

North Star Imaging X5000 / 450kV Installation Guide



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North Star Imaging manufactures turn-key **industrial 2D & 3D Digital Radiography & Computed Tomography X-ray equipment** which is used for R&D, Failure Analysis, Quality Control, Internal Measurements, High-Speed 3D Scanning, 3D Metrology & more. X-ray scanning allows users to inspect the external & internal structures of a part without destroying it.

NSI also offers **as-needed X-ray Inspection Services** at 6 global sites in Minnesota, California, Massachusetts, Florida, UK, and China and, 24/7 **Technical Service and Basic & Advanced NDT classroom and online trainings** all year round.

NSI is certified for ISO 9001:2015 QMS and ISO 14001:2015 EMS. Learn more: www.4nsi.com

Requirements for the operation of an X-ray System

NSI cabinet systems are manufactured in accordance with 21 CFR 1020.40 which regulates the certification and requirements of cabinet X-ray systems. NSI system shielding is based on proven designs with more than 30 years of field experience. We inspect 100% of the products we produce to ensure the requirements of 21 CFR 1020.40 are achieved. The federal regulation states maximum radiation leakage allowed is 0.5mr/hr. at 5 cm from the surface of the cabinet. The certification of the system is represented in the tag that is affixed to the radiation enclosure as indicated in the federal regulation. The language in the federal regulation regarding certification is as follows:

“The certification shall be in the form of a label or tag permanently affixed to, or inscribed on such product, so as to be legible and readily accessible to view when the product is fully assembled for use, unless the applicable standard prescribes some other manner of certification. All such labels or tags shall be in the English language.”

Typically, an X-ray system must be registered with the appropriate state agency. This registration must occur prior to the X-ray system being placed into service. Regulations may require initial and periodic inspections by a government agency or a qualified vendor. In addition, the regulations may require the implementation of standardized operating procedures, specialized training, and posting of radiation exposure warnings and other special notices. Radiation safety requirements differ significantly from one jurisdiction to another. It is the users' responsibility to ensure the X-ray system is installed and operated in compliance with all applicable governmental regulations. Failure to comply may result in substantial penalties.

Safety

The unloading and transport of NSI systems shall be completed by personnel trained and authorized to safely operate the equipment being used. Lifting equipment must be designed to accommodate the size and weight of the transported material. All equipment must be in proper working order and checked in accordance with the applicable standards and directives. NSI is not responsible for damage caused during the offloading or handling of equipment.

Shipping

NSI X-ray systems are delivered on dedicated, flat-bed, air-ride, Conestoga style trailers.

Equipment Considerations

System weight and lifting height must be used to properly determine the weight capacity requirements of the equipment being used to remove material from the trailer.

Packaging

NSI systems are packaged and delivered in accordance with internal requirements.

Standard domestic shipments are packaged in the following manner:

NSI radiation enclosures are wrapped in polyethylene sheeting to provide some protection from the elements. Shipping channels are affixed to the roof of the enclosure to provide strapping locations for transport. Additionally, 4 swivel hoist rings are provided on the base of the cabinet to provide locations to secure the load.

Two additional wooden crates contain the various system components required. These components are wrapped in VCI poly sheeting to provide moisture protection. The crates are then sealed with a low-density polyethylene material to provide additional moisture resistance and protection.

Upon delivery, the radiation enclosure and system crates should be stored in closed, dry rooms with temperatures between 40 and 104°F (5 to 40°C).

Domestic X5000 / 450kV					
Contents	Packaging	Length	Width	Height	Gross Weight
Radiation Enclosure	Pallet	118"	80"	98"	30,500 lbs.
Desk	Crate	91"	72"	73"	2,000 lbs.
X-Ray	Crate	91"	72"	59"	2,500 lbs.

- *Actual sizes and weights may vary.*

Modular domestic shipments are packaged in the following manner:

The cabinet radiation enclosure panels are placed and secured onto wooden skids then wrapped in polyethylene sheeting to provide some protection from the elements.

Nine additional wooden crates contain the various system components required. These components are wrapped in VCI poly sheeting to provide moisture protection. The crates are then sealed with a low-density polyethylene material to provide additional moisture resistance and protection.

Upon delivery, the system crates should be stored in closed, dry rooms with temperatures between 40 and 104°F (5 to 40°C).

Domestic X5000 450kV Modular					
Contents	Packaging	Length	Width	Height	Gross Weight
Desk	Crate	91"	72"	73"	2,000 lbs.
X-Ray	Crate	91"	72"	74"	2,500 lbs.
Electrical Panel	Crate	83"	70"	29"	1,200 lbs.
Electrical Cabinet	Crate	93"	38"	31"	1,500 lbs.
Exterior Skins	Crate	96"	60"	29"	1,500 lbs.
Manipulator Base	Crate	141"	68"	43"	2,500 lbs.
Manipulator Tower	Crate	113"	68"	43"	1,500 lbs.
Manipulator Tower	Crate	115"	68"	43"	1,500 lbs.
Door Rail / Misc.	Crate	109"	31"	28"	1,000 lbs.
Walls	Skid	96"	38"	31"	3,000 lbs.
Walls	Skid	96"	38"	31"	3,250 lbs.
Walls	Skid	96"	38"	31"	4,000 lbs.
Walls	Skid	96"	38"	31"	4,250 lbs.

- Actual crate quantity, sizes, and weights may vary.

Domestic X5000 450kV Modular - Continued					
Contents	Packaging	Length	Width	Height	Gross Weight
Walls	Skid	96"	38"	31"	5,250 lbs.
Corners	Skid	93"	38"	31"	3,000 lbs.
Door	Skid	99"	41"	30"	1,500 lbs.
Roof	Skid	96"	44"	22"	4,000 lbs.
Base	Skid	96"	44"	25"	3,500 lbs.

- Actual crate quantity, sizes, and weights may vary.

International shipments are packaged in the following manner:

NSI radiation enclosures are wrapped in aluminum coated foil, packaged with desiccant, and sealed to provide moisture protection. Shipping channels are affixed to the roof of the enclosure to provide strapping locations for transport. The sealed radiation enclosure is packaged in a wooden shipping crate in conformance with IPPC/ISPM 15 standards. The crate is sealed with a reinforced low-density polyethylene material to provide additional moisture resistance and protection.

Two additional wooden crates contain the various system components required. These components are wrapped in aluminum coated foil, packaged with desiccant, and sealed to provide moisture protection. The crates are then sealed with a reinforced low-density polyethylene material to provide additional moisture resistance and protection.

Upon delivery, the radiation enclosure and system crates should be stored in closed, dry rooms with temperatures between 40 and 104°F (5 to 40°C).

International X5000 / 450kV						
Contents	Packaging	Length	Width	Height	Net Weight	Gross Weight
Radiation Enclosure	Crate	144"	94"	119"	30,000 lbs.	33,500 lbs.
Desk	Crate	91"	72"	73"	1,500 lbs.	2,000 lbs.
X-Ray	Crate	91"	72"	59"	2,000 lbs.	2,500 lbs.

- Actual sizes and weights may vary.

Standard Cabinet In-Plant Transport

Sufficient floor and ceiling load capacity of the transport routes must be verified prior to moving material. Transport routes must be designed to accommodate the weight of the transported material and transportation equipment.

NSI systems are designed to be lifted only from the base of the enclosure, any other lifting methods may cause damage. NSI is not responsible for damage caused during the offloading or handling of equipment. See Figures 1 and 2 for lifting instructions.

Following movement of the radiation enclosure to the final location, the system's leveling feet must be installed prior to placement on the ground. The six leveling feet must be installed as shown in Figure 3. Leveling of the cabinet should be completed by the customer during radiation enclosure placement. A contractor grade construction level, 2ft - 4ft in length, should be used in the X (front to back) and Z (left to right) planes to ensure the system is level. Ensure that all mounting feet are in contact with the floor and equal pressure has been applied to each foot.

For systems requiring seismic isolation feet, installation of the concrete anchors must be completed by the customer, see Fig. 4 for details. To determine layout requirements, see provided system specification drawings.

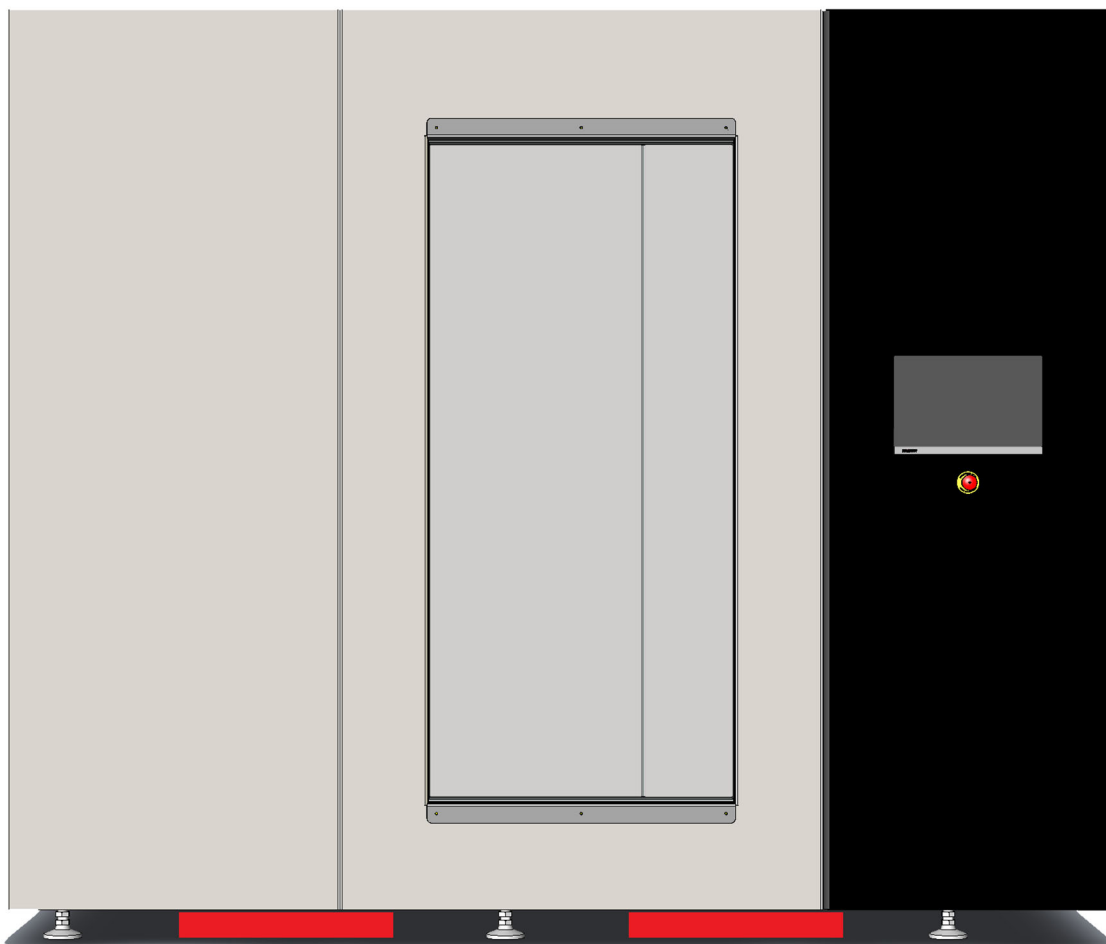


Figure 1 – Lifting should only be completed by areas marked in red.



Figure 2 – Lifting should only be completed by areas marked in red.

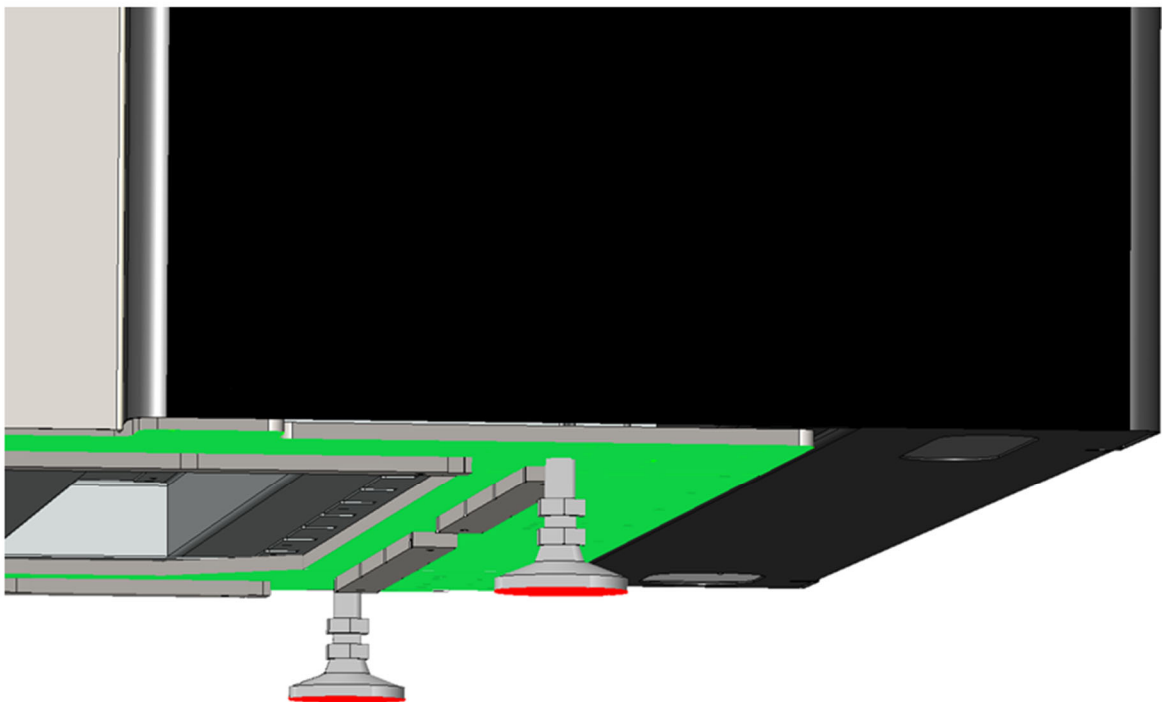


Figure 3 – Distance from base of leveling foot (red) to base of cabinet (green) should be approximately 4".

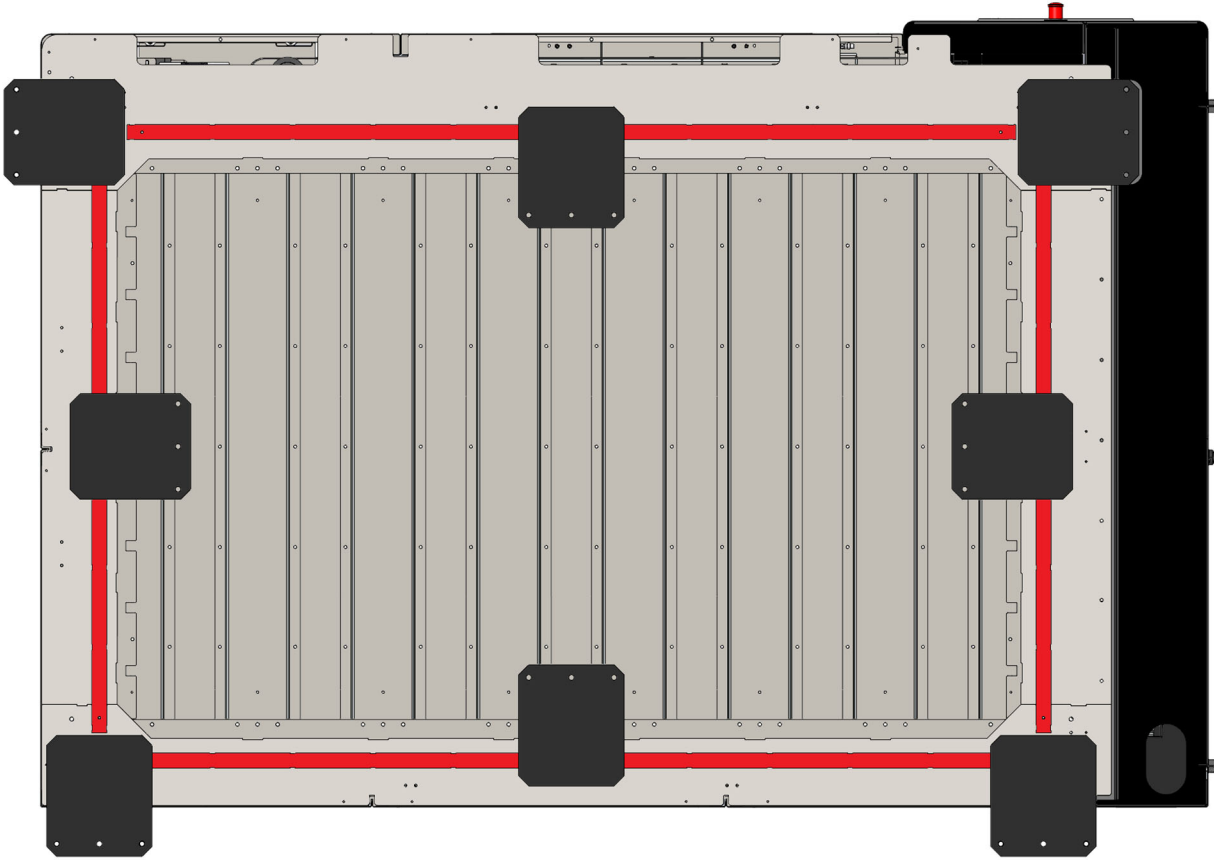


Figure 4 – Orientation of Seismic Feet as shown is required. Anchors may be installed after cabinet is placed in final location.

Foundation and Floor Load

The specified surface pressure indicates the maximum load applied to the floor covering. This value must not be used to calculate the permissible floor or ceiling load. The load conditions at the installation sites vary individually and must be clarified and/or calculated by a structural engineer before installation of the NSI system.

Standard System Leveling Feet

Mean surface pressure on the 8 support surfaces is approximately 300 PSI, determined from the NSI system weight distributed over the 8 support surfaces.

Seismic System Leveling Feet

Mean surface pressure on the 8 support surfaces is approximately 30 PSI, determined from the NSI system weight distributed over the 8 support surfaces. For specific installation instructions, see provided seismic feet drawings.

Uncrating Materials

Standard Cabinet

Supporting material crates may be unpackaged, and materials moved to the installation site by the customer. Care should be taken to ensure damage does not occur. Any damage incurred must be immediately communicated to your NSI Project Manager. Disposal of packaging materials and crating is the customer's responsibility.

Modular Cabinet

NSI will uncrate all materials for the installation of the system. Disposal of packaging materials and crating is the customer's responsibility. Appropriate means of refuse disposal must be supplied while NSI is onsite for installation. Wooden skids and crates contain metal hardware (i.e. lag bolts, metal banding, staples) and may not be accepted by all recycling services.

Modular Installation Tooling and Equipment

NSI typically supplies tooling and equipment necessary for the installation of the X5000 modular system. Installation tooling and equipment will be shipped to the site at the commencement of the installation process. Upon installation completion, all NSI equipment and tooling will be shipped back to NSI – Rogers on a dedicated, flat-bed, air-ride, Conestoga style trailer.

Installation Tooling and Equipment					
Crate Description	Packaging	Length	Width	Height	Gross Weight
Rigging Box	Skid	55"	36"	51"	900 lbs.
StorageMaster	Skid	81"	38"	60"	1,050 lbs.
Tool Chest	Crate	77"	42"	83"	1,650 lbs.
Cart and Boom	Skid	103"	48"	51"	3,600 lbs.
A-Frame	Crate	149"	41"	41"	1,500 lbs.
A-Frame Attachments	Crate	144"	39"	41"	1,350 lbs.

- Actual crate quantity, sizes, and weights may vary.

Additional equipment necessary for the installation includes a 6,000 lbs. capacity warehouse-style forklift with a minimum of 6' forks. NSI will need access to the forklift throughout the duration of the installation week. Our entire installation team is forklift certified through a 3rd party agency and can provide proof of certification upon request.

Modular Installation Process

Upon arrival at the site our trained technicians will begin the installation process. A sizeable offload and staging area are required for staging and removal of each component from the transport trucks. Our team requires a free and clear path to the installation location from the staging area. Each component of the assembly will be transported to the final location with the use of a heavy-duty moving cart, as required. Our installation technicians will utilize an A-frame style gantry crane to assemble the cabinet and manipulator in the final location.

The cabinet and manipulator assembly will typically be completed in two days onsite; at which point the electrical provisions will be required, reference “Electrical Requirements” on page 13 for more information.

Electrical Requirements

Category	Value
Line Voltage	230 VAC (L1/N/G) or 240 VAC (L1/L2/G)
Frequency	50/60 Hz
Current Type	Single Phase – L1/N/Ground or L1/L2/Ground
Required Fuse	60 Amps
Total Amps (FLA)	48 Amps

Due to high leakage current created by operation of the X-ray source, an additional 6 AWG dedicated ground (to structural steel or earth ground) must be supplied to the high voltage generator.

The 60 Amp disconnect shall be placed within 15 feet of the system main electrical cabinet. The power cable/wire will be supplied by and landed in the main electrical cabinet by the customer. Rigid conduit may also be attached to the cabinet for routing of power and ground wires. Electrical work shall be performed by a qualified electrician in accordance with state and local code. NSI is not responsible for damage caused by improper wiring.

Continuous power is essential for quality data processing. Other systems with permanent high-power consumption and systems with peak loads should not be connected to the same electrical circuit as the NSI X-ray system. This avoids malfunctions on the NSI X-ray system.

Workstation Requirements

NSI provides provisions for power to the acquisition PC to be placed at the supplied ergo desk. Additional PCs (reconstruction, review, data storage devices, etc.) shall be placed at a location provided by the customer with the required power provisions available.

Additionally, it is the customer’s responsibility to provide means of data transfer between NSI system PCs. This can be accomplished through interfacing with an existing network or direct connection between PCs. NSI system components are networked during start-up by an NSI installation technician in accordance with the applicable specifications and must not be modified by the customer. Any change may lead to connection problems.

An internet connection is not required for NSI system use but is beneficial where available.

Environmental conditions for operation

The following conditions must be met to ensure proper operation of the NSI X-ray system.

Permissible environmental temperature 50-95°F (10-35°C)

Permissible humidity (without condensation) 40-70%

System Heat Load

Configuration	Total Watts	Total BTU/HR
450kV source with DDA	1170	3,990
225kV and 450kV source with DDA	1370	4,675
225kV and 450kV source with DDA and LDA	1380	4,710

- *Actual output depends on system usage.*

Support

For additional information, contact your NSI Project Manager.

Revision History		
Revision	Effective Date	Description of Changes
A	1/10/2022	Initial release – Mike Vojacek author
B	4/13/2023	Renamed document, added modular crating and installation information, revised electrical requirements -Nate Coffin

