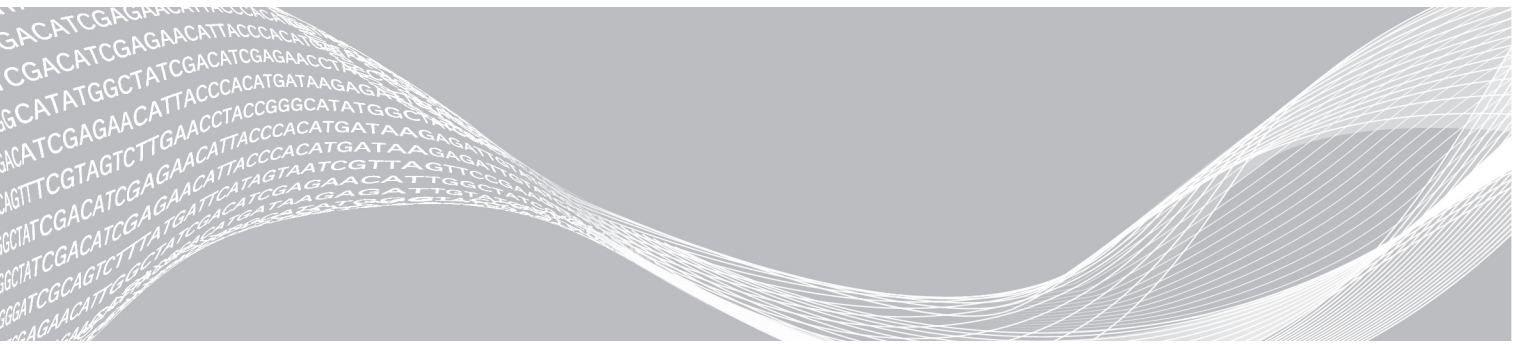
illumina®

NovaSeq 6000 Sequencing System

Site Prep Guide



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Introduction

This guide provides specifications and guidelines for preparing your site for installation and operation of the Illumina® NovaSeq™ 6000 Sequencing System.

- Laboratory space requirements
- Electrical requirements
- Environmental constraints
- Computing requirements
- User-supplied consumables and equipment

Safety Considerations

See the *NovaSeq 6000 Sequencing System Safety and Compliance Guide (document # 1000000019357)* for important information about safety considerations.

Additional Resources

The NovaSeq 6000 Sequencing System support pages on the Illumina website provide additional system resources. These resources include software, training, compatible products, and the following documentation. Always check support pages for the latest versions.

Resource	Description
Custom Protocol Selector	A wizard for generating customized end-to-end documentation that is tailored to the library prep method, run parameters, and analysis method used for the sequencing run.
NovaSeq 6000 Sequencing System Safety and Compliance Guide (document # 1000000019357)	Provides information about operational safety considerations, compliance statements, and instrument labeling.
RFID Reader Compliance Guide (document # 1000000002699)	Provides information about the RFID reader in the instrument, including compliance certifications and safety considerations.
NovaSeq Series Custom Primers Guide (document # 1000000022266)	Provides information about replacing Illumina sequencing primers with custom sequencing primers.
NovaSeq 6000 Sequencing System Guide (document # 1000000019358)	Provides an overview of instrument components, instructions for preparing sequencing consumables, instructions for operating the instrument, and maintenance and troubleshooting procedures.

Delivery and Installation

An authorized service provider delivers the system, uncrates components, and places the instrument. Make sure that the lab space is ready before delivery.

Floor loading risks related to instrument installation must be evaluated and addressed by building facility personnel.

CAUTION

Only authorized personnel can uncrate, install, or move the instrument. Mishandling of the instrument can affect the alignment or damage instrument components.

An Illumina representative installs and prepares the instrument. When connecting the instrument to a data management system or remote network location, make sure that the path for data storage is selected before the date of installation. The Illumina representative can test the data transfer process during installation.

CAUTION

After your Illumina representative has installed and prepared the instrument, ***do not*** relocate it. Moving the instrument improperly can affect the optical alignment and compromise data integrity. If you must relocate the instrument, contact your Illumina representative.

Crate Dimensions and Contents

The NovaSeq 6000 System and components are shipped in one wooden crate (Crate #1) and one cardboard crate (Crate #2). Use the following dimensions to determine the minimum door width required to accommodate the shipping crates.

Measurement	Crate #1	Crate #2
Height	155 cm (61 in)	84 cm (33 in)
Width	104 cm (41 in)	122 cm (48 in)
Depth	155 cm (61 in)	102 cm (40 in)
Crated Weight	628 kg (1385 lbs)	176 kg (388 lbs)

NOTE

For Crate #1, the forklift access points are on the depth side of the crate. Take this into consideration for doorway and elevator clearance when transporting the instrument in the crate.

NOTE

The weight of the UPS and external battery pack for the UPS contained in Crate #2 can vary based on the model shipped.

- Crate #1 contains the instrument.
- Crate #2 contains five boxes with the following contents:
  - Box—Uninterruptible power supply (UPS), weight 46 kg (100 lbs)
  - Box—External battery pack for the UPS, weight 64 kg (140 lbs)
  - Box—Accessories, total weight 31 kg (68 lbs)
    - Monitor
    - Large used reagents bottle and small used reagents bottle
    - Instrument leak tray
    - Wire thaw racks

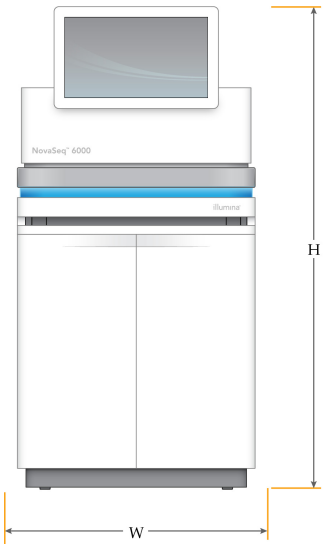
- Wash flow cells
- SBS wash cartridges
- Cluster wash cartridges
- Wireless keyboard and mouse, if appropriate for the region. In the absence of a wireless keyboard, use a wired keyboard.

- Box—Additional components
  - Two buffer tray bottles that are individually packaged
  - Region-specific power cord
  - *NovaSeq 6000 Sequencing System Guide (document # 1000000019358)*
  - *NovaSeq 6000 Sequencing System Safety and Compliance Guide (document # 1000000019357)*
  - *RFID Reader Compliance Guide (document # 1000000002699)*
- Box—Chimney adapter

Laboratory Requirements

Use the specifications and requirements provided in this section to set up your lab space.

Instrument Dimensions



Measurement	Instrument Dimensions*
Height	165.6 cm (65.2 in)
Width	80.0 cm (31.5 in)
Depth	94.5 cm (37.2 in)
Weight	481 kg (1059 lb)

* The UPS system is not included in this dimension, additional space must be allocated.

Placement Requirements

Position the instrument to allow proper ventilation, access for servicing the instrument, and access to the power switch, power outlet, and power cord.

- Position the instrument so that personnel can reach around the right side of the instrument to turn on or turn off the power switch. This switch is on the back panel adjacent to the power cord.
- Position the instrument so that personnel can quickly disconnect the power cord from the outlet.
- Make sure that the instrument is accessible from all sides using the following minimum clearance dimensions.
- Place the UPS on either side of the instrument. The UPS can be placed within the minimum clearance range of the instrument sides.

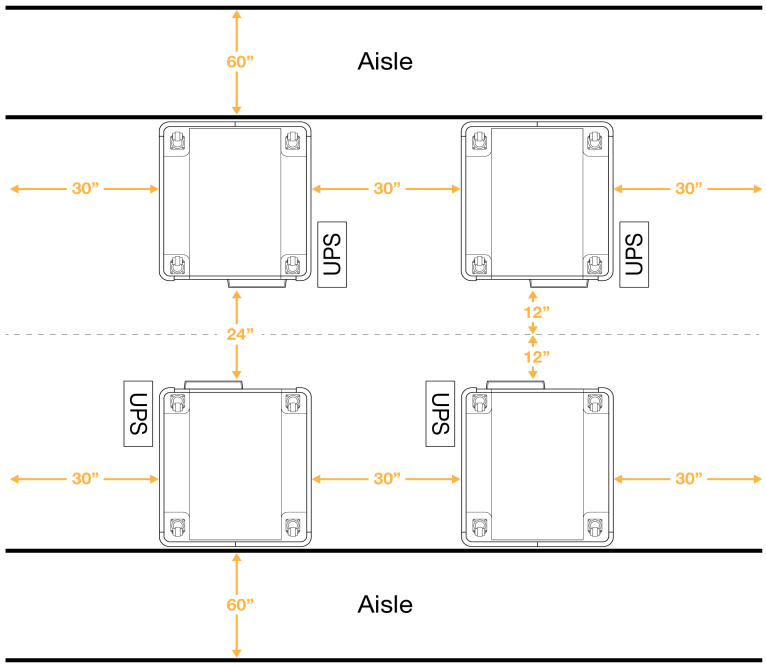
Access	Minimum Clearance
Front	Allow at least 152.4 cm (60 in) in front of the instrument for opening the liquids compartment and to provide general lab access for movement of personnel around the lab.
Sides	Allow at least 76.2 cm (30 in) on each side of the instrument for access and clearance around the instrument. Instruments placed side by side only require 76.2 cm (30 in) total between the two instruments.
Rear	Allow at least 30.5 cm (12 in) behind the instrument placed next to a wall for ventilation and access. Allow at least 61 cm (24 in) between two instruments placed back-to-back.
Top	Make sure that shelving and other obstructions are not above the instrument.

WARNING

Incorrect placement can reduce ventilation. Reduced ventilation increases heat output and noise output, which compromises data integrity and personnel safety.

Multisystem Installation Layout

The following diagram illustrates an example layout for a multisystem installation, including minimum spacing requirements.



Vibration Guidelines

Keep the vibration level of the lab floor at the VC-A standard of 50 µm/s for ⅓ octave band frequencies of 8–80 Hz, or lower. This level is typical for labs. Do not exceed the ISO Operating Room (baseline) standard of 100 µm/s for ⅓ octave band frequencies of 8–80 Hz.

During sequencing runs, use the following best practices to minimize vibrations and ensure optimal performance:

- Place the instrument on a flat hard floor and keep the clearance area free of clutter.
- Do not place keyboards, used consumables, or other objects on top of the instrument.
- Do not install the instrument near sources of vibration that exceed the ISO Operating Room standard. For example:
  - Motors, pumps, shake testers, drop testers, and heavy air flows in the lab.
  - Floors directly above or below HVAC fans, and controllers, and helipads.
  - Construction or repair work on the same floor as the instrument.
- Keep sources of vibration such as dropped items and movement of heavy equipment at least 100 cm (39.4 in) from the instrument.
- Use only the touch screen, keyboard, and mouse to interact with the instrument. Do not directly impact the instrument surfaces during operation.

Storage Requirements for Reagent Kits

The NovaSeq 6000 Reagent Kit supports sequencing on a high-throughput system and can require significant storage space. Use the following specifications to determine storage requirements.

Storage Temperatures

A single flow cell run requires 1 of each of the following items. A dual flow cell run requires 2 of each item.

Item	Storage Temperature
Buffer cartridge	15°C to 30°C
Cluster cartridge	-25°C to -15°C
Flow cell	2°C to 8°C
Library tube	15°C to 30°C
SBS cartridge	-25°C to -15°C

Light Sensitivity

The SBS and buffer cartridges contain reagents that are sensitive to light. If you remove the SBS cartridge from the packaging for storage, make sure that it is stored in the dark with no sources of light. Keep the buffer container packaged until use.

Reagent Kit Dimensions

The following table provides quantities and dimensions for the packaged components in a NovaSeq 6000 Reagent Kit. The specifications are the same regardless of kit size.

Table 1 Dimensions of Kit Components

Kit Component	Quantity	Length	Width	Height
Buffer cartridge	1	42.2 cm (16.6 in)	20.6 cm (8.1 in)	21.1 cm (8.3 in)
Cluster cartridge	1	29.5 cm (11.6 in)	13 cm (5.1 in)	9.4 cm (3.7 in)
Flow cell	1	35.6 cm (14 in)	20.3 cm (8 in)	2.8 cm (1.1 in)
Library tube	1	4.1 cm (1.6 in)	2.3 cm (0.9 in)	12.4 (4.9 in)
SBS cartridge	1	30 cm (11.8 in)	12.4 cm (4.9 in)	11.2 cm (4.4 in)

Lab Setup for PCR Procedures

Some library prep methods require the polymerase chain reaction (PCR) process.

Establish dedicated areas and lab procedures to prevent PCR product contamination before you begin work in the lab. PCR products can contaminate reagents, instruments, and samples, delaying normal operations and causing inaccurate results.

Pre-PCR and Post-PCR Areas

Use the following guidelines to avoid cross-contamination.

- Establish a pre-PCR area for pre-PCR processes.
- Establish a post-PCR area for processing PCR products.
- Do not use the same sink to wash pre-PCR and post-PCR materials.
- Do not use the same water purification system for pre-PCR and post-PCR areas.
- Store supplies used for pre-PCR protocols in the pre-PCR area. Transfer them to the post-PCR area as needed.

Dedicate Equipment and Supplies

- Do not share equipment and supplies between pre-PCR and post-PCR processes. Dedicate a separate set of equipment and supplies in each area.
- Establish dedicated storage areas for consumables used in each area.

Electrical Requirements

Power Specifications

Type	Specification
Line Voltage	200–240 VAC at 50/60 Hz
Peak Power Consumption	2500 Watts

For 200–240 Volts AC, your facility must be wired with a minimum 15 Amp grounded line with proper voltage. An electrical ground is required. If the voltage fluctuates more than 10%, a power line regulator is required.

The instrument must be connected to a dedicated circuit that must not be shared with any other equipment.

For more information, see the *NovaSeq 6000 Sequencing System Safety and Compliance Guide (document # 1000000019357)* .

Protective Earth

The instrument has a connection to protective earth through the enclosure. The safety ground on the power cord returns protective earth to a safe reference. The protective earth connection on the power cord must be in good working condition when using this device.

Power Cords

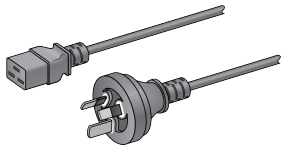
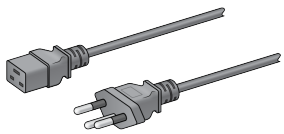
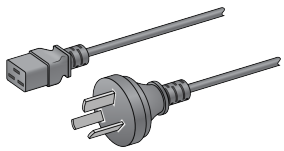
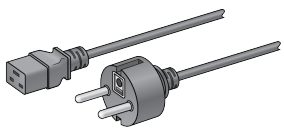
The instrument comes with an international standard IEC 60320 C20 receptacle, and is shipped with a region-specific power cord. To obtain equivalent receptacles or power cords that comply with local standards, consult a third-party supplier such as Interpower Corporation (www.interpower.com). All power cords are 2.5 m (8 ft) in length.

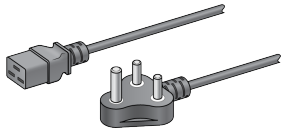
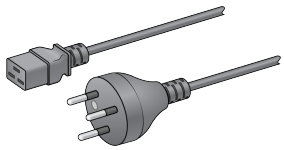
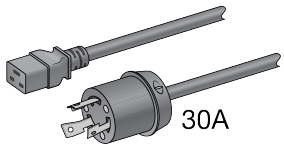
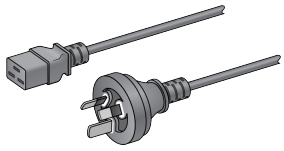
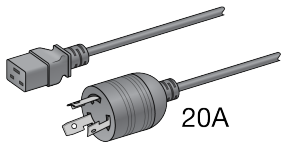
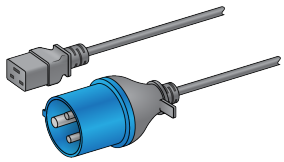
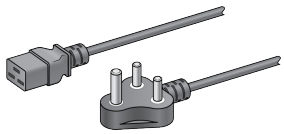
Hazardous voltages are removed from the instrument only when the power cord is disconnected from the AC power source.

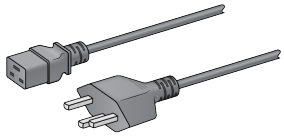
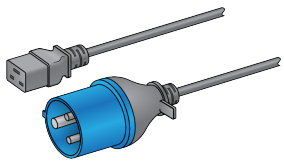
CAUTION

Never use an extension cord to connect the instrument to a power supply.

Table 2 Power Cord Requirements of Selected Regions

Region	Shipped Power Cord	Electrical Supply	Socket
Australia	AS 3112 SAA Male to C19, 15 Amps 	230 VAC, 15 Amps	15 Amp Type I
Brazil	NBR14136 Plug to C19, 16 Amps 	220 VAC, 16 Amps	NBR 14136 Type N
China	GB2099 to C19, 16 Amps 	220 VAC, 16 Amps	GB 1002, GB 2099, Type I
European Union[1]	Schuko CEE 7 (EU1-16p) to C19, 16 Amps 	220-240 VAC, 16 Amps	Schuko CEE 7/3

Region	Shipped Power Cord	Electrical Supply	Socket
India	IS1293 to C19, 16 Amps 	230 VAC, 16 Amps	BS546A Type M
Israel	IEC 60320 C19, 16 Amps 	230 VAC, 16 Amps	SI 3216 Amp Type H
Japan	NEMA L6-30P, 30 Amps 	200 VAC, 30 Amps	NEMA L6-30R
New Zealand	AS 3112 SAA Male to C19, 15 Amps 	230 VAC, 15 Amps	Dedicated 15 Amp Type I
North America	NEMA L6-20P to C19, 20 Amps 	208 V, 16 Amps	NEMA L6-20R
Singapore	IEC60309 316P6 to C19, 16 Amps 	230-250 VAC, 16 Amps	IEC60309 316C6
South Africa	SANS 164-1 to C19, 16 Amps 	230 VAC, 16 Amps	BS546A Type M

Region	Shipped Power Cord	Electrical Supply	Socket
Switzerland	SEV 1011 Type 23 Plug J, 16 Amps 	230 VAC, 16 Amps	SEV 1011 Type 23 J socket
United Kingdom	IEC60309 316P6 to C19, 16 Amps 	230-250 VAC, 16 Amps	IEC60309 316C6

[1] Excepting Switzerland and the United Kingdom.

NOTE

Alternatively, all regions can use IEC 60309.

Fuses

The instrument contains no user-replaceable fuses.

Uninterruptible Power Supply

The following specifications apply to the worldwide UPS and battery that ships with the instrument.

For countries that require a different model of UPS and battery, and alternatives, see *Country-Specific Uninterruptible Power Supply*.

- **UPS**—APC Smart-UPS X 3000 Rack/Tower LCD 200-240V, Model # SMX3000RMHV2U
- **Battery**—APC Smart-UPS X, Model # SMX120RMBP2U

Specification	UPS With Battery
Maximum Output Power	2700 Watts*/ 3000 VA
Input Voltage (nominal)	200–240 VAC
Input Frequency	50/60 Hz
Input Connection	IEC-60320 C20
Typical Run Time (Average Power of 1.8 kW)	51 minutes
Typical Run Time (Peak Power of 2.5 kW)	34 minutes
Weight	95 kg (210 lb)
Dimensions (Tower format: H × W × D)	(43.2 cm × 66.7 cm × 17 cm) (17 in × 26.26 in × 6.72 in)

* The UPS requires up to a maximum of 330 Watts to charge batteries and perform other internal functions. 2700 Watts is available for output during this time.

Country-Specific Uninterruptible Power Supply

Illumina supplies the following country-specific UPS and batteries. Unless indicated, only one battery is required.

Country	UPS Model #	Battery Model #
Columbia	SRT3000RMXLW-IEC	SRT96RMBP
India	SUA3000UXI	SUA48XLBP (2)
Japan	SRT5KXLJ	SRT192BPJ
Mexico	SRT3000RMXLW-IEC	SRT96RMBP
South Korea	SRT3000RMXLW-IEC	SRT96RMBP
Thailand	SRT3000RMXLW-IEC	SRT96RMBP

For additional specification information, see the APC website (www.apc.com).

NOTE

Exact UPS and battery options are subject to availability and can change without notice.

Environmental Considerations

Element	Specification
Temperature*	Maintain a lab temperature of 19°C to 25°C (22°C ±3°C). Failure to operate the instrument within the temperature range can degrade performance or cause a run to fail.
Humidity*	Maintain a noncondensing relative humidity between 20–80%. Preferred range is a relative humidity between 20–60%.
Elevation	Locate the instrument at an elevation below 2000 meters (6500 feet).
Air Quality	Operate the instrument in an indoor environment with air particulate cleanliness levels per ISO 9 (ordinary room air), or better. Keep the instrument away from sources of dust.
Vibration	Limit the continuous vibration of the lab floor to ISO operating room level (baseline), or better. During a sequencing run, limit intermittent disturbances or shocks to the floor near the instrument. Do not exceed ISO office level.

*Avoid a combination of high temperature and high humidity. For example, 25°C and 80% relative humidity.

Noise Output

Noise Output (dB)	Distance From Instrument
< 75 dB	1 meter (3.3 feet)

Heat Output

Peak Power Consumption	Thermal Output
2500 Watts	Maximum 8530 BTU/h Average 6000 BTU/h

Venting

A 10 inches round vertical chimney vents 60% of instrument heat output. You can vent to the room or connect the chimney to a user-supplied duct.

Use the following guidelines for venting ducts.

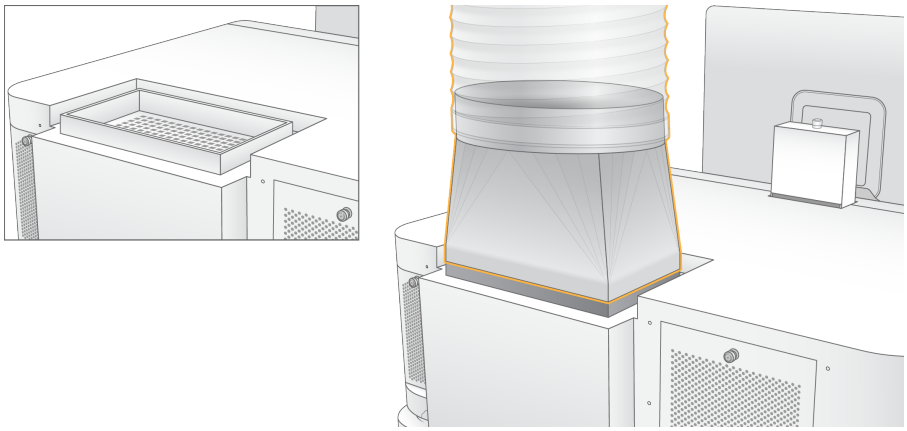
- Flexible ducting is preferred.
- Avoid bending flexible ducts where possible. Keep bends in flexible ducts to a minimum.
- Flexible ducts with bends must maintain the 10 inch diameter of the chimney at all points.
- Remove kinks or other restrictions to the airflow.
- Rigid ducting can be used. Use of rigid ducting can require Illumina personnel to move the instrument for service.
- Use the shortest length of ducting possible.
- Route to a space with sufficient ventilation to prevent airflow restriction or backup into the instrument.

CAUTION

Failure to follow these guidelines can impact instrument performance and can cause run failures.

Chimney airflow is 450 CFM. Chimney air temperature is up to 12°C higher than ambient temperature.

Figure 1 Chimney Placement for Venting



Bulk Used Reagent Handling

The NovaSeq 6000 System system is equipped to dispense used reagent buffer to a customer-supplied bulk container for separate processing or handling. The supplied external used reagent tubes included in the accessory kit are 5 meters long, and connect to the left rear of the instrument.

Illumina only supports external used reagent collection with the supplied tubes. Each tube contains the buffer waste from a single flow cell position, and must be routed individually to the bulk container.

The container must be placed within 5 meters of the instrument. The aperture must be at a height of 1000 mm or less from the floor.

Network and Computer Security

The following sections provide guidelines for maintaining network and computer security. For information on recommended configurations, see *Operating System Configurations* on page 17.

Compute Engine Security

The Compute Engine (CE) is an ancillary compute system that runs the camera interface board (CIB), BaseSpace Sequence Hub software. For security purposes, the Compute Engine is not user-accessible. However, it interfaces with the instrument control computer, which runs the control software and service software.

Linux Security

The Compute Engine runs on the instrument and uses a Linux-based operating system. To protect the system, Linux uses security configurations that cannot be disabled. Other features of Linux include Security-Enhanced Linux (SELinux).

Compute Engine Connection

The Compute Engine uses the IP address 169.254.0.1 to interface with the control computer.

Control Computer Security

The control computer combines user-supplied antivirus software and the following configurable options for enhanced security.

- Enhanced Mitigation Experience Toolkit (EMET)—Prevents the exploitation of software vulnerabilities.
- Software restriction policies—Increase the reliability, integrity, and manageability of computers in a domain. By restricting configurations, only identified applications can run.

If necessary, EMET and software restriction policies can be disabled. Software restriction polices are configurable. For more information, see the *NovaSeq 6000 Sequencing System Guide (document # 1000000019358)*.

Antivirus Software

An antivirus software of your choice is highly recommended to protect the instrument control computer against viruses. To avoid data loss or interruptions, configure the antivirus software as follows:

- Set for manual scans. Do not allow automatic scans.
- Perform the manual scans only when the instrument is not in use.
- Set updates to download without user authorization, but not install.
- Do not make updates during instrument operation. Make updates only when the instrument is not running and when it is safe to reboot the control computer.
- Do not reboot the computer automatically upon update.
- Exclude the application directory and data drives from any real-time file system protection. Apply this setting to the C:\Illumina and Z:\ilmn directories.
- Turn off Windows Defender. This Windows product can affect the operating system resources used by Illumina software.

Host Network Considerations

The NovaSeq 6000 Sequencing System is designed for use with a network, regardless of whether runs are configured for BaseSpace Sequence Hub. The system is not intended to store run data. Therefore, performing a run in standalone mode requires a network connection to transfer run data to a network location.

The following operations require an external internet connection, even if BaseSpace Sequence Hub is not used.

- Updating the control software.
- Uploading instrument performance data to Illumina.
- Remote assistance from Illumina Technical Support.

Do not save run data to a local hard drive. The system hard drive is intended for temporary storage before data are transferred automatically. Data saved on the hard drive that are not used by the current run can compromise performance.

Network Connections

Illumina does not install or provide technical support for network connections. Review network maintenance activities for potential compatibility risks with the NovaSeq 6000 Sequencing System.

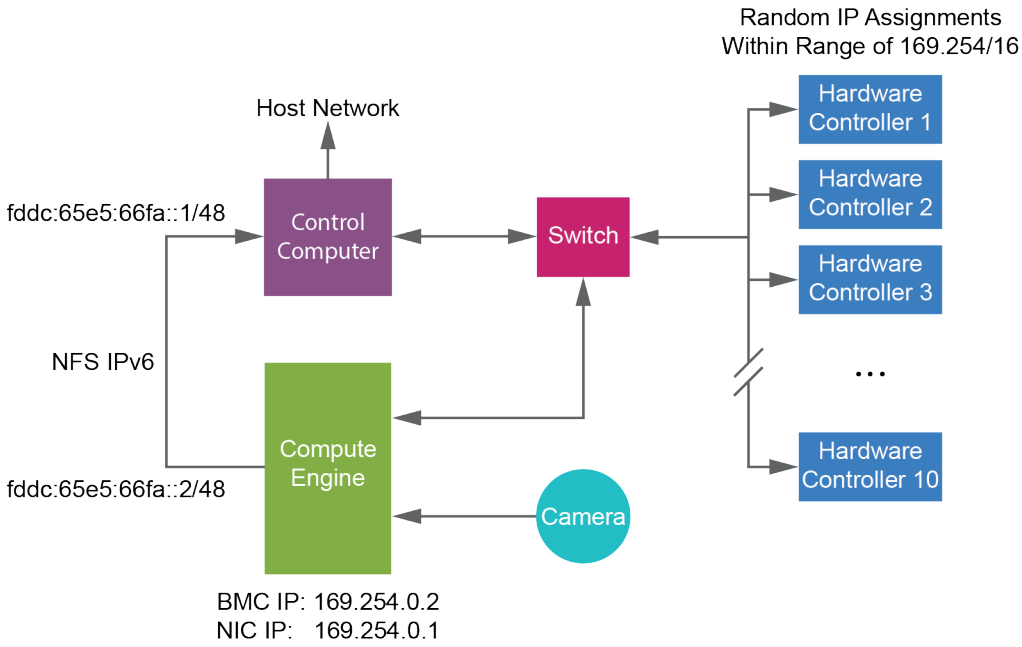
Use the following guidelines to install and configure a network connection:

- Use a dedicated 1 gigabit connection between the instrument and data management system. Make this connection directly or through a network switch.
- Required bandwidth for a connection is:
  - 200 Mb/s/instrument for internal network uploads.
  - 200 Mb/s/instrument for BaseSpace Sequence Hub network uploads.
  - 5 Mb/s/instrument for Instrument Operational Data uploads.
- Switches must be managed.
- Network equipment such as switches must have a minimum of 1 gigabit per second.
- Calculate the total capacity of the workload on each network switch. The number of connected instruments and ancillary equipment, such as a printer, can impact capacity.
- If possible, isolate sequencing traffic from other network traffic.
- Cables must be CAT-5e, or better, Illumina recommends the use of CAT-6. A shielded network cable that is 3 meters (9.8 feet) long is provided with the instrument for network connections.

Control Computer Connections

For the system to function properly, reserve the IP ranges 169.254/16 and IPv6 fddc:65e5:66fa::*.

Figure 2 Network Illustration



NOTE

The CE is not visible on the host network.

The following tables describe the network ports and domains of the control computer. Use these tables as a reference when setting up your network.

Internal Connections

Connection	Value	Purpose
Domain	localhost:*	All ports for localhost-to-localhost communication, which are needed for interprocess communication
Port	5555	Hardware controller interface
	8081	Real-Time Analysis
	8080	NovaSeq Control Software
	8090	Universal Copy Service
	22, 80, 111, 443, 623, 2049, 5900, 8889, 9980, fddc:65e5:66fa::1/48, fddc:65e5:66fa::2/48	Data transfer

Outbound Connections

The following sections provide domain and IP address information for configuring access to BaseSpace Sequence Hub domains, Illumina Proactive, software updates, and uploads of run and performance data.

BaseSpace Sequence Hub Domains

The following domains provide access from Universal Copy Service to BaseSpace Sequence Hub and Illumina Proactive. Some Enterprise addresses include a user-defined domain field. This custom field is reserved with {domain}.

Instance	Address
US Enterprise	{domain}.basespace.illumina.com
	{domain}.api.basespace.illumina.com
	basespace-data-east.s3-external-1.amazonaws.com
	basespace-data-east.s3.amazonaws.com
	instruments.sh.basespace.illumina.com
EU Enterprise	{domain}.euc1.sh.basespace.illumina.com
	{domain}.api.euc1.sh.basespace.illumina.com
	euc1-prd-seq-hub-data-bucket.s3-eu-central-1.amazonaws.com
	instruments.sh.basespace.illumina.com
US Basic and Professional	basespace.illumina.com
	api.basespace.illumina.com
	basespace-data-east.s3-external-1.amazonaws.com
	basespace-data-east.s3.amazonaws.com
	instruments.sh.basespace.illumina.com
EU Basic and Professional	euc1.sh.basespace.illumina.com
	api.euc1.sh.basespace.illumina.com
	euc1-prd-seq-hub-data-bucket.s3-eu-central-1.amazonaws.com
	instruments.sh.basespace.illumina.com

IP Addresses and Ports

Use the following IP address and port connections for BaseSpace Sequence Hub, Illumina Proactive configuration, uploads, and software updates.

	TCP	UDP	IP
BMC	22,80,443,623,5900,8889	623	169.254.0.2
NFS	111,2049	111,2049	fddc:65e5:66fa::2/48 fddc:65e5:66fa::1/48
CE	22,9980	n/a	169.254.0.1
Hardware Controllers	n/a	n/a	169.254.x.x/16

Operating System Configurations

Illumina instruments are tested and verified to operate within specifications before shipping. After installation, changes to settings can create performance or security risks.

The following configuration recommendations mitigate performance and security risks for the operating system:

- Configure a password that is at least 10 characters, and use local ID policies for additional guidance. *Keep a record of the password.*

  - Illumina does not keep customer login credentials, and unknown passwords cannot be reset.
  - An unknown password requires that an Illumina representative restore the factory default, which removes all data from the system and extends the necessary support time.
- When connecting to a domain with Group Policy Objects (GPOs), some settings might affect the operating system or instrument software. If the instrument software operates incorrectly, consult your facility IT administrator about possible GPO interference.
- Use the Windows firewall or a network firewall (hardware or software) and disable the Remote Desktop Protocol (RDP). For more information on firewalls and RDP, see the *Illumina Security Best Practices Guide (Pub No. 970-2016-016)*.
- Maintain administrative privileges for users. Illumina instrument software is configured to allow user permissions when the instrument is shipped.
- The system has fixed internal IP addresses, which can cause system failure when conflicts occur.
- The control computer is designed to operate Illumina sequencing systems. Web browsing, checking email, reviewing documents, and other nonsequencing activity creates quality and security problems.

Windows Updates

To secure your data, it is recommended that all Windows critical security updates are applied on a regular schedule. The instrument must be idle when updates are applied as some updates require a full system reboot. General updates can put the system operating environment at risk and is not supported.

If security updates are not possible, alternatives to turning on Windows Update include:

- More robust firewalling and network isolation (virtual LAN).
- Network isolation of network attached storage (NAS), which still allows for data to sync to the network.
- Local USB storage.
- User behavior and management to avoid improper use of the control computer and ensure the appropriate permission-based controls.

For more information on Windows Update alternatives, contact Illumina Technical Support.

Third-party Software

Illumina supports only the software provided at installation.

Chrome, Java, Box, and other third-party software are untested and can interfere with performance and security. For example, RoboCopy interrupts streaming performed by the control software suite. The interruption can cause corrupt and missing sequencing data.

User Behavior

The instrument control computer is designed to operate Illumina sequencing systems. Do not consider it a general-purpose computer. For quality and security reasons, do not use the control computer for web browsing, checking email, reviewing documents, or other unnecessary activity. These activities can result in degraded performance or loss of data.

Data Output and Storage

Storage Requirements for BaseSpace Sequence Hub

Illumina recommends uploading data to BaseSpace Sequence Hub. Based on run size, BaseSpace Sequence Hub requires the following storage per run.

Flow Cell Type	Single Flow Cell Run	Dual Flow Cell Run
NovaSeq 6000 System SP 300 Cycle	0.10 TB	0.20 TB
NovaSeq 6000 System SP 500 Cycle	0.16 TB	0.32 TB
NovaSeq 6000 System S1 300 Cycle	0.37 TB	0.73 TB
NovaSeq 6000 System S2 300 Cycle	0.73 TB	1.43 TB
NovaSeq 6000 System S4 300 Cycle	2.19 TB	4.35 TB

Locally Attached Storage or Network Requirements

The following table provides file types and minimum storage requirements for a sequencing run and its secondary analysis. The table lists requirements for a dual flow cell run by each flow cell type.

NOTE

For single flow cell runs, the minimum space requirements are half of those in the table. Alternate run configurations have different storage requirements.

File Type	SP 300 Cycle	SP 500 Cycle	S1 300 Cycle	S2 300 Cycle	S4 300 Cycle
CBCL	235 GB	392 GB	470 GB	930 GB	2800 GB
Interop folder	0.6 GB	1 GB	1.2 GB	2.3 GB	7.0 GB
FASTQ	285 GB	475 GB	570 GB	1125 GB	3387 GB
BAM	265 GB	442 GB	530 GB	1050 GB	3160 GB
gVCF and VCF	7 GB	11.6 GB	14 GB	28 GB	84 GB

NOTE

Map mounted storage locations using the full UNC path. Do not use letters or symbolic links.

Example Data Usage

The following table provides an example for building an infrastructure that supports data generated with the NovaSeq 6000 Sequencing System. The table lists data storage options for whole-genome sequencing analysis with BaseSpace Sequence Hub.

The examples assume that a dual flow cell, 300 cycle run with S2 flow cells generates 2 TB of data at a usage rate of 10 runs per month. The SP, S1, and S4 data points are extrapolated from the S2 assumptions. Both the SP and S1 flow cells complete in approximately half the time of an S2 flow cell. For a 500 cycle run with SP flow cells at a usage rate of 10 runs per month, 0.25 TB of data is generated.

Adjust the numbers in the table for a lower rate of use. If you expect to perform repeat analysis of data sets, increase storage proportionately.

Because actual data retention is subject to local policies, confirm conditions before calculating storage needs.

NOTE

Run sizes vary depending on multiple factors including length and the percentage of pass filter (PF). The numbers provided are intended to be a guide to the relative range of the data footprint.

File Type	Time Period	Number of Runs	SP 300 Cycle	SP 500 Cycle	S1 300 Cycle	S2 300 Cycle	S4 300 Cycle
BAM	Monthly	10 runs/1 month per system*	2.65 TB	4.42 TB	14 TB	14 TB	42 TB
BAM	Annual	120 runs/1 year per system	31.8 TB	53.04 TB	163 TB	168 TB	504 TB
VCF and gVCF	Monthly	10 runs/1 month per system	0.07 TB	0.12 TB	0.3 TB	0.3 TB	0.9 TB
VCF and gVCF	Annual	120 runs/1 year per system	0.84 TB	1.39 TB	3.6 TB	3.6 TB	10.8 TB

* Storage for data backup and archival is not included.

User-Supplied Consumables and Equipment

The following user-supplied consumables and equipment are used for consumable preparation, sequencing, and system maintenance. For more information, see the *NovaSeq 6000 Sequencing System Guide (document # 1000000019358)*.

Consumables

Consumable	Supplier	Purpose
1 N NaOH	General lab supplier	Diluting to 0.2 N for denaturing libraries.
10 mM Tris-HCl, pH 8.5	General lab supplier	Diluting libraries and an optional PhiX control before denaturation.
400 mM Tris-HCl, pH 8.0	General lab supplier	Neutralizing libraries and an optional PhiX control after denaturation.
Centrifuge bottle, 500 ml	General lab supplier	Diluting Tween 20 for a maintenance wash.
Centrifuge tube, 30 ml	General lab supplier	Diluting NaOCl for a maintenance wash.
Disposable gloves, powder-free	General lab supplier	General purpose.
Isopropyl alcohol wipes, 70% or Ethanol alcohol wipes, 70%	VWR, catalog # 95041-714, or equivalent General lab supplier	Cleaning components before a run and general purpose.
Lab tissue, low-lint	VWR, catalog # 21905-026, or equivalent	Drying the flow cell stage and general purpose.
Microcentrifuge tube, 1.5 ml	VWR, catalog # 20170-038, or equivalent	Combining volumes when diluting NaOH and library.
NaOCl, 5%	Sigma-Aldrich, catalog # 239305	Performing a maintenance wash.
Pipette tips, 20 µl	General lab supplier	Pipetting for diluting and loading libraries.
Pipette tips, 200 µl	General lab supplier	Pipetting for diluting and loading libraries.
Pipette tips, 1000 µl	General lab supplier	Pipetting for diluting and loading libraries.
Reagent or spectrophotometric-grade isopropyl alcohol (99%), 100 ml bottle	General lab supplier	Cleaning optics components periodically and support the objective cleaning cartridge.
Tween 20	Sigma-Aldrich, catalog # P7949	Performing a maintenance wash.

Consumable	Supplier	Purpose
Water, laboratory-grade (see *Guidelines for Laboratory-Grade Water* on page 21)	General lab supplier	Diluting NaOH for denaturing libraries. Diluting Tween 20 and sodium hypochlorite for a maintenance wash.
[NovaSeq Xp workflow] One of the following kits: • NovaSeq Xp 2-Lane Kit • NovaSeq Xp 4-Lane Kit	Illumina: • Catalog # 20021664 • Catalog # 20021665	Manually loading libraries onto a flow cell: • Two-lane kit for SP, S1, and S2 flow cells • Four-lane kit for S4 flow cells
[NovaSeq Xp workflow] 0.5 ml and 1.7 ml tubes	General lab supplier	Required for ExAmp mixing.
[NovaSeq Xp workflow] [Optional] One of the following manifold packs: • NovaSeq Xp 2-Lane Manifold Pack • NovaSeq Xp 4-Lane Manifold Pack	Illumina: • Catalog # 20021666 • Catalog # 20021667	Spare NovaSeq Xp manifolds for manually loading libraries onto a flow cell.
[Optional] PhiX Control v3	Illumina, catalog # FC-110-3001	Spiking in PhiX control.

Guidelines for Laboratory-Grade Water

Always use laboratory-grade water or deionized water to perform instrument procedures. Never use tap water. Use only the following grades of water or equivalents:

- Deionized water
- Illumina PW1
- 18 Megohms (MΩ) water
- Milli-Q water
- Super-Q water
- Molecular biology grade water

Equipment

Item	Source
Freezer, -25°C to -15°C	General lab supplier
Graduated cylinder, 500 ml, sterile	General lab supplier
Ice bucket	General lab supplier
Pipette, 20 µl	General lab supplier
Pipette, 200 µl	General lab supplier
Pipette, 1000 µl	General lab supplier
Refrigerator, 2°C to 8°C	General lab supplier
Tub, water baths*	General lab supplier
[NovaSeq Xp workflow] NovaSeq Xp Flow Cell Dock	Illumina, catalog # 20021663

* Use a tub that can accommodate two reagent cartridges and the appropriate water level. For example, (61 cm × 91.4 cm × 25.4 cm)(24 in × 36 in × 10 in).

Revision History

Document	Date	Description of Change
Document # 1000000019360 v06	January 2019	Updated information for SP 300 cycle and SP 500 cycle flow cells. Corrected link to the support site.
Document # 1000000019360 v05	September 2018	Updated power specification information with requirement for a dedicated circuit for the instrument. Updated venting requirements to prevent overheating of the instrument. Noted to map mounted storage locations using the full UNC path.
Document # 1000000019360 v04	July 2018	Corrected Compute Engine connection IP address. Corrected reserve IP addresses for computer connections.
Document # 1000000019360 v03	May 2018	Noted forklift access points for the crate that contains the instrument. Updated country-specific universal power supply information: • Removed Brazil and Taiwan UPS information. • Corrected part number for Japan UPS. Data output and storage information: • Updated BaseSpace storage requirements for S2 flow dual cell run. • Updated local storage requirement for dual flow cell runs.
Document # 1000000019360 v02	September 2017	Added data output and storage information for S1 and S4 flow cells. Updated venting information: • Flexible ducting is preferred. • Added graphic to illustrate chimney placement for venting. Added reference to *NovaSeq 6000 Sequencing System Guide (document # 1000000019358)* in the Control Computer Security, for information on configuring software restriction policies. Added descriptive information to instrument placement requirements table. Updated outbound connection information: • Added BaseSpace US and EU domains • Added IP address and port connection information for BaseSpace, instrument performance data, and software updates. Updated the Network Illustration. Updated operating system configuration information for automatic updates in Windows. Updated recommendations for securing data in Windows. Corrected Compute Engine connection IP address. Added reagent or spectrophotometric-grade isopropyl alcohol (99%) consumable.

Document	Date	Description of Change
Document # 1000000019360 v01	April 2017	Added *Custom Protocol Selector* to the list of Additional Resources. Updated packaging changes for crate contents and weights. Updated instrument information: • Updated H × W × D dimensions and weight. • Noted that building facility personnel are responsible for evaluating floor loading risk for instrument installation. Updated instrument placement requirements: • Updated access requirements. • Added Multi-system Installation Layout section. Updated environmental information: • Noted to avoid a combination of 25°C and 80% relative humidity. • Added information on how to dispense used waste buffer in bulk. Updated line voltage frequency to 50/60 Hz. Updated power cord information: • Specified additional power cords by region. • Corrected the image of the NEMA L6-20P power plug. Updated universal power supply information: • Added information for countries that require a different model of UPS and battery. • Noted that exact UPS and battery options are subject to availability and can change without notice. • Added H × W × D dimensions to worldwide UPS/Battery table • Specified an additional 300 Watts of power consumption for internal UPS functions. • Removed third party UPS reference. Updated chimney vent dimension to 10 inches vertical round. Corrected Outbound Connections, Domain Values table.
Document # 1000000019360 v00	January 2017	Initial release.

Technical Assistance

For technical assistance, contact Illumina Technical Support.

Website: www.illumina.com
Email: techsupport@illumina.com

Illumina Customer Support Telephone Numbers

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North America	+1.800.809.4566	
Australia	+1.800.775.688	
Austria	+43 800006249	+43 19286540
Belgium	+32 80077160	+32 34002973
China	400.066.5835	
Denmark	+45 80820183	+45 89871156
Finland	+358 800918363	+358 974790110
France	+33 805102193	+33 170770446
Germany	+49 8001014940	+49 8938035677
Hong Kong	800960230	
Ireland	+353 1800936608	+353 016950506
Italy	+39 800985513	+39 236003759
Japan	0800.111.5011	
Netherlands	+31 8000222493	+31 207132960
New Zealand	0800.451.650	
Norway	+47 800 16836	+47 21939693
Singapore	+1.800.579.2745	
Spain	+34 911899417	+34 800300143
Sweden	+46 850619671	+46 200883979
Switzerland	+41 565800000	+41 800200442
Taiwan	00806651752	
United Kingdom	+44 8000126019	+44 2073057197
Other countries	+44.1799.534000	

Safety data sheets (SDSs)—Available on the Illumina website at support.illumina.com/sds.html.

Product documentation—Available for download in PDF from the Illumina website. Go to support.illumina.com, select a product, then select **Documentation & Literature**.

Document # 1000000019360 v06

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