CYTOF XT System

Contents

About This Document

This document describes the site requirements for the CYTOF® XT system. For detailed instructions on system and software operation, see the CYTOF XT™ User Guide (FLDM-00254).

IMPORTANT Read and understand the detailed instructions and safety guidelines in this document. Failure to follow these guidelines may result in improper system performance, injury to personnel, and/or damage to the instrument or to property. For complete safety information, see Appendix B.

Safety Alert Conventions

Fluidigm documentation uses specific conventions for presenting information that may require your attention. Refer to the following safety alert conventions.

Safety Alerts for Chemicals

For hazards associated with chemicals, this document follows the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and uses indicators that include a pictogram and a signal word that indicates the severity level:

Indicator	Description
	Pictogram (see example) consisting of a symbol on a white background within a red diamond-shaped frame. Refer to the individual safety data sheet (SDS) for the applicable pictograms and hazards pertaining to the chemicals being used.
DANGER	Signal word that indicates more severe hazards.
WARNING	Signal word that indicates less severe hazards.

Safety Alerts for Instruments

For hazards associated with instruments, this document uses indicators that include a pictogram and signal words that indicate the severity level:

Indicator	Description
	Pictogram (see example) consisting of a symbol on a white background within a black triangle-shaped frame. Refer to the system user guide for the applicable pictograms and hazards pertaining to system usage.
DANGER	Signal word that indicates an imminent hazard that will result in severe injury or death if not avoided.
WARNING	Signal word that indicates a potentially hazardous situation that could result in severe injury or death if not avoided.
CAUTION	Signal word that indicates a potentially hazardous situation that could result in minor or moderate personal injury if not avoided.
IMPORTANT	Signal word that indicates information necessary for proper use of products or successful outcome of experiments.

Safety Data Sheets

Read and understand the SDSs (safety data sheets) before handling chemicals. To obtain SDSs for chemicals ordered from Fluidigm, either alone or as part of this system, go to fluidigm.com/sds and search for the SDS using either the product name or the part number.

Some chemicals referred to in this user guide may not have been provided with your system. Obtain the SDSs for chemicals provided by other manufacturers from those manufacturers.

Introduction

This guide is designed to help you prepare for the reception and successful installation of your CYTOF XT instrument. The CYTOF XT mass cytometer is shipped to you as a complete system with the exception of the following items, which must be obtained prior to installation: electrical power, exhaust vents, and argon gas supply with approved regulator.

When preparing the laboratory for instrument installation by a Fluidigm field service engineer, the following items must be considered:

- Receiving the instrument
- System layout
- Network connectivity
- Electrical requirements
- Argon gas requirements
- Exhaust ventilation
- Environmental conditions
- Materials required for maintenance and operation

Fluidigm technical support will schedule a time to install the CYTOF XT system at your site and train your staff to use the instrument. Before a Fluidigm service representative arrives to install the system, choose and prepare your site according to the instructions in this document.

Notify your Fluidigm representative if special shipping arrangements are necessary at your site or if you need assistance in placing the CYTOF XT system.

Installation Time Estimate

Installation of the CYTOF XT is estimated to take 3–4 hours. Site issues and other factors may delay or extend the installation time.

Site Preparation Workflow

To choose and prepare an installation site for the CYTOF XT system:

1 Review this guide.

2 Select a site for the CYTOF XT instrument.

3 Receive the system.

4 Place the crated and boxed components at the site.

Step 1: Review This Guide

Read and understand this guide for information on all CYTOF XT system site requirements, including safety, environmental, electrical, and space requirements.

For a complete list of reagents and consumables used with the CYTOF XT system, see the CYTOF XT User Guide (FLDM-00254).

Step 2: Select a Site for the CYTOF XT

To install and operate the CYTOF XT system, consider the following at your site:

- Harmonized standards
- Environmental conditions
- System dimensions and laboratory bench requirements
- Electrical requirements

WARNING The installation location cannot be done at a site designated Biosafety Level 3 (BSL-3) or Biosafety Level 4 (BSL-4). Fluidigm does not install, service, or repair the CYTOF XT system in areas designated BSL-3 or BSL-4.

Environmental Conditions

CYTOF XT is for indoor use only and should be used in an environment that meets these conditions:

Conditions	Requirements
Temperature	Ambient 18–25 °C (59–86 °F) with a maximum rate of change of 2.8 °C (5 °F) per hour. NOTE For optimal performance, the temperature should be 20 °C ±2. **IMPORTANT** Do not locate the system next to heat sources or cooling ducts, or in direct sunlight or extreme ambient lighting. Temperature extremes can cause system instability.
Humidity	20–80%, non-condensing
Pollution	Degree 2 rating, whereby only nonconductive pollution occurs for electrical and laboratory equipment. CYTOF XT conforms to standard laboratory environments. Do not install the system where conductive pollutants are present.
Electrical installation	Category II
Altitude	CYTOF XT is for use in altitudes not exceeding 2,000 m (6,562 ft) above sea level. Use of the instrument at elevations greater than 2,000 m is subject to acceptance by local inspection authorities. If your facility is located above this elevation, call technical support.

Conditions	Requirements
Ventilation	Ensure that your lab space is ventilated using non-recirculating air exchanges. Maintain at least 10.2 cm (4 in) of clearance at the exhaust grill exits. CYTOF XT produces only hot air exhaust (no fumes or vapors). It has an exhaust grill exit at the back of the instrument and on the left side of the instrument. Multiple air intakes are located underneath the instrument.

The instrument should be in an area that is:

- free of smoke and corrosive fumes,
- not prone to excessive vibration,
- out of direct sunlight,
- away from direct sources of heating or cooling.

WARNING Do not use the instrument in an area where explosion hazards may exist.

System Dimensions and Laboratory Bench Requirements

IMPORTANT Provide appropriate seismic anchors, such as straps or other devices to secure the instrument to a seismically secure surface such as a bench or a wall.

IMPORTANT Do not place the instrument on a heated surface or near a source of heat.

The CYTOF XT system consists of the main instrument, CYTOF XT and a system computer with workstation.

To accommodate the instrument, consider the following dimensions:

	Height	Width	Depth	Weight
Instrument dimensions (CYTOF XT)	135 cm (53 in)	93 cm (37 in)	75 cm (30 in)	288 kg (635 lb)
Instrument minimum footprint	63 cm (24.8 in)	90 cm (35.4 in)	66 cm (25.9 in)	

It is recommended that the instrument be located near the required electrical, gas supplies and ventilation system ports. The length of the provided electrical cables is approximately 3.0 m or 9.8 ft. The CYTOF XT mass cytometer is on wheels and can be moved for service and regular maintenance if necessary.

Leave a space of at least 61 cm (24 in) behind the instrument to provide adequate clearance for the vent hose as shown in Figure 2. Allow space (approximately 50 cm/20 in) on the right side of the instrument for access to the circuit breakers and to ensure that there is no obstruction to the air intake vent located on the right side of the instrument. Access for most service procedures is through the front of the instrument. Allow space (approximately 50 cm/20 in) on the left side of the instrument for Instrument heat dissipation

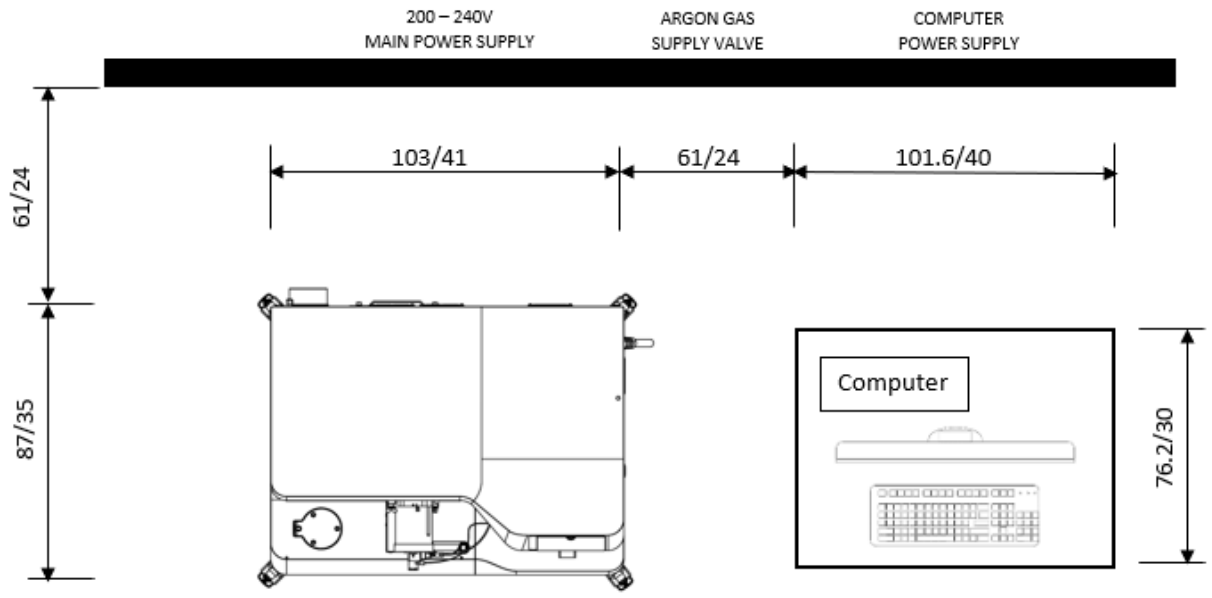

Figure 1: Footprint diagram of the CYTOF XT system and its accessories

Electrical Requirements

Instrument Electrical Requirements

Power to the CYTOF XT system is to be delivered from a 30 A single-phase 200–240 V AC, 50–60 Hz dedicated electrical branch circuits. Table 3 details the power specifications of the instrument and its accessories.

Table 1: CYTOF XT and accessories power consumption specifications

	Power Consumption
Instrument	200 – 240V AC
Maximum (two circuits)	4000VA
Computer	300W

The operating range for the electrical supply is provided in Table 4. If the power line is unstable, fluctuates, or is subject to surges, additional control of the incoming power (e.g., surge protection or line conditioning) may be required.

Table 2: CYTOF XT electrical specifications

Electrical Specification	
Operating Voltage	200 - 240 V AC
Peak Current (per circuit)	20 A
Operating Frequency	50 or 60 Hz ±1 Hz

Maximum Allowable Percent Sag	5%
Maximum Allowable Percent Swell	5%
Maximum Supply Voltage Total Distortion	5%
Maximum Supply Voltage Distortion by Single Harmonics	3%
Phase (single or three)	Single or between two of the three phases

Plug Information

Table 5 provides the plug information for the instrument and accessories.

Table 3: Electrical plug specification for CYTOF XT instrument and accessories

Accessories	Voltage (V AC)	Current (A)
CYTOF XT Plug	200 - 240	30
Computer	100–240	3
Monitor	100–240	1.5

NOTE For AC MAINS supply panel, use CB rated at 30 **A**, or RCBO rated at 30A **(**minimum**)**, 32A amps **(**maximum**)** with 30mA residual current trip **and** with time delay characteristic **of** "with short time delay characteristic"**.**

60 Hz Operation Connections

The instrument is shipped with a 3.0 m line cord cable and a redundant ground wire. The installation kit includes one NEMA L6-30R plugs (250 V, 30 A) for use with 60 Hz single phase outlets.

NOTE For safety reasons, ensure that the external ground cable is securely connected before attempting to power on the instrument.

50 Hz Operation Connections

The instrument is shipped with a 3.0 m line cord cable and a redundant ground wire. The Fluidigm Field Service Engineer will wire the cables with IP44 2P+E 32A on installation (EU only). The single-phase connectors must be supplied by the customer.

NOTE Use plugs rated to the specified voltage according to the local code.

NOTE For safety reasons, ensure that the external ground cable is securely connected before attempting to power on the instrument.

Connections to a Three-Phase Power

Connection to a three-phase power may be required (by local electrical code). The instrument can be connected to two phases and to the ground wire of the three-phase line. The three-phase plugs must be supplied by the customer.

IMPORTANT Supply voltage fluctuation must not exceed ± 10% of the normal value. If the voltage fluctuation exceeds normal value, see Uninterruptible Power Supply.

Uninterruptible Power Supply

If your CYTOF XT is installed in a region that has electrical voltage fluctuations exceeding ±10% of the normal value, it is strongly recommended that you protect the system with an uninterruptible power supply (UPS). Fluctuating voltage can compromise CYTOF XT. Table 6 outlines the recommended UPS.

Table 6: Recommended Uninterruptible Power Supply.

UPS	Voltage (kVA)	Manufacturer	Quantity
APC Smart UPS SRT 6000VA 208V	6	Schneider Electric	1

Gas Requirements

Argon Specification

Ultra High Purity argon is used as the inductively coupled plasma (ICP) torch gas with the CYTOF XT system. The quality criteria for argon are listed in Table 7.

Table 7: Argon requirements

GAS	Purity	Pressure (psi)	Flow Rate (L/min)
Argon	≥99.996% (4.6)	85 ±5	20
	Impurities (ppm)		
Oxygen <5,	Nitrogen <20,	Hydrogen <1,	Water <4

NOTE The choice of liquid argon or compressed gas argon tanks is determined primarily by the availability of each and the usage rate. We recommend installing a 350-psi pressure relief valve with the liquid argon tank.

IMPORTANT Do not use electronic pressure regulator and auto-switching valves, because they may affect the plasma stability and may also result in frequent loss of plasma.

WARNING It is recommended to install an oxygen sensor in the room where the operator and gas storage are located.

Safe Handling of Gas Cylinders

The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building codes. The following are a list of safety precautions that should be observed when handling argon gas cylinders.

- Fasten all gas cylinders securely to an immovable bulkhead or a permanent wall.
- When gas cylinders are stored in confined areas, ventilation should be adequate to prevent dangerous accumulations. Move or store gas cylinders only in a vertical position with the valve cap in place.

- Locate gas cylinders away from heat or ignition sources, including heat lamps. Cylinders have a pressure relief device that will release the contents of the cylinder if the temperature exceeds 52 °C (125 °F).
- When storing cylinders external to a building, the cylinders should be stored so that they are protected against temperature extremes (including the direct rays of the sun) and should be stored above ground on a suitable floor.
- Gas cylinders should be clearly marked to identify the contents and status (e.g., full, empty).
- Do not attempt to refill gas cylinders.
- Use only approved mechanical regulators and hose connectors. Left-hand thread fittings are used for fuel gas tank connections, whereas right-hand fittings are used for oxidant and support gas connections.
- Arrange gas hoses away from foot traffic to avoid damage.
- Perform periodic gas leak tests by applying a soap solution to all joints and seals.

Exhaust Requirement

The main venting system is required to remove fumes and vapors from the torch housing. Exhaust venting is important for four reasons:

- It protects laboratory personnel from ozone and hot argon generated in plasma.
- It minimizes the effects of room drafts and the laboratory atmosphere on ICP torch stability.
- It helps protect the instrument from corrosive vapors that may originate from the samples.
- It removes dissipated heat produced by the ICP torch.

The CYTOF XT system has an exhaust vent and three ventilation fans, which are located at the back of the instrument as shown in Figure 3.

The torch box vent exhausts plasma and the vacuum pump system. It removes fumes and vapors from the torch housing and the rough pump exhausts. The torch box vent is 100 mm or 4 inches in diameter.

The three ventilation fans (System Vent) exhaust heat from the instrument to cool the roughing pumps, system power supply, and radio frequency generator power supply.

Table 8: Exhaust positions

Exhaust Vent	Hose Diameter. mm (in)	Distance from the Ground cm (in)
Torch Box	100 (4)	112 (44)

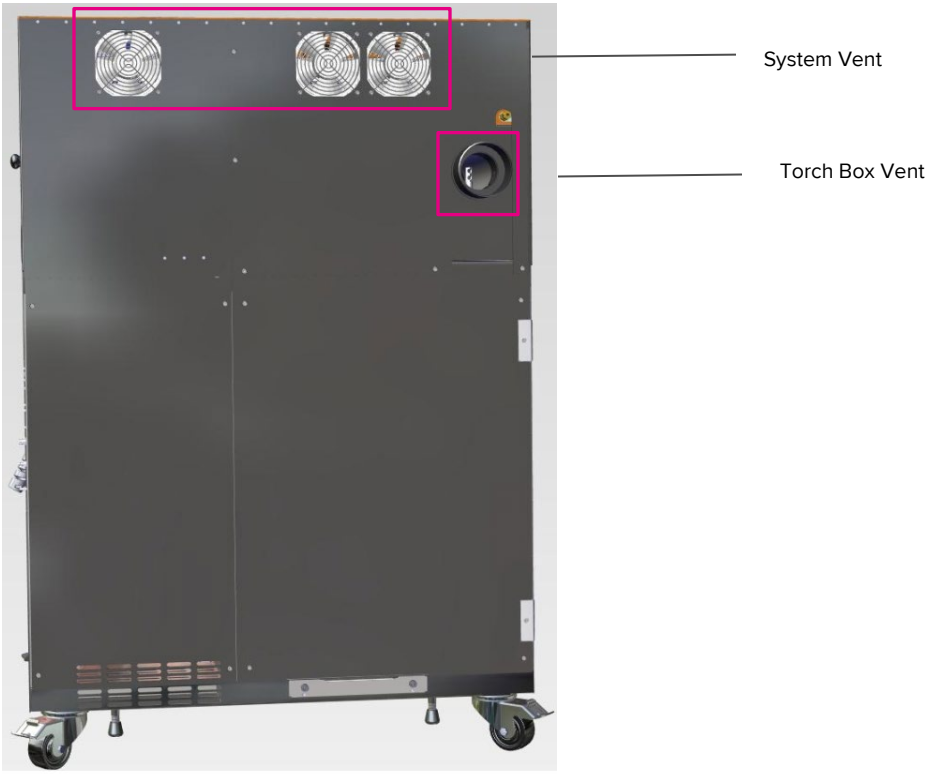

Figure 2: Instrument rear view drawing with exhaust vent positions highlighted in magenta, torch box vent (top), and system vent (bottom)

Flow Rates

The CYTOF XT instrument is supplied with 3.6 m (12 ft) of 100 mm (4 in) flexible hose. A venting system with the ability to provide a suction with a flow rate of at least 37 L/sec (80 cfm) should be connected to a single 100mm (4 in) duct equipped with a damper Ensure that there is access to the damper during installation. Table 9 details the exhaust specifications.

Table 9: Exhaust specifications

Vent	Hose Diameter. mm (in)	Flow Rate cfm(L/sec)	Anemometer m/sec (ft/min)	Vented Outside Lab Power W (BTU/hr)
Torch Box	100 (4)	75 +/–15 (35)	5 (917)	-
System	-	-	-	3.6K(12276)

The flow rates as measured with the hoses connected to the ducts will need to be verified and adjusted during installation of the instrument. An exhaust flow damper is recommended to stabilize exhaust flow and improve the signal stability of the instrument. A mechanical damper installed on the exhaust duct can be used for this purpose. The static pressure drop caused by the CYTOF XT system at the nominal exhaust flow is 0.45 inches H_2O (298 Pa).

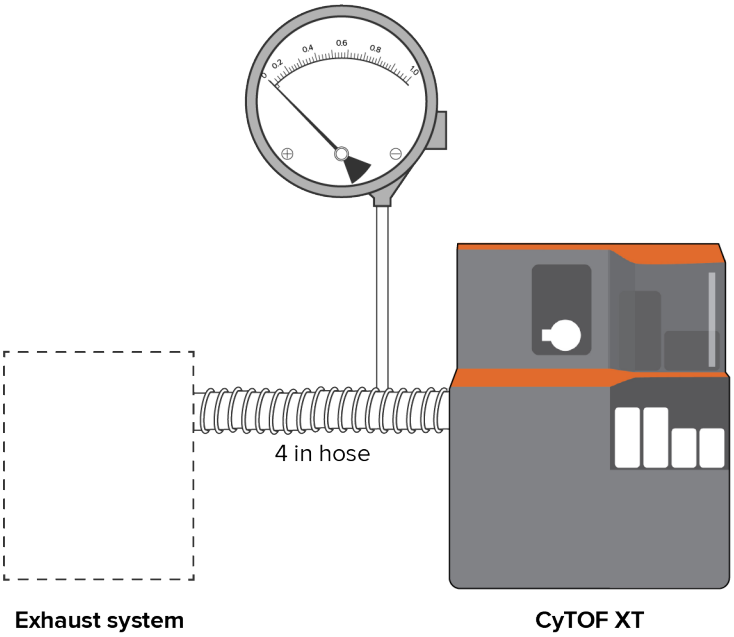

Figure 4. Static pressure drop from the CyTOF XT system.

Exhaust System Recommendations

The exhaust flow rate at the instrument (the ability to vent the system) is dependent on the blower provided by the customer, the duct length, the duct material, and the number of elbows or bends used. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volumetric flow at the instrument.

Additional recommendations on the venting system include:

- The duct casing and venting system should be made of materials suitable for temperatures as high as 70 °C (160 °F) and be installed to meet local building code requirements.
- Equip the outlet end of the system with a backdraft damper.
- Take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents and to extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- For best efficiency, make sure the length of the duct that enters the blower is a straight length at least 10 times the duct diameter. An elbow entrance into the blower inlet causes a loss of efficiency.
- Provide makeup air in the same quantity as is exhausted by the system. An airtight laboratory can cause an efficiency loss in the exhaust system.
- Ensure that the system is drawing properly by placing a piece of cardboard over the mouth of the vent

NOTE The heat vented into of the lab due to the operation of CYTOF XT is approximately 3.6 KW.

Additional Site Recommendations

Institutional Network Connectivity

Enabling network connectivity to the instrument workstation allows for more efficient transfer of instrument data through the Ethernet network port of the instrument workstation. Contact your site IT Department.

IMPORTANT Data should not be written directly to a Network Drive during sample acquisition and must be written directly to the instrument workstation. Data may only be transferred/shared via network connection upon completion of sample acquisition.

Internet Connectivity

It is highly recommended that you have the CYTOF XT instrument computer on a network with internet connection so that the Fluidigm Support team can better assist you and your team and to facilitate remote diagnostics of the instrument. Please work with your IT department to ensure that internet connectivity can occur prior to installation. Access to the internet can reduce instrument down time and unanticipated field service/repair costs. Under no circumstance will Fluidigm be able to access instrument control and data obtained, or associated data stored on the workstation, without the end user's express permission.

Telephone Access

If internet connection is unavailable and mobile telephone reception is poor, it is recommended that you provide a landline phone in the immediate vicinity of the instrument workstation.

Site Safety

IMPORTANT Safety personnel at your company must ensure that:

- Safety policies to protect laboratory personnel from potential harm are established and are followed by personnel.
- All necessary safety devices and equipment are in the laboratory or in proximity.

Fluidigm expects your laboratory to have safety policies in place to protect laboratory personnel from potential harm. We expect that appropriate safety practices are always followed.

Step 3: Receive the System

For new CYTOF XT system installations, you can anticipate receiving:

- CYTOF XT system, crated
- Instrument accessories, boxed
- Optional: Bar code reader, boxed

Because the crated CYTOF XT system weighs approximately 413 kg (911 lb), consider the space and weight-bearing for the intended delivery site and the path to that site. Also consider using a forklift such as pallet truck (pallet jack) for on-site transportation.

CYTOF XT Crated System Size and Weight Specifications

WARNING PHYSICAL INJURY HAZARD. Do not attempt to lift or move any boxed or crated items unless you use proper lifting techniques. The crated CYTOF XT weighs 413 kg (911 lb).

The instrument is shipped in a crate and its components are shipped in a separate box. A standard pump truck with minimum rating for 1,600 lb is recommended for moving the crate if necessary. Once you have received the crate and the box, store them in a dry place not exposed to weather until the scheduled installation date. Table 1 provides the dimensions of the instrument crate and components box.

Table 41: Dimensions of the crated CYTOF XT system

Component	Width (cm/in)	Height (cm/in)	Depth (cm/in)	Weight (kg/lb)
CYTOF XT Crate	112/44	152/60	117/46	413/911
Components Box	64/25	77/30	64/25	24/53

Materials Required for Operation

Table 10 provides a list of the materials supplied with the instrument for the installation and operation of the instrument.

Table 10: Materials supplied for CYTOF XT instrument installation and operation

Description	Supplier	Product Number	Quantity (per batch run)
EQ™ Six Element Calibration Beads—100 mL	Fluidigm	201245	5–10 mL
Milli-Q™ High Quality 18, Deionised Water (DIW) of Highest Grade 18.2 MOhm	Milli-Q (Millipore)	R00001	Constant supply
5mL Round Bottom Tubes with 35 µm Mesh Cell Strainer (12 x 75 mm)	Fluidigm	352235	1 per sample
5mL Round Bottom Tubes with Solids Caps (12 x 75 mm)	Fluidigm	352054	1 per sample
Powder-Free Gloves			
50 mL Screw Cap Tube, Polyproplyene	VWR	101093-574	
15 mL Polypropylene Sample Tube with Cap	Sarstedt, Inc.	60.732.001	
Maxpar® Cell Acquisition Solution Plus for CyTOF XT*	Fluidigm	201244	1 x 1L
Maxpar Water for CyTOF XT	Fluidigm	201242	500 mL
Maxpar Washing Solution for CyTOF XT	Fluidigm	201243	2 x 500 mL
Isopropanol, 100%			250 mL

Kimwipes®	
1 L Empty bottle for CyTOF XT	202221
500 mL Empty bottle for CyTOF XT	202222

Delivery and System Inspection

Use this checklist to perform a check of all delivered components:

- ☐ Check the packing list against the original order.
- ☐ Check the crates for damage.
- ☐ Note any damage and report it to the Fluidigm service representative.
- ☐ Store each component at the appropriate temperature according to the instructions.

Step 4: Place the System at the Site

NOTE Notify your Fluidigm representative if you need assistance in placing the CYTOF XT system.

Remove all unnecessary materials from the installation site prior to the arrival of the Fluidigm field service engineer.

Have the crated CYTOF XT system at its permanent location prior to the arrival of a field service engineer. Wait for the engineer to arrive before unpacking the crate.

WARNING PHYSICAL INJURY HAZARD. The instrument is to be moved and positioned only by the Fluidigm service representative. The crated CYTOF XT weighs approximately 413 kg (911 lb).

WARNING PHYSICAL INJURY HAZARD. Do not attempt to lift or move any boxed or crated items unless you use proper lifting techniques. The crated CYTOF XT weighs approximately 413 kg (911 lb).

WARNING Do not tip the CYTOF XT instrument on end. Tipping damages the instrument hardware, and electronics.

Path Clearances

IMPORTANT A clear path from the loading dock to the install location must be established. The path must accommodate the dimensions of the crate.

Ensure that the path to the installation site has the following minimum clearances:

	Width	Height
Minimum path clearance	110 cm (43.3 in)	240 cm (94.5 in)

Installation

Before the installation date, be certain that you have done the following:

- ☐ Remove all unnecessary materials from the final installation site.
- ☐ Receive the CYTOF XT system and performed a visual check of the crate and Accessories box.
- ☐ Move the crated and boxed equipment from the receiving location to the installation area.
- ☐ Place the crated and boxed components at their final and permanent location.

Contact your Fluidigm representative if you require assistance with any of these steps.

Summary

Table 11 provides a summary of the requirements for the successful installation of your CYTOF XT system.

Table 11: CYTOF XT installation summary

Dimensions					Width (cm/in)	Height (cm/in)	Depth (cm/in)	Weight (kg/lb)
CYTOF XT Crate					114.9/45	104/41	139/55	413/911
CYTOF XT					93.2/37	135/53	75.2/30	320/750
Components Box	64/25	77/30	64/25	24/53				
Electrical						Voltage (V AC)		Current (A)
CYTOF XT						200 - 240		20
Computer						100–240		3
Monitor						100–240		1.5
					Gas	Purity	Pressure	Flow
					Argon	≥99.996%	85 ±5psi	20 L/min

Exhaust	Hose (mm/in)	Flow Rate (L/sec; cfm)	Anemometer (m/sec; ft/min)	Vented Outside Lab Power (W; BTU/hr)
Torch Box	100; 4	35 +/–15 (75)	5 (917)	-
System	--	-	-	3.6K(12276)

Appendix A: Related Documentation

Document Title	Part Number
CYTOF XT User Guide	FLDM-00254

Appendix B: Safety

Instrument Safety

The instrument should be serviced by authorized personnel only.

WARNING Do not modify this instrument. Unauthorized modifications may create a safety hazard.

WARNING BIOHAZARD. If you are putting biohazardous material on the instrument, use appropriate personal protective equipment and adhere to Biosafety in Microbiological and Biomedical Laboratories (BMBL), a publication from the Centers for Disease Control and Prevention, and to your lab's safety protocol to limit biohazard risks. If biohazardous materials are used, properly label the equipment as a biohazard. For more information, see the BMBL guidelines online at cdc.gov/biosafety/publications/index.htm.

WARNING PHYSICAL INJURY HAZARD. Do not attempt to lift or move any boxed or crated items unless you use proper lifting techniques. The weight of the boxed or crated instrument is 413 kg (911 lb). Remove boxed or crated as appropriate. If you choose to lift or move the instrument after it has been installed, do not attempt to do so without the assistance of others. Use appropriate moving equipment and proper lifting techniques to minimize the chance of physical injury.

Electrical Safety

NOTE The main power disconnect is on the rear panel of the instrument.

WARNING ELECTRICAL HAZARD. DO NOT REMOVE THE COVERS. Electrical shock can result if the instrument is operated without its protective covers. No internal components are serviceable by the user.

WARNING ELECTRICAL HAZARD. Ensure the external ground cable is always connected to a ground point when the instrument is powered on.

WARNING ELECTRICAL HAZARD. Plug the instrument into a properly grounded receptacle with adequate current capacity.

Chemical Safety

The responsible individuals must take the necessary precautions to ensure that the surrounding workplace is safe and that instrument operators are not exposed to hazardous levels of toxic substances. When working with any chemicals, refer to the applicable safety data sheets (SDSs) provided by the manufacturer or supplier.

For technical support visit techsupport.fluidigm.com.

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