

CyTOF 2 Mass Cytometer

SITE PREPARATION GUIDE



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CyTOF 2 Mass Cytometer Site Preparation Guide

Introduction

This manual is designed to help you with the preparation for the reception and successful installation of your CyTOF® 2 mass cytometer instrument. The CyTOF 2 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
- Electrical requirements
- Argon gas requirements
- Exhaust ventilation
- Environmental conditions
- Materials required for maintenance and operation

Instrument Dimension and Layout

Crate Information

The instrument is shipped in a single fully packaged crate. 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, store it in a dry place not exposed to weather until the scheduled installation date. Table 1 provides the dimensions of the instrument crate.

Table 1: Dimensions of the crated CyTOF® 2 instrument

Component	Width (cm/in)	Height (cm/in)	Depth (cm/in)	Weight (kg/lb)
CyTOF 2	213/84	106/42	157/62	635/1,400

CyTOF 2 Information

The CyTOF 2 system consists of the main instrument, a refrigerated chiller (PolyScience® Cat No. 6105PE), and a system computer with workstation as shown in Figure 1.



Figure 1: CyTOF 2 mass cytometer and components: chiller, left, and computer and monitor

The dimensions of the instrument, chiller, and optional autosampler are given in Table 2. Note that the autosampler is designed to rest on the instrument shelf and so does not occupy additional lab space. The system computer may be placed on a separate bench or computer table (not supplied).

Table 2: Dimensions of CyTOF 2, chiller, and autosampler

Component	Width (cm/in)	Height (cm/in)	Depth (cm/in)	Weight (kg/lb)
CyTOF 2	97/38	132/52	79/31	285/628
Chiller	38/15	64/25	67/27	81/178
Autosampler	39/16	24/10	36/14	20/44

It is recommended that the instrument be located near the required electrical and gas supplies. The length of the provided electrical cables is approximately 3.8 m or 12.5 ft. The CyTOF 2 mass cytometer is on wheels and can be moved for service and regular maintenance if necessary.

It is also recommended that you leave a space of at least 61 cm (24 in) behind the instrument to provide adequate clearance for the vent hoses 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. Access for most service procedures is through the front of the instrument.

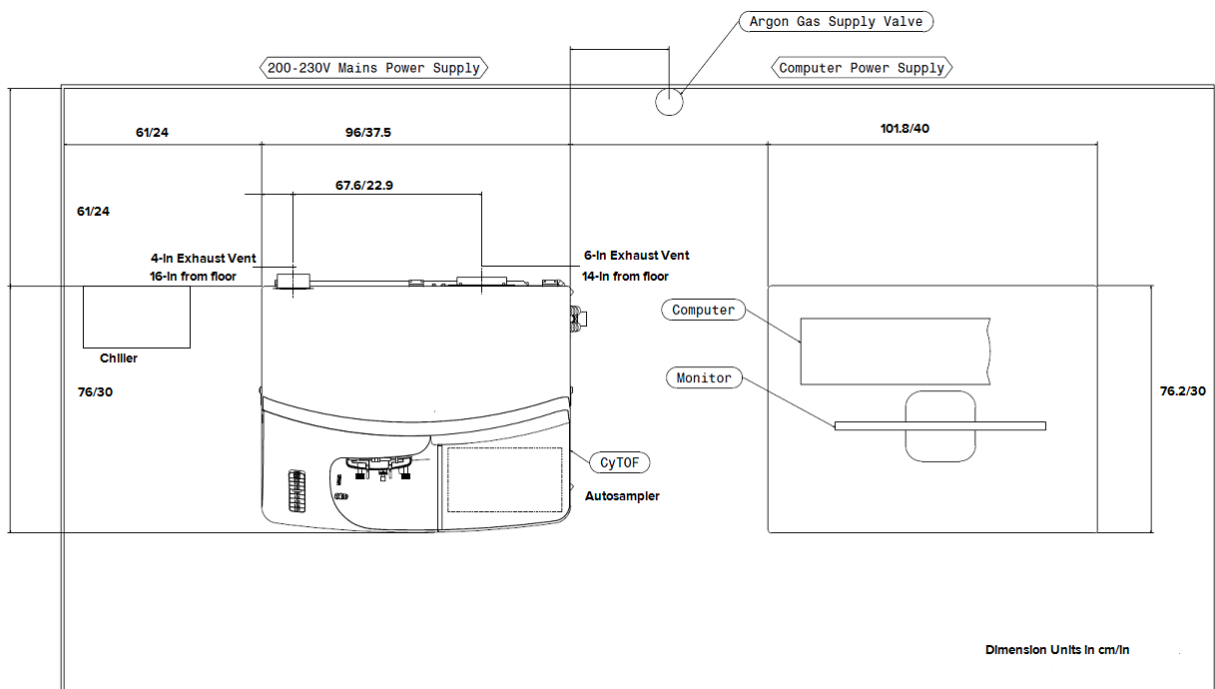


Figure 2: Footprint diagram of CyTOF 2 instrument and its accessories

The front and rear vents of the chiller must be a minimum of 24 in (61 cm) away from walls or vertical surfaces so air flow is not restricted.

Electrical Requirements

Electrical Specifications

Power to the CyTOF 2 instrument is to be delivered from two 30 A single-phase 220–240 V AC, 50–60 Hz dedicated electrical branch circuits. Table 3 details the power specifications of the instrument and its accessories.

Table 3: CyTOF 2 and accessories power consumption specifications

Power Consumption	
Instrument	
Maximum Volt Amperes (two circuits)	2 x 4,500 VA
Accessories	
Chiller (powered through the instrument)	2,300 VA
Computer	1,050 VA
Autosampler (optional)	100 VA

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 4: CyTOF 2 electrical specifications

Electrical Specification	
Operating Voltage	200–240 V AC
Peak Current (per circuit)	30 A
Operating Frequency	50 or 60 Hz \pm 1Hz
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 5: Electrical specification for CyTOF 2 instrument and accessories

Accessories	Voltage (V AC)	Current (A)
CyTOF 2	2 x 200–240	2 x 30
Chiller	Through CyTOF 2	6.0
Autosampler (optional)	100–240	4.2
Computer	100–240	6.0
Monitor	110–230	6.0

60 Hz Operation Connections

The instrument is shipped with two 3.8 m line cord cables. The installation kit includes two NEMA L6-30R plugs (250 V, 30 A) for use with two 60 Hz single-phase outlets.

50 Hz Operation Connections

The instrument is shipped with two 3.8 m line cord cables. It is up to the service person installing the instrument to wire the cables with IP44 2P+E 32A. The single-phase connectors must be supplied by the customer.

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.

Gas Requirements

Argon Specification

Ultra High Purity argon is used as the inductively coupled plasma (ICP) torch gas with the CyTOF 2 system. The quality criteria for argon are listed in Table 6.

Table 6: Argon requirements

Gas Specification	
Argon Purity	≥99.996%
Impurity Content	
Oxygen	<5 ppm
Hydrogen	<1 ppm
Nitrogen	<20 ppm
Water	<4 ppm

Argon gas at 80 ± 1 psi (522 ± 7 kPa) is to be supplied to the CyTOF 2 system from liquid or compressed gas storage tanks at a flow rate of approximately 20 L/min. The choice of liquid argon or compressed gas argon tanks is determined primarily by the availability of each and the usage rate. A regulator able to provide a pressure range of 0–100 psi is required with a $\frac{1}{4}$ in Swagelok termination. Mechanical pressure regulators are recommended for the argon supply.

NOTE A liquid cryogenic argon tank is preferred.

⚠ WARNING Do not use electronic pressure regulator and auto-switching valves as 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:

- To protect laboratory personnel from ozone and hot argon generated in plasma.
- To minimize the effects of room drafts and the laboratory atmosphere on ICP torch stability.
- To help protect the instrument from corrosive vapors that may originate from the samples.
- To remove dissipated heat produced by the ICP torch, ICP power supply, and pump motors.

Exhaust Positions

The CyTOF 2 instrument has two separate vents, both of 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 in in diameter.

The system vent exhausts heat from the blower that cools the roughing pumps, system power supply, and radio frequency signal generator. The system vent is 150 mm or 6 in in diameter.

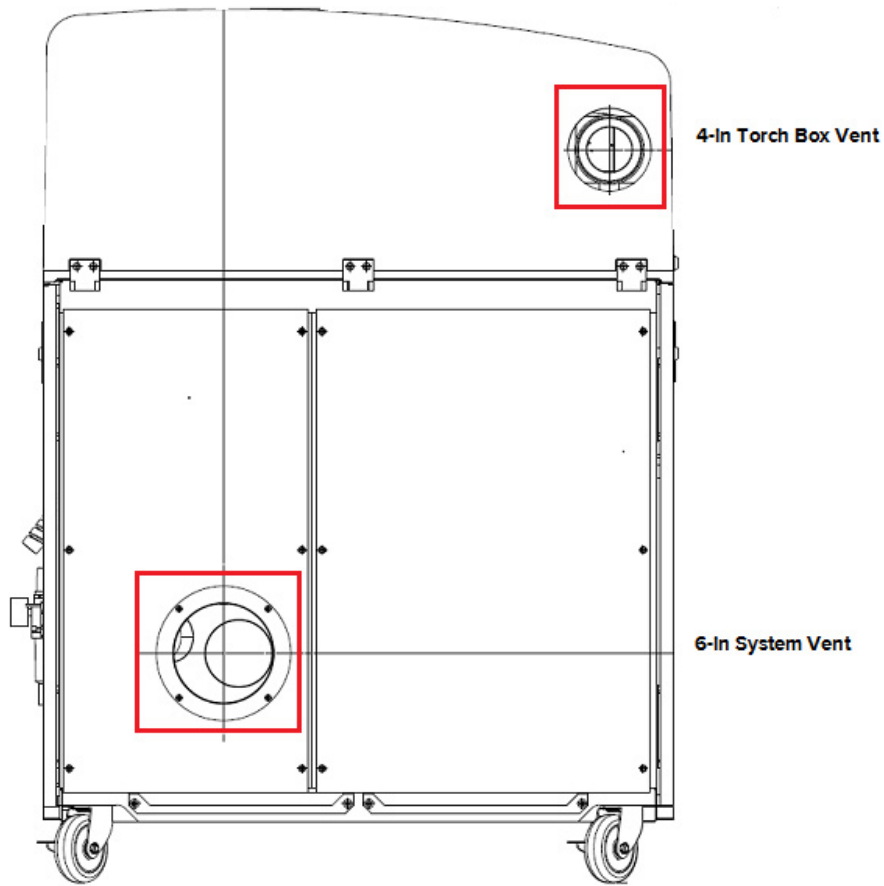


Figure 3: Instrument rear view drawing with exhaust positions highlighted in red

Flow Rates

The CyTOF 2 instrument is supplied with 3.6 m (12 ft) of 100 mm (4 in) and 3.6 m (12 ft) of 150 mm (6 in) flexible hoses. A venting system that uses a single inlet duct, having a flow rate of 280 L/sec (600 cfm), should be divided into the two separate 100 mm (4 in) and 150 mm (6 in) ducts equipped with individual dampers. Ensure that there is access to the dampers during installation. Table 7 details the exhaust specifications.

Table 7: Exhaust specifications

Vent	Hose Diameter mm (in)	Flow Rate L/sec (cfm)	Anemometer m/sec (ft/min)	Vented Outside Lab Power W (BTU/hr)
Torch Box	100 (4)	70 ±10% (150)	9 (1,695)	200 (690)
System	150 (6)	210 ±10% (450)	11.5 (2,250)	2,800 (9,400)

The flow rates as measured with the hoses connected to the ducts will need to be verified and adjusted during installation of the instrument. The static pressure drop caused by the CyTOF 2 system is 1.2 inH₂O (200 Pa).

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 volume 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.
- Locate the blower as close to the discharge outlet as possible. All joints on the discharge side should be airtight.
- 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 into 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


Environmental Requirements

The CyTOF 2 mass cytometer has been designed for indoor use only. The environment in which the instrument is installed should meet the following conditions:

- **Room temperature:** The room temperature should be between 15 and 30 °C (59 and 86 °F) with a maximum rate of change of 2.8 °C (5 °F) per hour.
- **Relative humidity:** The relative humidity should be between 20% and 80%, noncondensing.
- **Elevation:** The instrument should not be operated at an elevation greater than 2,000 m (6,500 ft) above sea level. Use of the instrument at elevations greater than 2,000 m is subject to acceptance by local inspection authorities.

The instrument should be located 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.

Materials Required for Operation

Table 8 provides a list of the materials supplied with the instrument for the installation and operation of the instrument.

Table 8: Materials supplied for CyTOF 2 instrument installation and operation

Description	Supplier	Catalog Number	Quantity
Tuning Solution, CyTOF, E-Pure, 250 mL	Fluidigm Corporation	201072	~10 mL
Washing Solution, 250 mL	Fluidigm Corporation	201071	~10 mL
EQ 4-Element Beads	Fluidigm Corporation	201073	5–10 mL
NORM-JECT® Syringes 1 mL	Henke-Sass Wolf		1 per sample
NORM-JECT Syringes 3 mL	Henke-Sass Wolf		4 units per operation session
Milli-Q® High Quality 18, Deionised Water (DIW) of Highest Grade 18.2 MOhm	Milli-Q (Millipore)	R00001	Constant supply
5 mL Round Bottom Tubes with 35 µm Mesh Cell Strainer	BD Biosciences	352235	1 per sample
Powder-Free Gloves			
50 mL Tube			
15 mL Tube			
Tuning Cells	Fluidigm Corporation		2
Methanol, 100%			100–200 mL
Kimwipes®			

Summary

Table 9 provides a summary of the requirements for the successful installation of your CyTOF 2 instrument.

Table 9: Instrument requirement summary


Dimensions	Width (cm/in)	Height (cm/in)	Depth (cm/in)	Weight (kg/lb)
Shipping Crate	213/84	106/42	157/62	635/1,400
CyTOF 2	97/38	132/52	79/31	285/628
Chiller	38/15	64/25	67/27	81/178

Electrical	Voltage (V AC)	Current (A)
CyTOF 2	2 x 200–240	2 x 30
Computer	100–240	6
Monitor	100–230	6

Gas	Purity	Pressure	Flow
Argon	≥99.996%	80 ±1 psi	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	70 ±10%; 150	9; 1,695	200; 690
System	150; 6	210 ±10%; 450	11.5; 2,250	2,800 9,400

This is a Class A device and is for use in commercial, industrial, or business environments.

 **WARNING** This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.



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