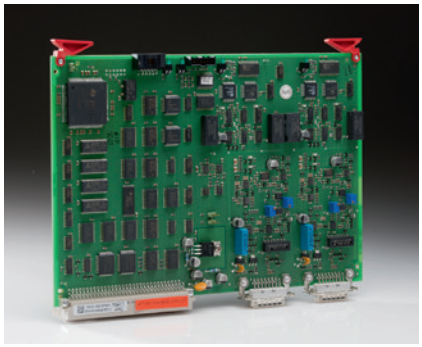


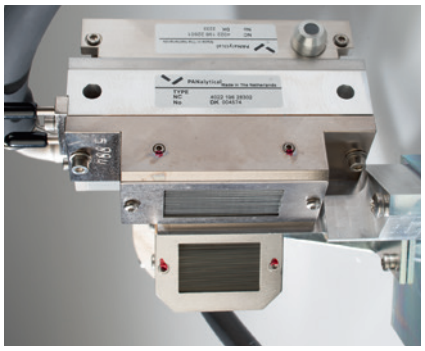
X-ray tube	Basic Zetium configuration	Power upgrades and optional items
Type	SST R, Super Sharp End Window Tube	SST R-mAX, Super Sharp End Window Tube featuring ZETA Technology
Anode	Rh	Cr optional, other anodes on request
Window	Ultra-high transmission, 75 µm	75 µm (standard) 50 µm (option)
Window coating		CHI-BLUE coating for corrosion resistance
Operation	Tube remains powered on during sample loading	
HV Generator	**Basic Zetium configuration**	**Power upgrades and optional items**
Output	Selectable in steps of 1 kV, 1 mA	
kV / mA switching	Isowatt switching	
Stability	0.0005% / 1% mains vari ation	
Stability mains	± 10%	
Power rating	**Basic Zetium configuration**	**Power upgrades and optional items**
	1 kW	Upgradable to 2.4, 3 or 4 kW
	Zetium 1 kW: 20 - 60 kV, 16 - 50 mA	Zetium 2.4 kW: 20 - 60 kV, 10 - 100 mA
		Zetium 3 kW: 20 - 60 kV, 10 - 125 mA
		Zetium 4 kW: 20 - 60 kV, 10 - 160 mA



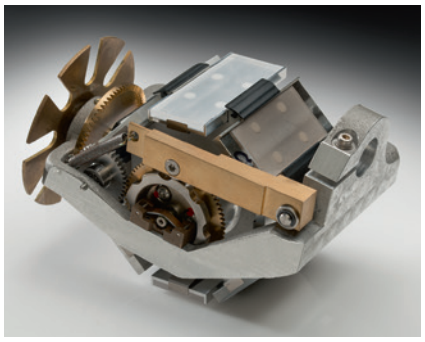


Goniometer	Basic Zetium configuration	Power upgrades and optional items
Type	θ/2θ decoupled with Direct Optical Position Sensing (DOPS)	
Angular accuracy	0.0025° θ and 2θ	
Angular reproducibility	0.0001° θ and 2θ	
Scanning speed	Up to 10° 2θ/s	
Slewing speed	40° 2θ /s	
Temperature stabilization	Chillerless ± 0.07°C at 35°C cabinet temperature	Chiller cooled ± 0.05°C at 30°C cabinet temperature

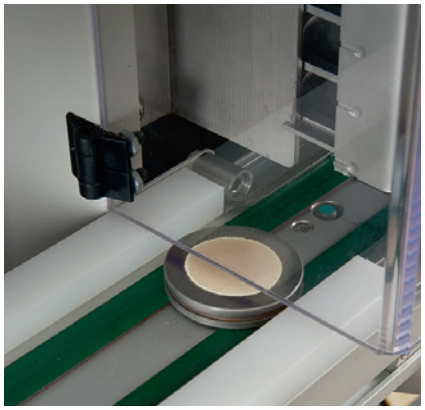




Optical path	Basic Zetium configuration	Power upgrades and optional items
Channels masks	Single mask (fixed 27, 30 or 37 mm)	Switchable 3 positions (27, 30, 37 mm) Switchable 6 positions (6, 10, 20, 27, 30, 37 mm, only for 2.4, 3 and 4 kW)
Primary collimators	1 collimator free choice (max. allowed 3)	3 max.: 100, 150, 300, 550, 700, 4000 µm
Primary beamfilters	4 max.: wide range of materials and thickness available. One may be used as beam stop	
Crystals	3 crystals (LiF200, PE002, PX1)	8 max.: choice of LiF420, LiF220, Ge111 (flat/curved), InSb (flat/curved), TIAP coated, PX8, PX10, PE002 curved, PX4, PX5, PX6, PX7
Detectors	Flow detector	Scintillation, Duplex counter (sealed Xe in tandem with flow counter), HiPer Scint
		Hi-Per channels, max. of 2 (from B to Mg)
Beam path	Vacuum: <10 Pa	He, N_2 optional



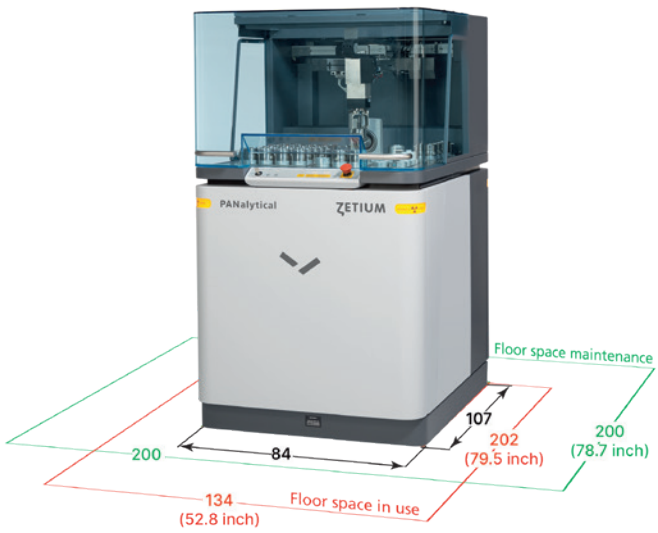
Counting electronics	Basic Zetium configuration	Power upgrades and optional items
Type	Dual multi channel analyser with digital signal processor	
Maximum count rate	Flow counter: 2500 kcps	Flow counter fixed channel: 3000 kcps Scintillation: 1000 - 1500 kcps Sealed counter: 1000 - 2500 kcps Duplex counter: 3500 kcps Hi-Per Scint: 3500 kcps (non-linearity ≤ 1%)
Pulse shift correction	Automatic, dynamic (selectable)	
Dead time correction	Automatic	



Automation interfacing	
Inverter	
Transfer point at side	41.1 cm (16.18 in) from front side, protruding 28.95 cm (11.4 in)
Transfer point heights	85, 88.5, 91.2, 111.2 cm (33.46, 34.84, 35.91, 43.78 in)
Back feed unit	
Transfer point at side	25.25 cm (9.94 in) from side, protruding 3.5 cm (1.38 in)
Transfer point height	104.8 cm (41.26 in)

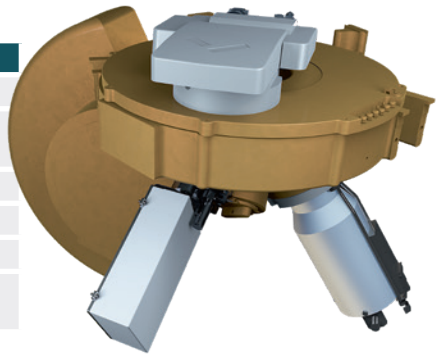
Safety standards	Basic Zetium configuration	Zetium equipped with Small Spot Mapping
Generic-Europe	CE	CE
Generic-CAN/ USA	CSA/UL 61010-1-12 (cMETus marked)	CSA/UL 61010-1-12 (cMETus marked)
X-ray safety	CSA/UL 61010-2-091 Vollschutz acc. to German RöV 2013/59/EURATOM	CSA/UL 61010-2-091 Vollschutz acc. to German RöV (pending) 2013/59/EURATOM
Various	Installation cat. Class II Pollution Degree 2 IP20	Installation cat. Class II Pollution Degree 2 IP20

Installation	Basic Zetium configuration	Power upgrades and optional items
Dimensions	84 × 107 × 151 cm (33.1 × 42.1 × 59.4 in) (WxDxH)	
Floor space (WxD, in use)	134 (25 + 84 + 25) x 202 (25 + 107 + 70) cm 52.8 (9.8 + 33.2 + 9.8) x 79.5 (9.8 + 42.1 + 27.6) inch	
Floor space (WxD, maintenance)	Min. 2 × 2 m (6.6 × 6.6 ft), i.e. 1 m (39 in) extra on service side	
Weight	630 kg	
Mains requirements	Single phase, 50-60 Hz, 187-253 V, 40 A max.	
Compressed air	4 to 5 bar	
Power consumption	2.0 kW, 3.0 kVA, 13 A (@ 230 V, 50 Hz)	5.5 kW, 7.5 kVA, 33 A (@ 230 V, 50 Hz)
Environment temp.	Chillerless 15° to 30°C (59° to 86°F)	Chiller cooled 10° to 35°C (50° to 95°F)
Cooling water		12° to 20°C (54° to 68°F), 3.5 to 8 bar, 5 to 11 l/min



Zetium - Spectrometer innovations

ED Core	
Detector	SDD (4th generation)
Resolution	<140 eV @ 5.9keV/ 100 kcps (ICR) Typically 135 eV @ 5.9keV
Max Count rate	1 Mcps ICR
Energy range	Na - Am
Cooling	Peltier cooling
Attenuators	3 programmable attenuators to optimise application results



Small spot analysis and mapping	
Spot size	0.5 mm FWHM
Step size	0.1 mm
Typical count rate standard SSM	Typically up to 3 kcps - Cu Kα
Typical count rate HiPer SSM	Typically 30 kcps
Detector	SDD (4th generation)
Resolution (as for ED core)	<140 eV @ 5.9keV/ 100 kcps (ICR) Typically 135 eV @ 5.9keV
Combined with other attenuations	SSM combined with 3 programmable attenuators for bulk ED measurements
Sample size mapping diameter	Max. 35 mm
Sample holder cup	SSM cup with clamp device for small samples

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Malvern Panalytical
a spectris company

Claisse® is a Malvern Panalytical brand

WROXI - Certified Reference Materials

Perfect solution for the determination of oxides in a wide range of materials

WROXI - CRM value to XRF analysis:

- Traceability guaranteed (ISO 17034)
- Forever available: synthetic standards
- Extendable

PERFECT SOLUTION FOR THE DETERMINATION OF **OXIDES IN A WIDE RANGE OF MATERIALS**

Solve unavailability, incompatible mineralogy, or expensive CRMs

WROXI - CRM is a synthetic, high quality Certified Reference Materials (CRM) kit that covers a wide range of oxide materials such as ores, rocks, and geological materials. It is commonly used in mining, raw materials (cement, steel, metal), slags, service laboratories, R&D facilities, geological surveys, and has a dual purpose: either for primary fusion glass disks calibration or to develop secondary pressed powder calibrations.

The kit is shipped with monitors and templates suitable for the Axios-mAX, Zetium and Epsilon 4 spectrometers.
The methods and fusion recipes are provided for each Malvern Panalytical fusion instrument. Borate flux and additives, instructions on use, and full SDS are also part of the kit.

Why use WROXI - CRM?

WROXI was developed by our XRF experts to solve the problem of finding suitable calibration material for WD and ED-XRF. It is the solution to the limited availability and elemental ranges of RM/CRMs from natural materials. Being synthetic, WROXI standards will be available forever, and that means there is no risk of the requested CRM being sold out or otherwise unavailable.

Need to extend your WROXI oxides coverage?

Our specialised team of CRM manufacturing experts can prepare synthetic CRMs for you based on your needs.

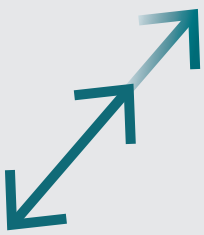
Guaranteed traceability

WROXI - CRM is manufactured under ISO 17034 accreditation which means the traceability is guaranteed. The synthetic CRMs are traceable to pure compounds and are shipped with certificates stating certified values and their uncertainties.

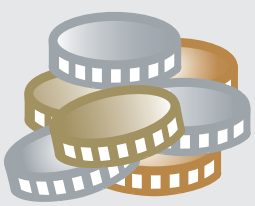
Different sets of CRM covering wide range of elements and concentrations of many materials. Also includes XRF monitors.

Full traceability - CRM **Certificate:** Batch No. release date, period of validity, intended use, certified values and their uncertainty as well as traceability.

Sample Preparation instructions, borate flux, XRF application templates and instrument concentration files.



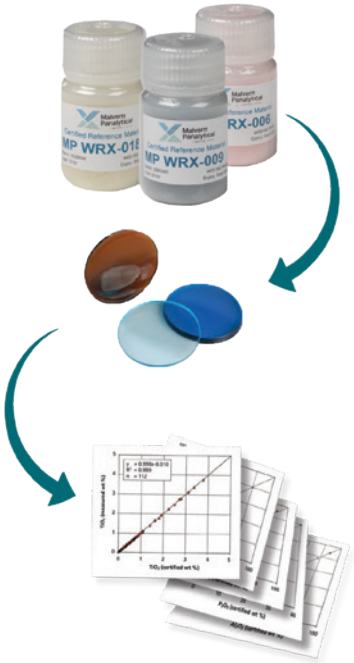
Extendable to include additional elements for concentration ranges.



Cost-effective solution compared to 'traditional' CRMs .

OUTSTANDING QUALITY STANDARDS ARE ESSENTIAL **TO ENSURE HIGH QUALITY ANALYTICAL RESULTS** FOR X-RAY FLUORESCENCE SPECTROMETRY (XRF)

XRF is a comparative technique. Standards of known composition are used to build a calibration curve. The compositions of the routine samples are determined by comparing their intensity with the calibration curve. The standards are one of the pillars of XRF analysis.



Why should I use fusion in my laboratory?
This universal technique has numerous benefits when you compare it with other sample preparation methods such as pressed pellets or acid digestion.

	Fusion	Pressed pellets
Affected by mineralogy	No	Yes
Affected by particle size	No	Yes
Desirable size of powder (microns)	50-100 (easy)	50-30 (difficult)
Accuracy	≤1%	≤10%
Easy calibration with synthetic standards	Yes	No
Application of matrix correction	Yes	No

WROXI - CRM IS PART OF THE **COMPLETE SOLUTION** OFFERED BY MALVERN PANALYTICAL FOR **ELEMENTAL ANALYSIS**

The traceability can be ensured all along the analytical chain by combining the data security audit trailing on our spectrometer, the sample monitoring options on our sample preparation equipment and the CRMs produced with metrological traceability.

SAMPLE PREPARATION

Automatic fusion

High-purity borate fluxes and additives

Automatic dosing and weighing

XRF ANALYSIS

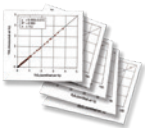
DATA SECURITY

Audit trailing

ISO 17025 Sample characterization

Sample tracking

Spectrometer



Calibration standards (ISO17034)

UKAS REFERENCE MATERIALS
7488

Malvern Panalytical is the first manufacturer to be accredited under **ISO 17034** to make **synthetic XRF calibration CRMs**

Certified Reference Material Producer

Malvern Panalytical is ISO 17034 accredited

Malvern Panalytical's facility in Nottingham has the prestigious accreditation as a Reference Material Producer, accredited to ISO 17034 for both synthetic and natural materials by the United Kingdom Accreditation Service (UKAS).

UKAS accreditation provides a level of confidence and assurance that international guidelines are followed in the production, labelling, and assignment of property values to reference materials, including stability and homogeneity determinations. This covers Certified Reference Materials (CRMs) as well as Reference Materials (RMs).

We can help you with the characterization of your sample as a RM

Malvern Panalytical's facility in Nottingham is a center of excellence for X-ray fluorescence analysis together with standards development and production. The laboratory offers ISO 17025 accredited analytical services (under UKAS) for a number of specific applications and can offer customized analysis of more diverse applications under the same infrastructure and protocols.

Analytical services

UKAS TESTING
7488

CATALOGUE OF **REGULAR PRODUCTS**

The certified reference materials are delivered as powders which are prepared on site as glass disks. The WROXI kits also include XRF application templates, calibration concentration files, methods and fusion recipes for Malvern Panalytical fusion instruments, borate flux and additives, instructions for use and full SDS.

WROXI - CRM Base

Contains 15 multi-element standards for the analysis of the 11 most common oxides in a variety of materials such as ores, minerals, slags and geological materials.

Oxide coverage and their concentration ranges (wt%):
Na_2O 0-50, MgO 0-80, Al_2O_3 0-80, SiO_2 0-90, P_2O_5 0-50, SO_3 0-59, K_2O 0-40, CaO 0-80, TiO_2 0-80, Mn_3O_4 0-80, Fe_2O_3 0-80.

Product Name	Compatibility	Part Number
WROXI - CRM Base WD	Zetium, Axio-mAX	9430 043 63011
WROXI - CRM Base ED	Epsilon 4	9430 043 63021

WROXI - CRM Cement Extension

WROXI-CRM Cement is an extension to the WROXI Base set of CRMs. This extension set provides 9 multi-element standards for the analysis of 10 additional analytes in a variety of cements and the raw materials used in its manufacture, including limestone, clay/ shale, gypsum clinker, raw meal fly ash, slags and iron ore.

Analytes and their concentration ranges (wt%):
Al_2O_3 0-10, SiO_2 0-32, CaO 50-63, ZnO, 0-1, Cr_2O_3 0-1, Fe_2O_3 0 - 7, F 0-1, Cl 0-1, SrO 0-1, BaO 0-1, SO_3 0-0.5

Product Name	Compatibility	Part Number
WROXI - CRM Cement Extension WD	Zetium, Axio-mAX	9430 043 63041
WROXI - CRM Cement Extension ED	Epsilon 4	9430 043 63051

WROXI - CRM Pro Extension

WROXI-Pro Extension is an add-on to the WROXI Base set of CRMs. This extension set provides 12 multi-element standards for the analysis of 10 additional oxides in a variety of materials such as ores, minerals, slags and geological material.

Oxide coverage and their concentration ranges (wt%):
V_2O_5 0-10, Cr_2O_3 0-10, NiO 0-10, CuO 0-10, ZnO 0-10, SrO 0-40, ZrO_2 0-40, BaO 0-40, HfO_2 0-10, PbO 0-10.

Product Name	Compatibility	Part Number
WROXI - CRM Pro Extension WD XRF	Zetium, Axio-mAX	9430 043 63031

WROXI CUSTOM EXTENSIONS: **45 POSSIBLE ADDITIONAL ELEMENTS!**

Available by expertise request, contact our sales team for more details.

For each standard, a certificate containing the following information is provided:

- Batch No,
- release date,
- period of validity,
- intended use,
- certified values and their uncertainty as well as traceability,
- uncertainty,
- instructions for handling,
- stability,
- storage,
- homogeneity,
- commutability.

Malvern Panalytical
a spectris company

WHY CHOOSE US?

When you make the invisible visible, the impossible is possible.

Our analytical systems and services help our customers to create a better world. Through chemical, physical and structural analysis of materials, they improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

With over 2200 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurements group.

Malvern Panalytical. We're BIG on small™.

SERVICE & SUPPORT

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
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Zetium

Cement edition

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Say hello to stable

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Elemental intelligence

Advanced analytical software for advanced analytical hardware

Now, our SuperQ software is enabling even more technology combinations and analytical possibilities for the Zetium. Its Virtual Analyst also makes setting up and operating the system simpler.

Elemental technology

60 years of experience: The ideal starting point

The Zetium Cement edition is the next generation in a long line of WDXRF platforms, including Axios, MagiX, and PW2400. Over the years, we've fine-tuned this proven technology – providing a strong foundation for the Zetium platform.

Elemental su

Reliable support – w

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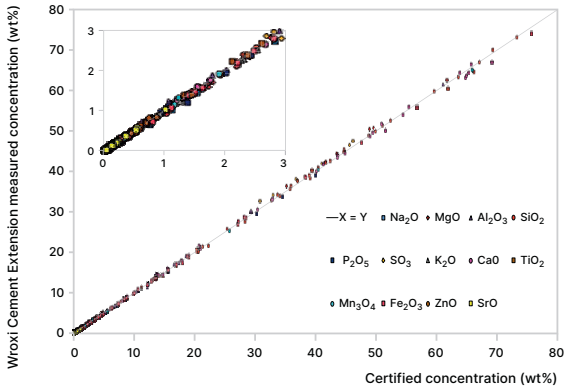
Maximum uptime, stability and precision

Instrument drift and contamination can affect the accuracy of your results. Luckily, the Zetium Cement edition's unique SST R-maX tubes eliminate the largest source of instrument drift, while its direct optical position sensing (DOPS) technology maximizes precision. And we've minimized sample contamination through a range of advanced technologies, including automatic sample-type recognition, turret-style sample loading, preloading dust removal, and CHI-BLUE tube window protection.



The Cement Extension contains nine synthetic Certified Reference Materials contains nine synthetic standards, reliable fusion recipes, an application template, and monitor samples. In other words, it's an out-of-the-box solution for the analysis of major and minor elements in raw materials, raw mix, clinker and cement.

Seamless integration in auto

Want to analyze the mineralogy of raw materials, raw meal, hot meal, clinker, a
as well as their elemental composition? Just link the Zetium to our Aeris X-Ray
and you'll be all set with reliable mineralogical feedback alongside your eleme

The power of combining technologies

You can easily integrate the Zetium with other instruments and sample preparation equipment via a belt connection. The result? An automated lab that supports both mineralogical and elemental analysis – which means higher productivity and lower process cycle times.

We provide a twin system package including hardware, software, and expertise support to steamline the connection between Zetium and Aeris

A process tailore

We make sample loadi
systems easy. You can
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Interested in a turnkey
Contact us today for a

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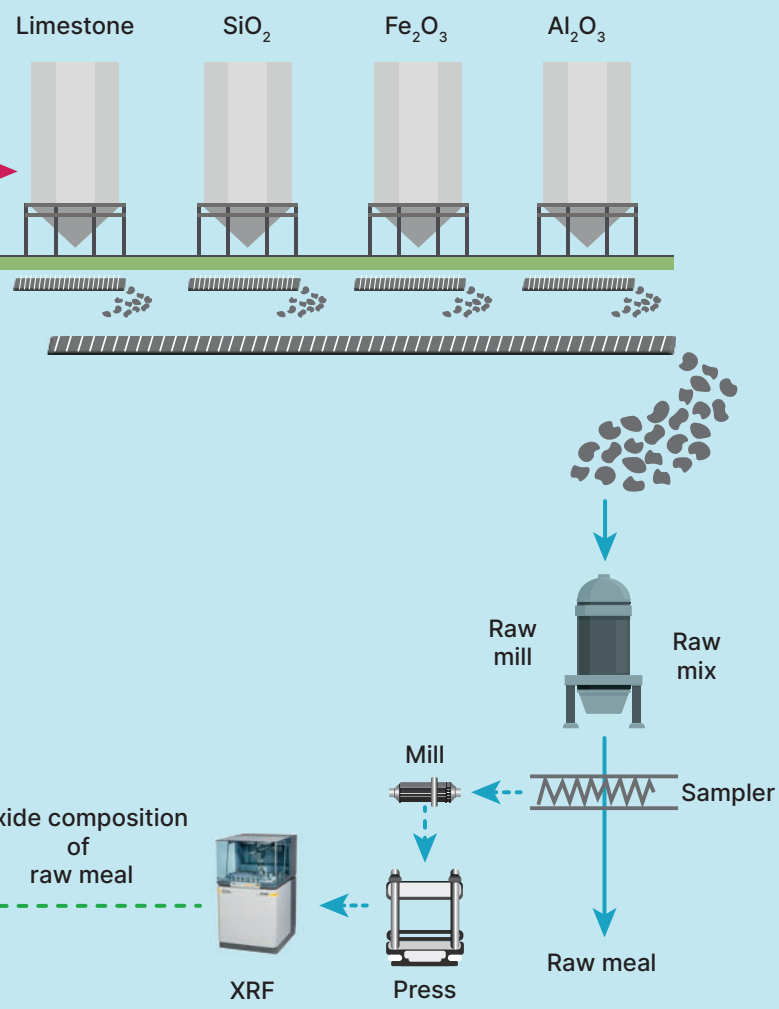
l. By synchronizing Zetium with Smart Blend, it independently
mpositions based on XRF data. This ensures optimal raw
nal human intervention. The comprehensive solution reduces
g processes and decreasing reliance on specialized personnel.

e integrated with an online elemental analyzer, such as
e analysis for stringent process and quality control. This
f clinker, extended refractory lifespan, and reduced
ant configuration, XRF make, and plant personnel
perated in either a manual or fully automatic mode.



Smart manager, smart Zetiu

The distractions and demands of quality control management can make it dif
to get the most out of your instruments. To make it easier, we've connected th
Zetium to our Smart Manager platform – making it a Smart Zetium.

Meet your new trusted team member

This cloud-based 'control room' connects all your Zetium instruments, giving you a clear picture of their performance – wherever they are in the world.

So you can keep on top of performance, optimize usage, reduce downtime, and unleash the potential of your data.

Just like having a new, trusted member of your team!

Maximum data security

And rest assured: all your data remains yours, and is only visible to Malvern Panalytical.

Smart Manager uses the latest Microsoft Azure cloud technology, ensuring that your data is safe and secure at all times. We don't collect data from your own samples unless you explicitly request it.

Malvern Panalytical
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About Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

Malvern Panalytical. We're BIG on small™

Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
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ZETIUM
PRE-INSTALLATION MANUAL

ZETIUM
PRE-INSTALLATION MANUAL

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This is the original publication of Edition 5 of this document, to be used with the Zetium instrument.

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TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

This Pre-installation Manual gives all the information that is necessary to prepare a site for the installation of the Zetium instrument.

With this information, the customer can make a decision about the best location and prepare supplies for electrical power, compressed air and water. This manual also has information about optional equipment, which is necessary if the available supplies are not in the specified range.

It is the responsibility of the customer to prepare the necessary supplies and items before the instrument is installed.

Figure 1.1 *Zetium*

1.1 Pre-installation checklist

The pre-installation checklist is used during a pre-installation visit or call to examine if the installation location agrees with the installation requirements. The checklist formalizes the responsibilities of the customer.

1.2 Pre-installation kit

Malvern Panalytical supplies a pre-installation kit for fast installation of the instrument. If necessary, this kit can be sent before the installation of the instrument. The pre-installation kit has these items:

- Wall interface bracket
- Water filter
- Pressure regulator for detector gas
- Installation material for the pressure regulator for detector gas

1.3 TWIN system (option)

The Zetium can be set up as a TWIN system with an XRD CubiX instrument. A conveyor belt is installed between the Zetium and the XRD CubiX to move samples between the instruments. The conveyor belt is 1300 mm long and it is installed at a height of 1112 mm.

1.4 Unit conversion information

Measurements are in metric units. These are useful conversions:

- Pressure: MPa = 10 bar = 10 atm = 145 psi
- Temperature: °F = 9/5 °C + 32
- Weight (N): mass * g (mass in kg and g ≈ 10 ms^{-2})

CHAPTER 2 SAFETY

2.1 Authorized personnel

NOTE: Authorized Personnel = Person who is trained, educated and authorized by the Malvern Panalytical organization to execute service work to a specified level and product area.

The installation, maintenance and repair procedures of the instrument must only be done by 'Authorized Personnel'.

All repairs, adjustments and alignments to any part of the instrument must obey all applicable local regulations.

2.2 Safety standards

Malvern Panalytical supplies a Declaration of Conformity with all instruments. The Declaration of Conformity is a legal statement by Malvern Panalytical that shows that the responsibilities related to the supplied instrument have been completed. The customer must keep this document with the instrument for its full life cycle.

Another important declaration for users of analytical X-ray instruments is the X-ray Safety Declaration, which is also supplied with all instruments.

The instrument complies with the requirements of the Machine Directive 2006/42/EC and EMC Directive 2004/108/EC and the applicable X-ray safety regulations.

Refer to the applicable standards, normative documents and directives in the Declaration of Conformity and the X-ray Safety Declaration of the instrument.

2.3 Alerts and labels

Special alerts that relate to the safety of personnel and/or equipment can be found in this manual. Where it is necessary, alert labels with the applicable symbol are attached to the instrument.

Obey all instructions in the alerts in the manual and on the labels attached to the different parts of the instrument.

Alerts in this manual are shown as follows:

DANGER - Electrical Hazard

Shows an immediately dangerous condition which, if not prevented, can result in death or very serious injury.

(The symbol relates to the specified hazard)

WARNING - Ionizing Radiation

Shows a dangerous condition where there is risk of bad injury.

(The symbol relates to the specified hazard)

CAUTION - General Hazard

Shows a condition that can cause damage to equipment or property, or where there is a risk of small injury.

(The symbol relates to the specified hazard)

NOTE: Gives the user more information about the procedure or system.

CHAPTER 3 TRANSPORT AND STORAGE

3.1 Impact indicators

Impact indicators monitor the handling of Malvern Panalytical equipment during shipping and/or transportation.

There are 2 types of impact indicators:

- TIP-N-TELL indicator, which monitors the tilt level.
- DROP-N-TELL indicator, which monitors the G-level.

Figure 3.1 TIP-N-TELL and DROP-N-TELL indicators and warning labels

Impact indicators and warning labels are attached to all Malvern Panalytical shipments. The indicators can be attached to the crates (external impact indicators) and/or to the equipment inside (internal impact indicators).

- Customers must examine the crate and the external impact indicators before they accept the delivery of the equipment. Refer to Section 3.1.1.
- Customer support engineers of Malvern Panalytical must examine the crate and the impact indicators before they unpack and install the equipment.

If an impact indicator is activated, its results can help with any damage claims procedure.

3.1.1 Examine the external impact indicators

1. When the instrument is delivered to your site, examine the crates and/or cartons, and any impact indicators that are attached to them.

   NOTE: If an impact indicator was attached to a crate or carton before shipping, this is shown on the shipping documents.

2. If an impact indicator is activated or missing, or a crate/carton has visible damage, do as follows.

   a. You can accept the shipment, but record the activated or missing indicator and any visible crate or carton damage on the delivery document.

      NOTE: The recorded results of the impact indicator can help with any damage claims procedure.

b. Contact Malvern Panalytical's local organization or agent/representative about the damaged crate and activated or missing indicator the same day.

3. Store the delivery document for future reference.
4. If you have accepted the shipment, make sure that a customer support engineer of Malvern Panalytical unpacks the instrument and examines it for internal damage as soon as possible.

3.2 Storage

You must keep the instrument in storage until it is installed.

Table 3.1 *Specifications for storage*

Parameter	Specification	Remark
Short term storage		
Time	Max. 0.5 years	
Temperature	-40 to +70 °C	
Humidity	5 to 95 %	No condensation allowed.
Special precautions	None	
Packaging requirements	Standard packaging Special packaging	Must stay closed during storage.
Long term storage		
Time	Max. 1 years	
Temperature	-40 to +70 °C	
Humidity	20 to 80 %	
Special precautions	None	
Packaging requirements	Long term packaging	Must stay closed during storage.

3.3 Transport

3.3.1 Move the instrument

Move the instrument on its pallet as close as possible to the final installation location. Malvern Panalytical recommends to keep the instrument in the crate when you move it.

One of the crate panels can be installed as a ramp. The instrument has wheels to move the instrument off the ramp and to the final installation location. A minimum length of 6 m free space is necessary to install the ramp and move the instrument off the pallet.

Keep the equipment on its pallet until all the supplies are prepared.

3.3.2 Dimensions and weights

Table 3.2 Dimensions and weights

System	Specification
Dimensions	**h x d x w (mm)**
Crate with pallet	1769 x 1324 x 978
Instrument with sample changer, cover closed	1510 x 1120 x 840
Instrument with sample changer, cover open	2190 x 1120 x 840
Crate with auxiliary equipment	Different for each configuration
Weight	**(kg)**
With crate and pallet	740
Instrument with pallet	663
Instrument only	600
Crate with auxiliary equipment	Different for each configuration

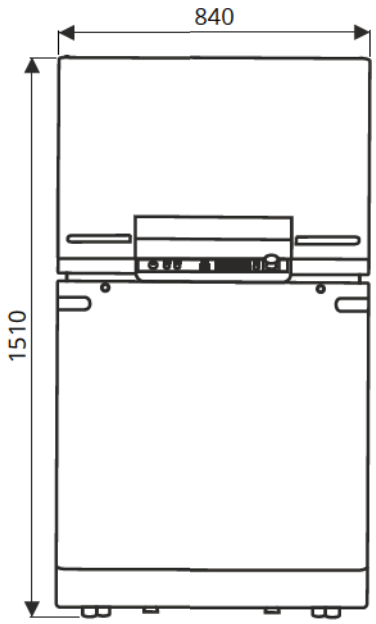


Figure 3.2 Dimensions (mm) - front

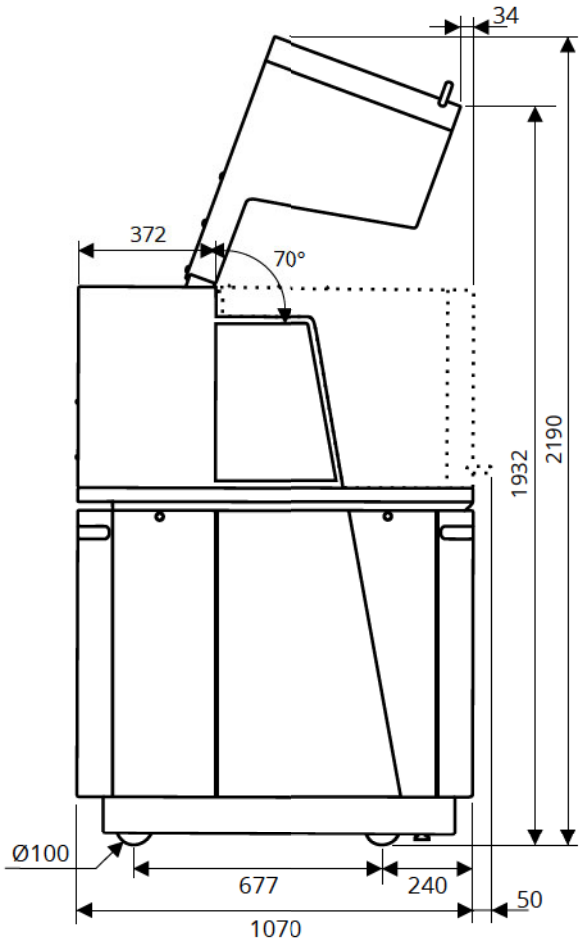


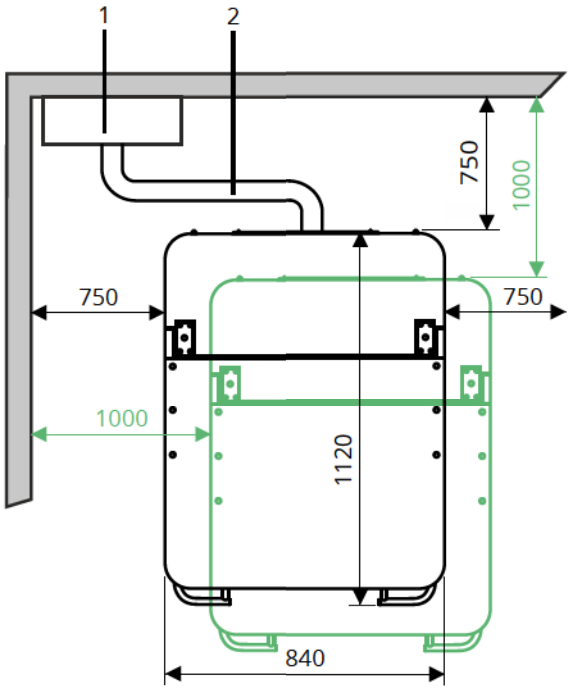
Figure 3.3 Dimensions (mm) - side

CHAPTER 4 INSTALLATION POSITION

The location of the supplies must be as close as possible to the connections of the instrument.

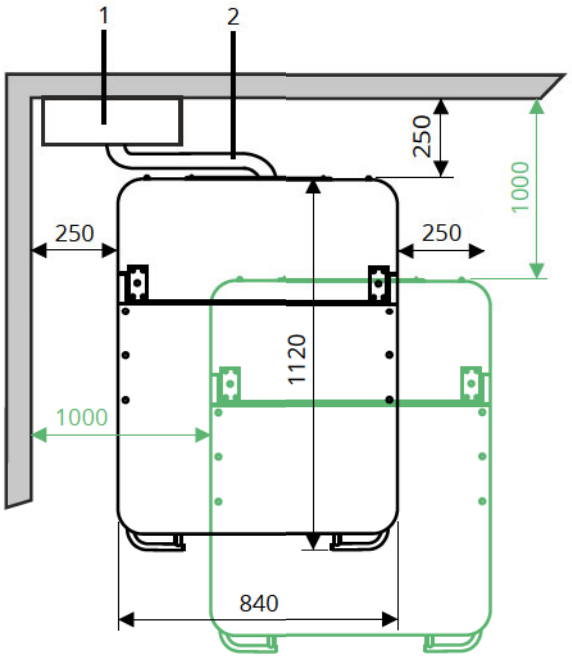
4.1 System layout

The figures show the minimum distance between the instrument and the wall when the instrument is in the operating position (black) and in the maintenance position (green). Use the wheels to move the instrument between the positions.



1.	Wall interface bracket	2.	Umbilical

Figure 4.1 System layout of the Zetium (1 kW) (mm)



1.	Wall interface bracket	2.	Umbilical

Figure 4.2 *System layout of the Zetium (2.4 kW to 4 kW) (mm)*

4.2 Floor loading

The system must be installed on a level floor that can hold the weight of the full system.

Calculate these 2 values to make sure that the floor can hold the system:

- Average floor loading. Refer to Section 4.2.1.
- Maximum point loading. Refer to Section 4.2.2.

4.2.1 Average floor loading

Use the system weight and the system area to calculate the average floor loading. The system weight is the weight of the instrument plus the weight of the auxiliary equipment. The system area also includes the service area around the system.

Example:

- System weight: 600 kg
- System area: 15 m²
- Permitted floor loading: 500 N/m².

Average floor loading:

*(system weight * 10) / system area*

*(600 * 10) N / 15 m² = 400 N/m²*

The system can be installed on this floor.

4.2.2 Maximum point loading

The maximum point loading is on the foot that holds the maximum load of the instrument.

To decrease the maximum point loading, put load spreaders under each of the 4 feet. Refer to Section 4.2.3.

Table 4.1 *Maximum point loading*

Maximum point loading	Conditions
800 N/cm²	Without load spreaders, on wheels.
3 N/cm²	On Ø260 mm load spreaders.

4.2.3 Load spreaders

The load spreaders are Ø260 mm. You can attach the load spreaders to the floor with a screw.

Load spreaders can be ordered with ordering code 9430 970 04861.

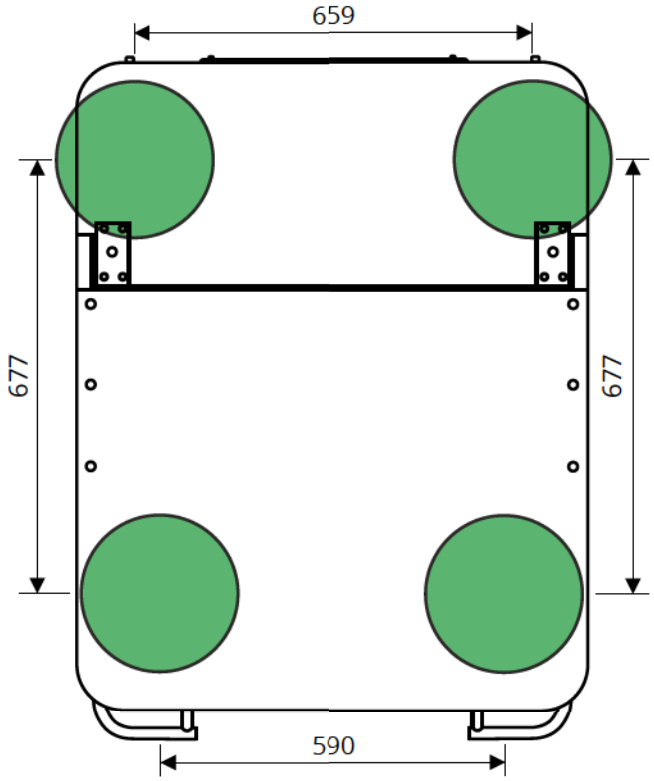


Figure 4.3 *Position of the load spreaders (mm)*

4.2.4 Center of gravity

The center of gravity is 800 mm above floor level.

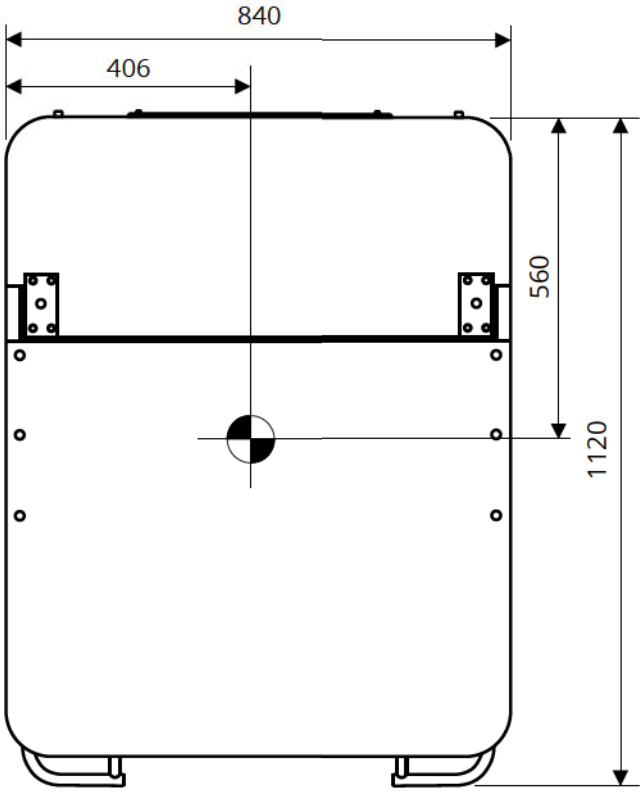


Figure 4.4 *Center of gravity (mm)*

CHAPTER 5 INSTALLATION DATA

5.1 Environmental conditions

The instrument is dust protected, but it is recommended to install and operate the instrument in a reasonably clean area.

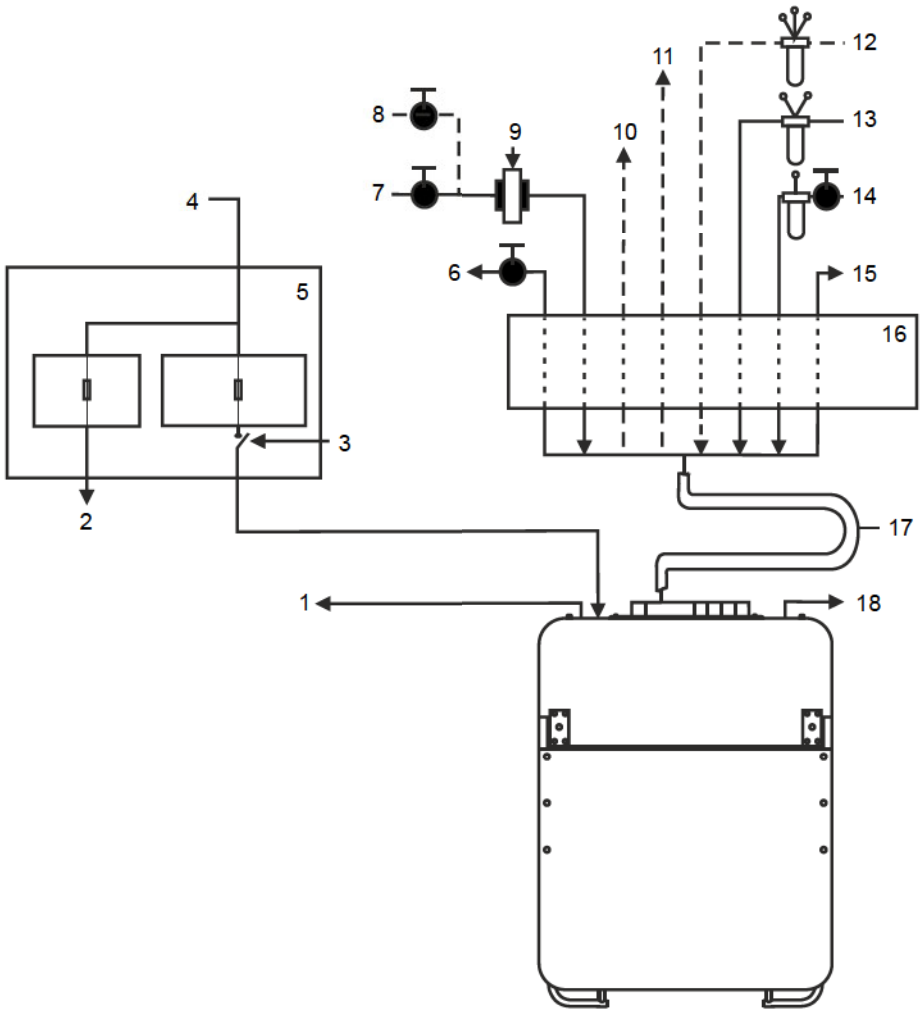
Prepare samples as clean and solid as possible. Dust or particles that fall from the sample could collect in important parts of the instrument and this has a negative effect on the accuracy of analyses. If dusty samples must be analyzed regularly, Malvern Panalytical recommends to install the optional dust removal device.

The instrument has no protection against dripping or splashing water.

Table 5.1 *Specifications for environments conditions*

Parameter	Specification	Remark
Direct solar radiation	Not permitted.	
Dust precautions/levels	Reasonably free from dust.	The cabinet has protection against dust: IEC 60529 class IP40.
Vibration levels	< 60 µm p-p < 25000 µm/Hz^2 p-p	For frequencies < 20 Hz. For frequencies > 20 Hz.
Room temperature changes	< 1 °C per 30 minutes	Do not install the instrument in the airflow of an air conditioning system.
Relative humidity	20 to 80 %	Prevent condensation.
Air pressure	0.06 to 0.12 MPa	
Pollution degree	2	
Zetium 1 kW		
Heat dissipation	< 2.0 kW	From the instrument into the room.
Room temperature	+15 to +30 °C	
Zetium 2.4 kW to 4 kW		
Heat dissipation	< 0.5 kW	From the instrument into the room.
Room temperature	+15 to +30 °C	If the cooling water temperature stays between +12 °C and +20 °C.
	+15 to +35 °C	If the cooling water temperature stays between +12 °C and +18 °C.

5.2 Supply connections



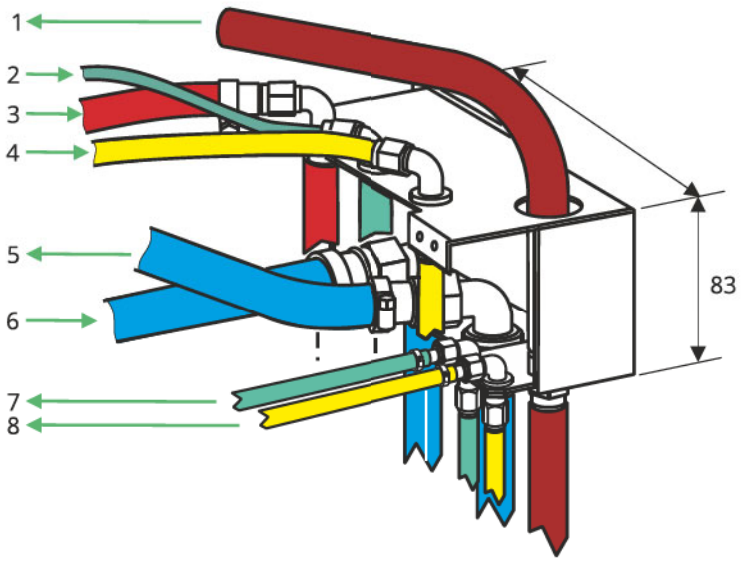
1.	Network connection	10.	Detector gas out (optional)
2.	PC power supply, fuse 16 A	11.	He/N gas out (optional)
3.	Mains disconnector with lockout functionality	12.	He/N gas in (optional)
4.	Mains power supply, 210 - 230 Vac, 50/60 Hz, ø, + PE	13.	Detector gas in
5.	Mains distribution box All peripherals that are connected to the instrument must be connected to the earth terminal in the mains distribution box	14.	Compressed air in
6.	Water out (2.4 kW to 4 kW)	15.	Vacuum out
7.	Water in (2.4 kW to 4 kW)	16.	Wall interface bracket
8.	Chiller unit (optional) (2.4 kW to 4 kW)	17.	Umbilical
9.	Water filter (2.4 kW to 4 kW)	18.	Internet connection

Figure 5.1 *Supply connections*

5.2.1 Wall interface bracket

Before the installation of the instrument, you can install the wall interface bracket to the wall. A 3.5 m umbilical is supplied with the instrument to connect air, gas and water from the instrument to the wall interface bracket.

The customer must supply the connections between the wall interface bracket and the air, gas and water supplies. Obey local regulations when the supplies are connected.



1.	Vacuum out	5.	Water out (2.4 kW to 4 kW)
2.	Detector gas in	6.	Water in (2.4 kW to 4 kW)
3.	Compressed air in	7.	Detector gas out
4.	Helium in (optional)	8.	Helium out (optional)

Figure 5.2 *Wall interface bracket (mm)*

5.2.2 Install the hook for the umbilical strain relief

The umbilical has a strain relief eye with an internal diameter of 10 mm. The strain relief eye must be attached to a hook to keep the umbilical in position.You must install the hook to the wall, close to the bottom of the wall interface bracket. The hook must hold a force of 2000 Nm.

5.2.3 Gas exhaust kit

The gas exhaust kit is optional. It releases used detector gas or flushing gas outside the building.

The connection between the instrument and the wall interface bracket is supplied with the gas exhaust kit. The customer must supply the connection from the wall interface bracket to the outlet point of the building.

An outlet venturi valve is supplied with the gas exhaust kit. Only use the outlet venturi valve if you use a lower pressure for suction of the outlet gases. If you do not use suction, do not use the outlet venturi valve, because gases will be blown into the instrument.

5.3 Mains power supply

The instrument must be connected in a single phase supply or between 2 phases.

Connect the instrument and all the peripherals to the same power line. This prevents electrical interference and damage to the system, caused by large equalizing current between 2 protected earths.

Do not operate other equipment on the same power line if it can cause electrical interference.

The customer is responsible for the installation of the mains disconnector. It must be clearly identified as mains disconnector, installed in a useful location and have easy access. It also must have lockout functionality.

If you do not obey the mains power specifications, you can damage the instrument. If you damage the instrument, the warranty of the instrument or parts of the instrument can be canceled. Refer to Table 5.2.

If the mains power supply is not stable, use a UPS (Uninterruptable Power Supply). Refer to Section 6.2.

If necessary, use a mains power generator. Refer to Section 6.3.

The system agrees with the relevant industrial requirements of IEC 61326-1.

NOTE: The Zetium is supplied with a 5 m cable for the mains power supply. Only use this cable if it agrees with local regulations.

Table 5.2 *Specifications for the mains power supply*

Parameter	Specification	Remark
Supply voltage: Single phase (L-N)	210 - 230 Vac	
Frequency	50/60 Hz ± 2 %	
Overvoltage category	II	Indoor use only
Zetium 1 kW		
Maximum power consumption	3 kVA	
Maximum loading current	16 A	
Main fuse	< 40 A Must agree with the local regulations.	In the mains power supply
Mains power supply cable	Must agree with the local regulations for the specification of the main fuse.	
Zetium 2.4 kW		
Maximum power consumption	5 kVA	
Maximum loading current	24 A	
Main fuse	< 50 A Must agree with the local regulations.	In the mains power supply
Mains power supply cable	Must agree with the local regulations for the specification of the main fuse.	
Zetium 3 kW		
Maximum power consumption	6 kVA	
Maximum loading current	28 A	
Main fuse	< 50 A Must agree with the local regulations.	In the mains power supply
Mains power supply cable	Must agree with the local regulations for the specification of the main fuse.	
Zetium 4 kW		
Maximum power consumption	7.5 kVA	
Maximum loading current	38 A	
Main fuse	< 60 A Must agree with the local regulations.	In the mains power supply
Mains power supply cable	Must agree with the local regulations for the specification of the main fuse.	

5.4 Earthing

WARNING - Electrical Hazard

Do not operate the instrument with the mains earth disconnected.

The earth connection must obey the local regulations.

Obey these earthing conditions:

- Use a good earthing conductor that agrees with the local safety regulations.
- Use 1 earth reference point for the instrument and its peripherals.
- Connect the earth reference point to the common earth of the power distribution box for the best electromagnetic compatibility (EMC) conditions.
- The leakage current must agree with the local safety regulations. It can be necessary to connect one more earth cable.

5.5 Peripherals and PC

Malvern Panalytical can supply a PC with the instrument. If you supply your own PC, it must agree with the specifications in the installation notes of the user software. To get these specifications, speak to your local Malvern Panalytical organization. The user software must be installed before the instrument installation.

Make sure that these supply items are compatible with the peripherals and the PC:

- Mains power supply voltage
- Mains power supply frequency
- Correct earthing
- Environmental conditions (noise, etc.)

Malvern Panalytical recommends that you take the power for the peripherals from the same phase as the instrument, and to use a central earth point.

All peripherals must be double isolated from the mains power supply.

A 10 m UTP cable is supplied with the instrument for the communication between the instrument and the PC.

5.6 Remote support

The PC that is connected to the instrument must have an Internet connection for remote support.

5.7 Smart Manager

Smart Manager is an optional Internet of Things (IoT) tool for Zetium that connects and monitors your systems. To use Smart Manager, the PC must agree with these specifications:

- The PC must have an Internet connection.
- The PC must agree with the specifications in the installation notes of the IoT Client. To get these specifications, speak to your local Malvern Panalytical organization.

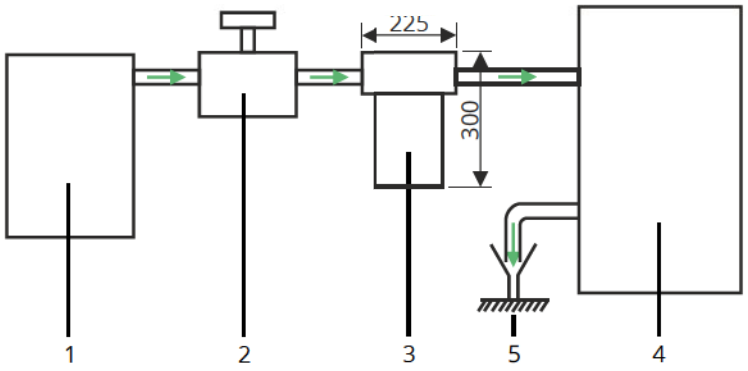
- User authentication is done with Azure Active Directory. Your IT department must set the correct permissions so that your Azure Active Directory can be used with Smart Manager.
- The PC must have a secure connection to the domain "azure-devices.net". You must use one of these ports:
  - Secure MQTT (port 8883)
  - Secure AMQP (port 5671)
  - HTTPS (port 443)

    The IT department must also permit HTTPS access to the domain "azurewebsites.net".
- All PCs that are used to view information on Smart Manager must have a secure link to "https://connectedworld.malvernpanalytical.com".

5.8 Mains water supply (Zetium 2.4 kW to 4 kW)

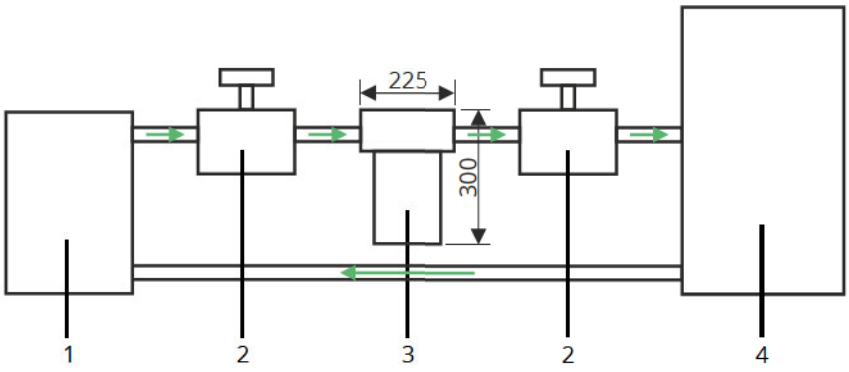
You need an uninterrupted water flow to cool the X-ray tube and instrument cabinet.

If the mains water supply is not within the specified range, Malvern Panalytical recommends to use an external chiller unit to control the temperature, pressure and purity of the water. Refer to Section 6.1.



1.	Mains water supply	4.	Instrument
2.	Water tap	5.	Water drain
3.	Water filter		

Figure 5.3 *Water connections with drain (mm)*



1.	Chiller unit	3.	Water filter
2.	Water tap	4.	Instrument

Figure 5.4 *Water connections with chiller unit (mm)*

NOTE: If you change the X-ray tube in a recirculating cooling system, water can spill because of overpressure. To release the pressure, install one more water tap in the return pipe.

Table 5.3 Specifications for the mains water supply

Parameter	Specification	Remark
Quality	Drinking water	A recirculating cooling system is recommended.
Water temperature	12 to 20 °C, and > dew point	Refer to the note below the table.
Water temperature changes	< 2 °C/h sine wave	
Pressure	0.35 to 0.8 MPa	Between the inlet and outlet of the water connections on the instrument.
Flow	≥ 11 L/min	Stable and uninterrupted.
Water filter (supplied with the instrument)	50 µm filtering	Attach to the wall.
Hose or pipe for the mains water supply (3.5 m supplied with the instrument)	Inner diameter: 13 mm Outer diameter: 19 mm	Malvern Panalytical recommends a pipe for the installation.

NOTE: Keep the temperature of the cooling water above dew point to prevent condensation and corrosion of the X-ray tube.

Use this formula to calculate the dew point:

Tdew point = Troom - ((100 - Relative humidity) / 5)

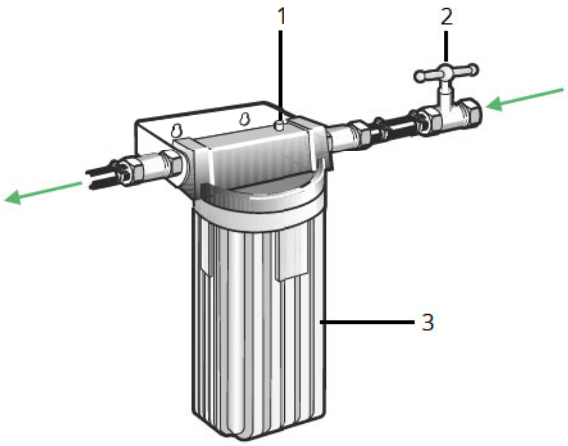
T_{room} : the highest possible temperature of the room where the instrument is installed.
Relative humidity : the relative humidity of the room where the instrument is installed.

5.8.1 Water filter unit

A water filter unit is supplied with the instrument. Install this filter vertically on the wall, close to the tap of the mains water supply and system input connection.

Both connections to the filter have a 15 mm diameter hose or pipe clamp fitting. If the distance between the filter and the system is more than 20 m, Malvern Panalytical recommends to use a pipe with a diameter more than 15 mm.

If you want to continue measurements during maintenance on the filter, use 2 parallel filters and a changeover valve.



1. Bleed button
2. Water tap
3. Water filter container

Figure 5.5 Water filter

5.9 Compressed air supply

Get the compressed air from a local supply line, a compressed air cylinder or a small compressor. Refer to Section 6.4.
As an alternative to compressed air, you can use nitrogen gas from a nitrogen gas cylinder.

The connection of the compressed air supply must agree with ISO 8573-1 class 2-4-3.

If you get the compressed air from a factory system, install an oil separator.

CAUTION - General Hazard

Use dry air only. Do not install an oil mister.

Install an air preparation unit with a water trap, pressure regulator and 30 to 50 µm filter in the compressed air circuit.

Table 5.4 *Specifications for the compressed air supply*

Parameter	Specification	Remark
Pressure	Zetium Cement edition: 0.55 MPa Other Zetium instruments: 0.4 to 0.5 MPa	Input pressure of the instrument.
Consumption	2.0 standard liter/sample at 0.4 MPa	To move the sample from the loading position to the measuring position and back.
Lubrication	No lubrication.	Use dry air only.
Maximum distance	5 m between the pressure regulator and the instrument	
Hose or pipe for compressed air supply (5 m supplied with the instrument)	Outer diameter: 14 mm Inner diameter: 8 mm	Malvern Panalytical recommends a pipe for the installation.

5.10 Detector gas supply

Detector gas is used in the flow detector.

Malvern Panalytical recommends to use P10 gas, a mixture of 90 % Ar and 10 % CH_4. As an alternative, you can use P5 gas, a mixture of 95 % Ar and 5 % CH_4. Get these gases from your local Malvern Panalytical representative.

WARNING - Flammable Material

If P10 gas is identified as flammable at your location, use P5 gas.

An optional gas exhaust kit is available to release the used gas out of the building. Refer to Section 5.2.3.

Table 5.5 Specifications for the detector gas supply

Parameter	P5	P10
Hazard classification UN number ADR/RID no. IMDG page	 1956 2.1A Non-flammable gas, non-toxic	 1954 2.1F Flammable gas
Volume percentages Argon (Ar) Methane (CH_4)	 94.5 - 95.5 % 4.5 - 5.5 %	 89 - 91 % 9 - 11 %
Impurities Nitrogen (N_2) Oxygen (O_2) Water (H_2O) Hydrogen (H_2) CarboHydrogen (C_xH_x)	 < 25 ppm < 10 ppm	 < 200 ppm < 40 ppm < 10 ppm < 10 ppm < 250 ppm
Consumption	1.0 liter/hour	1.0 liter/hour
Pressure regulator	Supplied with the instrument	Supplied with the instrument
Pressure	0.08 MPa	0.08 MPa
Maximum distance	10 m between the pressure regulator and the instrument	10 m between the pressure regulator and the instrument
Hose and pipe for detector gas (hose and 4 m of copper pipe supplied with the instrument)	Inner diameter: 3 mm	Inner diameter: 3 mm

5.10.1 Gas preparation unit

If you are not sure that the gas is pure, Malvern Panalytical recommends to use a gas preparation unit. An applicable gas preparation unit is available from MATHESON, USA. Website: www.mathesongas.com.

The gas preparation unit must have these items:

- 2 x model 450b, shell without cartridge.
- 1 x model 451, cartridge to remove oil and water.
- 1 x model 453, cartridge to remove particles larger than 5 µm.

Table 5.6 Specifications for the gas preparation unit

Parameter	Specification	Remark
Flow	1.0 to 1.5 liter/hour	

5.10.2 Detector gas cylinder

Put the gas cylinder as close as possible to the gas inlet of the instrument. Make sure that the gas cylinder cannot fall. For example, put the gas cylinder in an applicable holder and attach the holder to the wall.

Where the gas pipe crosses walls and floors, put a strong duct over the pipe for protection.

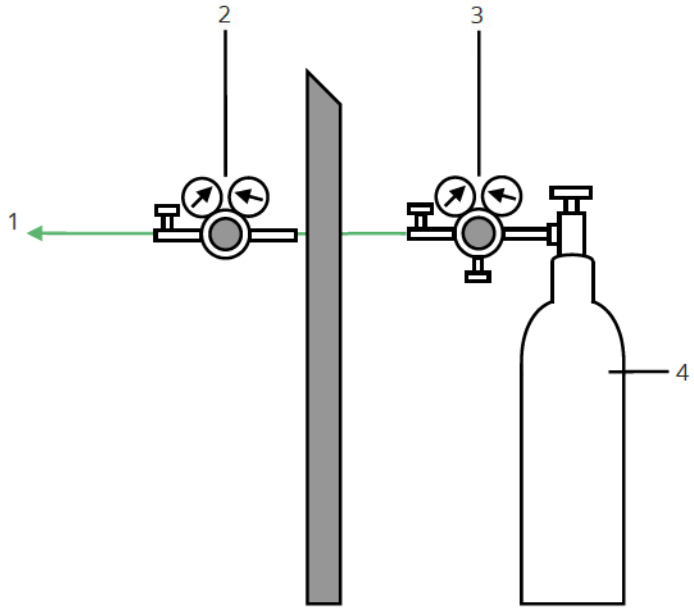
If local safety regulations make it necessary to put the gas cylinders in a different room than the instrument, use these items:

- Oxygen-free Cu pipe SF-Cu-F20.
- A second pressure regulator on the cylinder.

The pressure regulator supplied by Malvern Panalytical is for gas cylinders with a maximum pressure of 200 bar.

WARNING - General Hazard

Do not install couplings behind a cover, for example in walls or above a lowered ceiling.



1.	To the instrument	3.	Pressure regulator supplied by the customer
2.	Pressure regulator supplied by Malvern Panalytical	4.	Gas cylinder

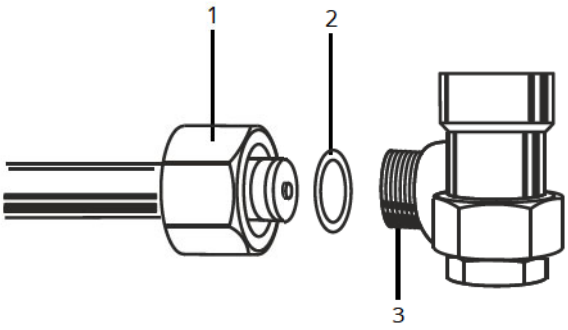
Figure 5.6 *Detector gas cylinder outside the instrument room*

5.10.3 Pressure regulator connection

The pressure regulator connection of the detector gas agrees with these international standards:

- DIN 477 connection No. 1
- W21.80 x 1¼ inch left DIN1

If the gas cylinder has a different connection, use an adapter that is certified and in accordance with applicable local regulations.



1.	Pressure regulator connection	3.	Gas cylinder connection
2.	Washer		

Figure 5.7 Pressure regulator connection

5.11 Vacuum system

The exhaust of the vacuum pump must be released outside the building to discard oil fumes. If the vacuum pump outlet is put through the ceiling of the room, install an oil separator.

Table 5.7 Specifications for the vacuum system

Parameter	Specification	Remark
Hose for the vacuum exhaust	Inner diameter: 13 mm	

5.12 Helium flushing system

The helium flushing system is optional and has these items:

- Pressure regulator
- Overpressure relief valve
- Set of rubber hoses
- Helium gas cylinder

The pressure regulator supplied by Malvern Panalytical is for gas cylinders with a maximum pressure of 200 bar.

Put the gas cylinder as close as possible to the gas inlet of the instrument. Make sure that the gas cylinder cannot fall, for example, put the gas cylinder in an applicable holder and attach the holder to the wall.

An optional gas exhaust kit is available to release the used gas out of the building. Refer to Section 5.2.3.

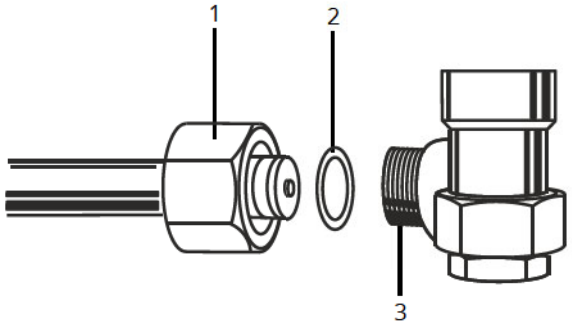
Table 5.8 Specifications for the helium gas supply

Parameter	Specification	Remark
Volume percentage Helium (He)	> 99.996 %	Minimum requirement Helium 4.6, to agree with IEC standards.
Impurities Nitrogen (N_2) Oxygen (O_2) Water (H_2O)	 < 20 ppm < 5 ppm < 5 ppm	
Pressure regulator	Supplied with the instrument	
Cylinder pressure (typical)	20 MPa	
Secondary pressure (typical)	0.1 MPa	
Secondary pressure range	45 to 130 kPa	
Consumption	1 liter/min	Static or measurement mode
Consumption per sample loading	1 liter/sample	Based on an airlock flush time of 10 seconds.
Maximum distance	10 m between the pressure regulator and the instrument	
Hose for helium gas (10 m hose supplied with the instrument)	Inner diameter: 5 mm	
Environmental conditions	IEC 60359-C1	

The regulator connection of the helium gas agrees with these international standards:

- DIN 477 connection No. 10
- NEN 3268, type RU3
- External right thread, 24.32 mm x 1/14 inch

If the gas cylinder has a different connection, use an adapter that is certified and in accordance with applicable local regulations.



1. Pressure regulator connection
2. Washer
3. Gas cylinder connection

Figure 5.8 Pressure regulator connection

5.13 Nitrogen flushing system

Nitrogen is optional and is an alternative to helium.

Table 5.9 Specifications for the nitrogen gas supply

Parameter	Specification	Remark
Volume percentage Nitrogen (N_2)	 > 99.98 %	
Impurities Oxygen (O_2) Water (H_2O) CarbonHydrogen (C_xH_x) Argon (Ar)	 < 3 ppm < 5 ppm < 0.1 ppm < 200 ppm	Total impurities must be < 200 ppm.

CHAPTER 6 OPTIONAL EQUIPMENT

6.1 Chiller unit (Zetium 2.4 kW to 4 kW)

If you use a chiller unit, make sure that the water supply specifications are in the specified range. Refer to Table 5.3.

CAUTION - General Hazard

Supply sufficient room ventilation to make sure that heat from the chiller unit does not cause a room temperature that is too high. Refer to Table 5.1.

Table 6.1 Specifications for the chiller unit

Parameter	Specification
Cooling capacity for 2.4 kW instrument	Minimum 5 kW
Cooling capacity for 3 kW instrument	Minimum 5.7 kW
Cooling capacity for 4 kW instrument	Minimum 6.5 kW

6.2 Uninterruptable power supply

If the mains power supply to the instrument is not stable, use an Uninterruptable Power Supply (UPS). Refer to Table 5.2.

Make sure that the UPS can supply the total power that is connected to the UPS, for example the instrument, PC, chiller unit and third party items.

CAUTION - General Hazard

If the chiller unit is not connected to the UPS, the X-ray tube will switch off immediately in case of a power failure. This can damage the X-ray tube.

6.3 Mains power generator

Use the same generator for the peripherals. To calculate the total power necessary for the full system, add the load of the peripherals to the normal load of the instrument.

Table 6.2 Specifications for the mains power generator

Parameter	Specification
Supply voltage	230 V nominal, -10 % to +6 %
Phase	Single
Frequency	50/60 Hz ± 2 %
Nominal output power	1.6 x power necessary

6.4 Air compressor

Malvern Panalytical can supply an air compressor. If you want to use a different type of air compressor, it must agree with these specifications:

Table 6.3 Specifications for the air compressor

Parameter	Specification
Normal pressure	0.7 MPa
Maximum pressure	1.0 MPa
Maximum room temperature	40 °C
Minimum air buffer	17 L

PRE-INSTALLATION CHECKLIST ZETIUM

Customer details			
Company/organization			
Address for equipment installation			
Telephone/fax number		Date of visit	
Contact name		Malvern Panalytical representative	

Pre-installation checks

Customer responsibilities	Reference	[x]	Remark
If necessary, are the storage facilities in the specified range?	Refer to Section 3.2.	[ ]	
Is there sufficient space to move the instrument to the installation location?	Refer to Section 3.3.1.	[ ]	
Are facilities available to move the instrument to the installation location?	Refer to Section 3.3.1.	[ ]	
Can the floor at the installation location hold the instrument weight?	Refer to Section 3.3.2.	[ ]	
Is there sufficient space at the installation location for the system layout?	Refer to Section 4.1.	[ ]	
Are the environmental conditions at the installation location in the specified range?	Refer to Section 5.1.	[ ]	
Can the wall interface bracket be attached to the wall?	Refer to Section 5.2.1.	[ ]	
If necessary, is a detector/flushing gas exhaust available?	Refer to Section 5.2.3.	[ ]	
Is the mains power supply in the specified range?	Refer to Section 5.3.	[ ]	
Is the earthing of the instrument in the specified range?	Refer to Section 5.4.	[ ]	
Do the peripherals and PC agree with the specifications?	Refer to Section 5.5.	[ ]	
Is a connection for remote support available?	Refer to Section 5.6.	[ ]	
If Smart Manager is used, does the PC agree with the specifications?	Refer to Section 5.7.	[ ]	
For 2.4 to 4 kW instruments, is the mains water supply in the specified range?	Refer to Section 5.8.	[ ]	
Is the compressed air supply in the specified range?	Refer to Section 5.9.	[ ]	
Is the detector gas supply in the specified range?	Refer to Section 5.10.	[ ]	
Is a vacuum exhaust system available?	Refer to Section 5.11.	[ ]	
If used, is the helium flushing system in the specified range?	Refer to Section 5.12.	[ ]	
If used, is the nitrogen flushing system in the specified range?	Refer to Section 5.13.	[ ]	

Customer responsibilities	Reference	[x]	Remark
Is optional equipment included:			
chiller unit?	Refer to Section 6.1.	[ ]	
uninterruptable power supply?	Refer to Section 6.2.	[ ]	
mains power generator?	Refer to Section 6.3.	[ ]	
air compressor?	Refer to Section 6.4.	[ ]	
Does the installation site agree with local regulations (*):			
X-ray safety regulations?		[ ]	
electrical safety regulations?		[ ]	
building safety regulations?		☐	
other relevant regulations?		☐	
(*) Specify the norms or standards in the Remark field.			

Comments

The installation will only be planned after all customer pre-installation requirements have been confirmed by the customer. If the installation must be scheduled again, the additional visit can be invoiced.

Customer pre-installation requirements confirmed			
Name	**Company/organization**	**Signature**	**Date**

LLATION OVERVIEW ZETIUM 1 KW

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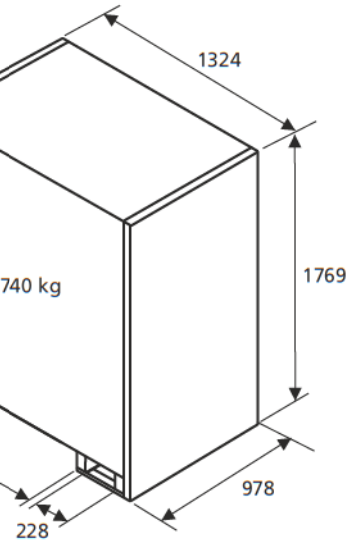
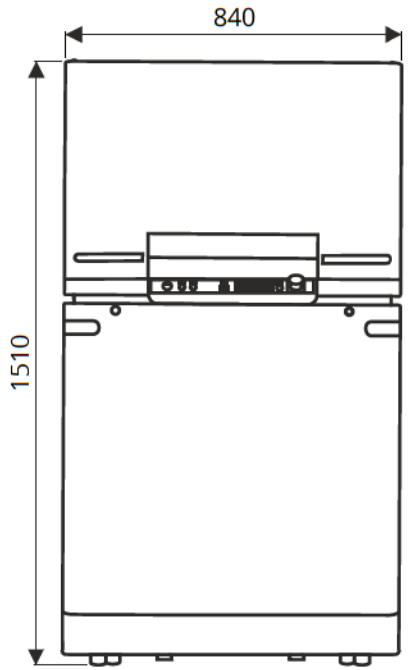
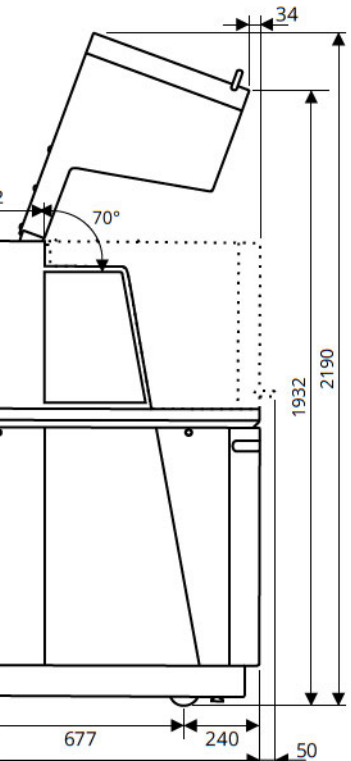
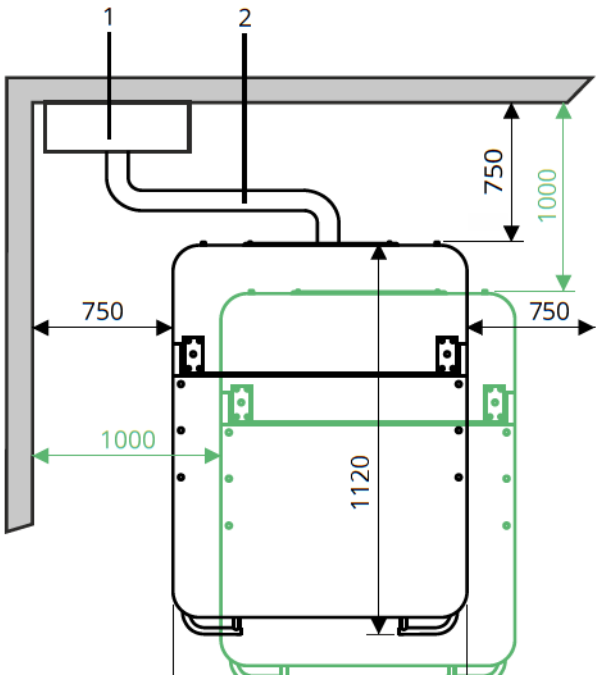


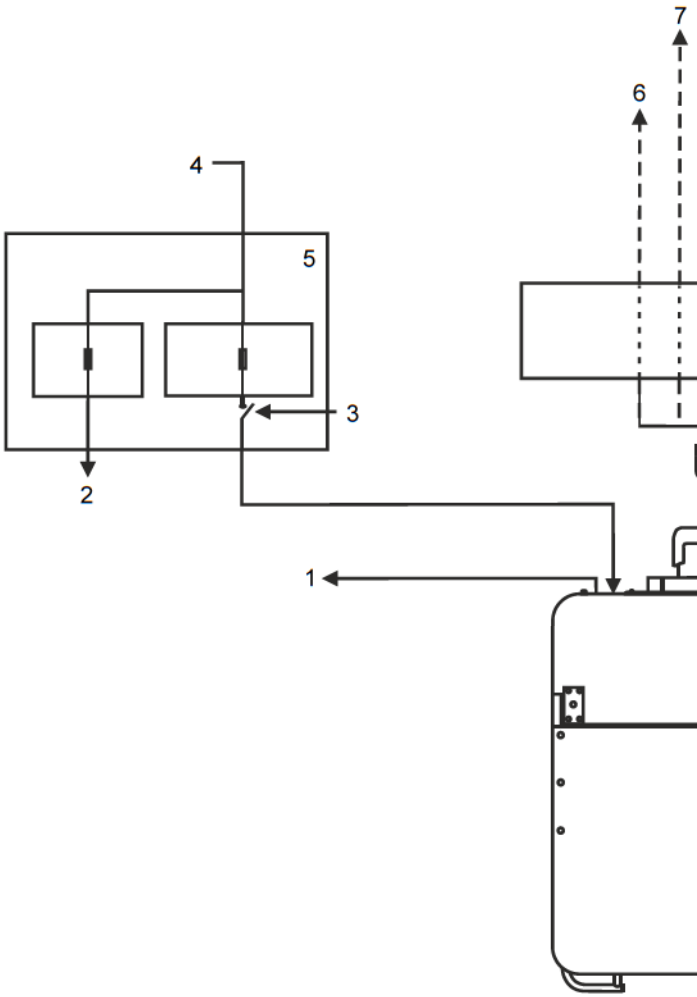




System layout



Supply connections



1.	Network connection	8.	He/
2.	PC power supply, fuse 16 A	9.	Det
3.	Mains disconnector with lockout functionality	10.	Con
4.	Mains power supply, 210 - 230 Vac, 50/60 Hz, ø, + PE	11.	Vac
5.	Mains distribution box All peripherals that are connected to the instrument must be connected to the earth terminal in the mains distribution box	12.	Wal
6.	Detector gas out (optional)	13.	Um
7.	He/N gas out (optional)	14.	Inte

LLATION OVERVIEW ZETIUM 2.4 KW TO 4 KW

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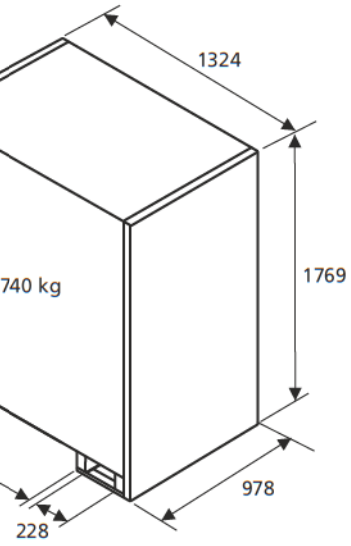
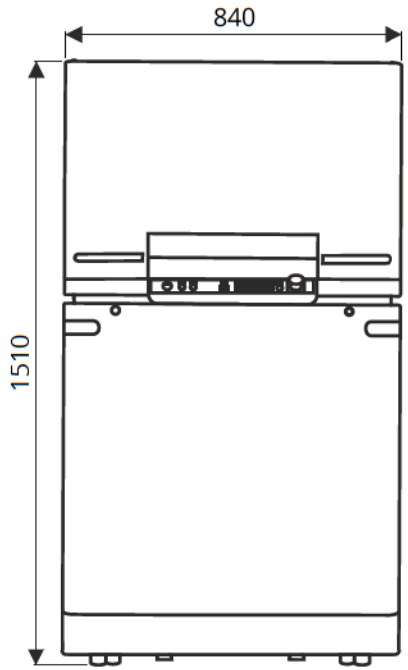
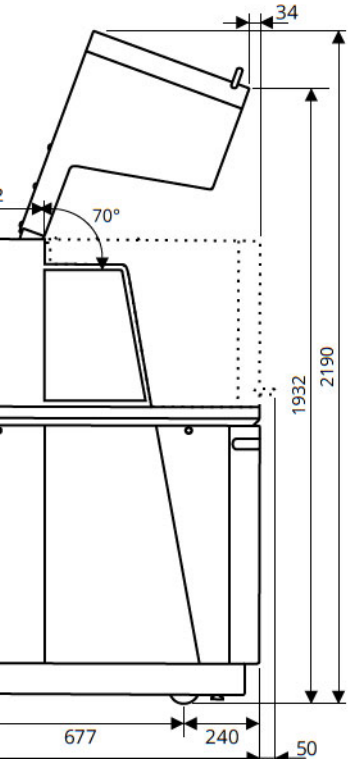
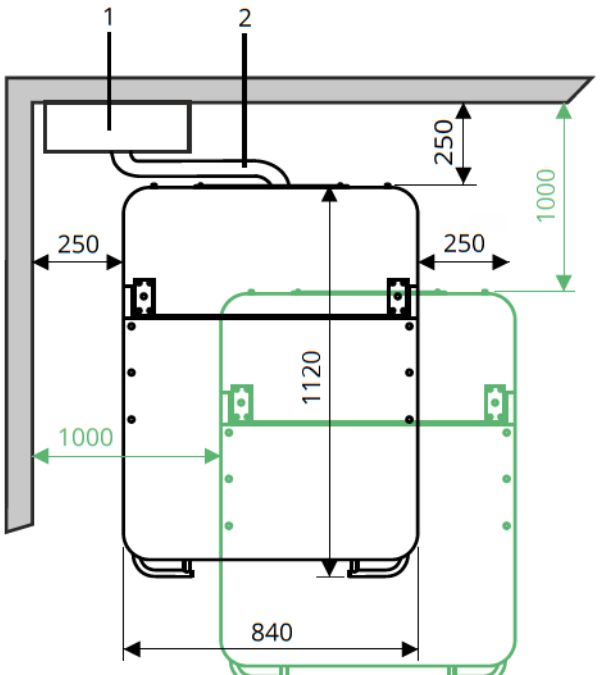


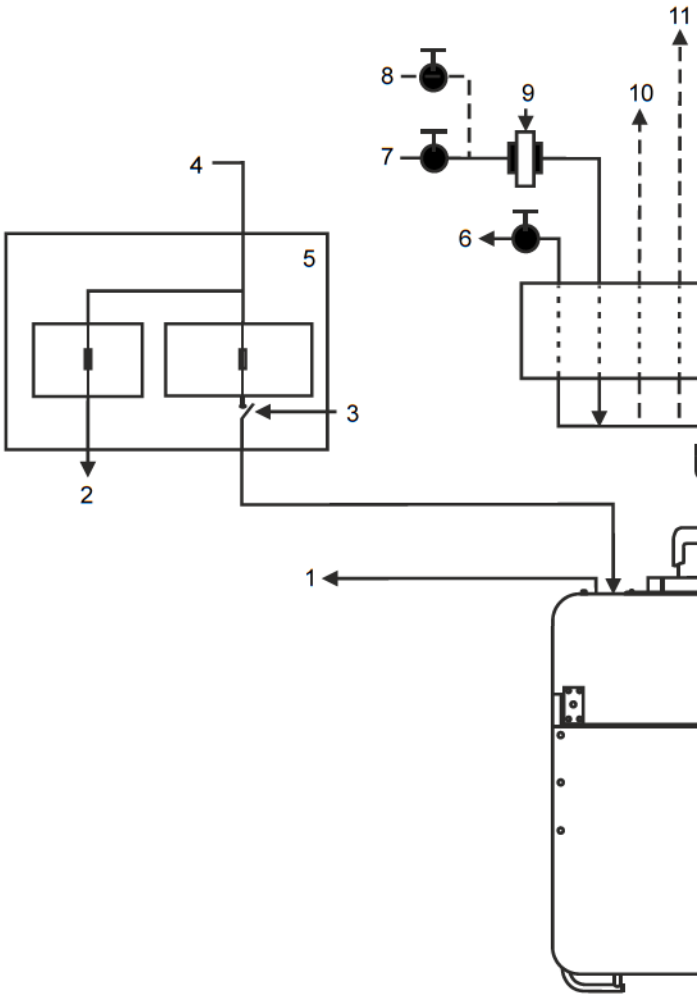




System layout



Supply connections



1.	Network connection	10.	Det
2.	PC power supply, fuse 16 A	11.	He/
3.	Mains disconnector with lockout functionality	12.	He/
4.	Mains power supply, 210 - 230 Vac, 50/60 Hz, ø, + PE	13.	Det
5.	Mains distribution box All peripherals that are connected to the instrument must be connected to the earth terminal in the mains distribution box	14.	Cor
6.	Water out	15.	Vac
7.	Water in	16.	Wal
8.	Chiller unit (optional)	17.	Um
9.	Water filter	18.	Inte