

SIGNA Pioneer/Voyager Mechanical Installation Training



imagination at work

Module 1 MR Installation Introduction

Learning Objectives

- Identify the purpose, uses and major parts of SIGNA Pioneer/Voyager
- Identify the conventions for SIGNA Pioneer/Voyager
- Identify the feature of SIGNA Pioneer/Voyager installation
- Identify the task owner from installation flowchart
- MR safety requirements

Introduction

MR systems have similar components that are consistent across product lines.

Major components include the:

- Magnet and Magnet Monitoring Unit
- Patient Table
- RF and Gradient amplifiers
- Data acquisition hardware
- Operator workspace area



SIGNA Pioneer



SIGNA Voyager

GE MR System Type

GE MR Performance products

- SIGNA Pioneer/Voyager

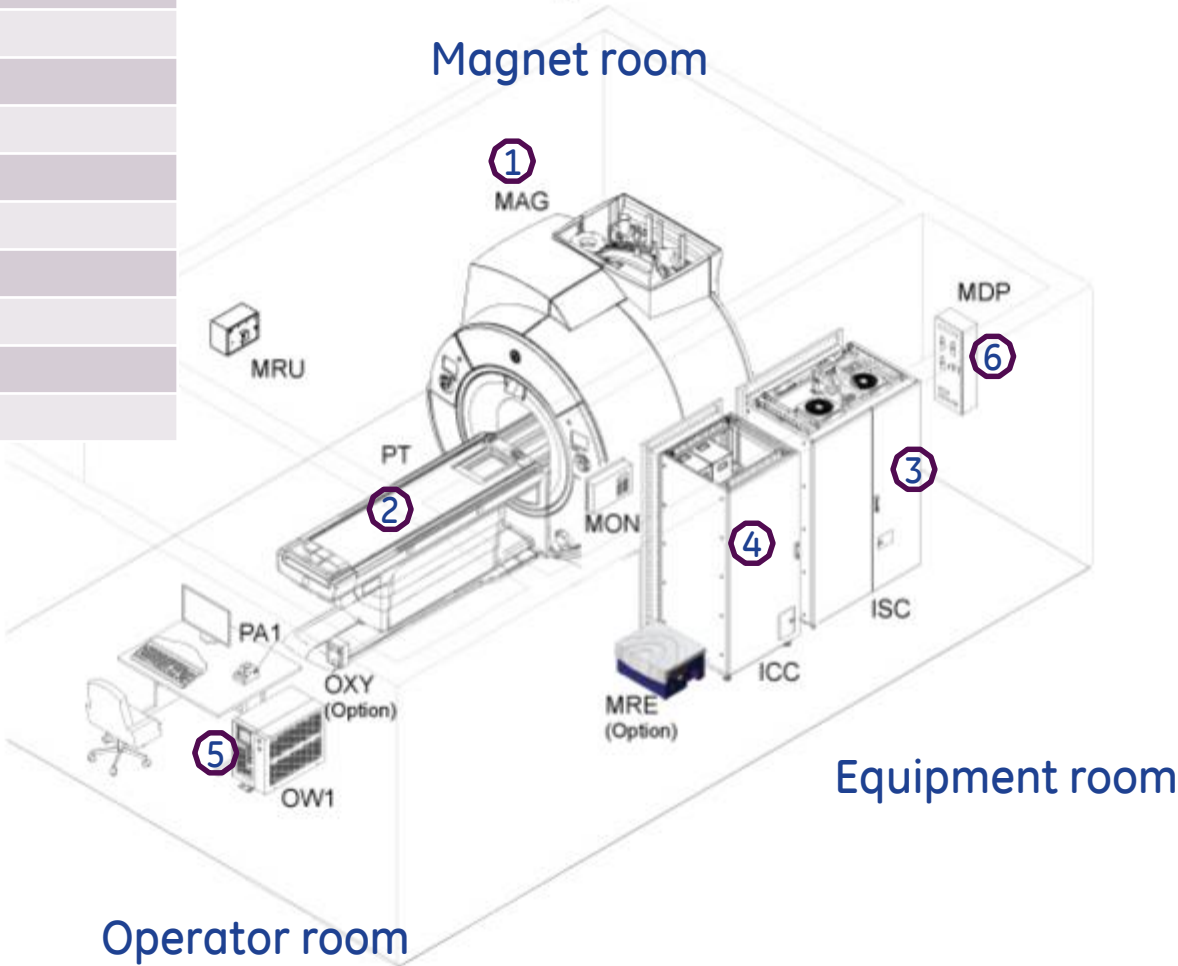


Note: The components pictures are for Pioneer, example to show system type.



Typical SIGNA Pioneer/Voyager Components

Component Designator	Description
MAG (1)	Magnet and Enclosure
ISC (3)	Integrated System Cabinet
ICC (4)	Integrated Cooling Cabinet
PT (2)	Patient Table
OC (5)	Operator Console
MON	Magnet Monitor
MRU	Magnet Rundown Unit
MDP (6)	Main Disconnect Panel
PA	Patient Alert
OXY	Oxygen Monitor
OW	Operator Workspace Equipment
MRE	Magnetic Resonance Elastography



Feature of SIGNA Pioneer/Voyager Installation

Installation of SIGNA Pioneer/Voyager has some difference with previous MR system installation.

- Most of cable are pre connected to magnet components and stored on magnet. They will be routed from magnet to Penwall panel.
- Some of the cables are banding by spiral tube. These cables can be routed together to get routing time reduction.
- Two cable options provided - long and short.
- Cabinets shall be attached to the equipment room wall opening with Mesh shield tunnel.
- Cryo. Cooler will be installed into cooling cabinet. But, power supplied separated with system.
- *! For SIGNA Pioneer, patient table shall be installed AFTER magnet ramp up and shimming. This task is NOT Mechanical install task.*
- *! For SIGNA Voyager, Patient table installation is MI task, can be installed before magnet ramping/shimming.*

The flowchart will be presented in the Installation Module (Module 2).

Safety

- High Magnetic Field
- Electrical
- Cryogenics
- Biological
- Chemical
- Lifting (Crane, Hoist, Fork lift)
- Dollies
- Mechanical Pinch Points



Note: This list includes hazards that may be encountered during an installation. They are not listed in order of importance.

High Magnet Field

- Superconducting magnets are shipped with cryogenics under pressure but without an active magnet field.
- Tools and some system equipment constructed of ferrous materials will be strongly attracted to the magnet and will become dangerous projectiles. Keep ferrous tools and equipment away from the magnet.
- Pacemakers, stents, staples, and hearing aids are examples of devices that can be affected by strong magnetic fields.
- Ferrous metal particles could be attracted to the magnet and cause future problems. Thoroughly sweep and vacuum the site to eliminate any metal particles.



Electrical

- Annual electrical safety and LOTO training is a requirement for all field service employees. Be sure your training is up-to-date.
- Bring your personal LOTO equipment with you for the installation
 - Red lock and tags
 - Yellow transition lock and tags
 - Multiple locking device
- LOTO procedures for specific equipment installations are located in the EHS documentation that accompanies the system



Cryogenics

- Cryogenics can create an asphyxiation hazard. Use proper ventilation and keep the door open when in the scan room.
- Cryogenics can cause burns. Use proper PPE: face shield, gloves, leather apron.
- Never attempt any magnet related procedure without proper training.
- Two qualified people must be present during any magnet related procedure.
- Annual MR512 Magnet & Cryogen Safety is required for all MR FEs.
 - COURSE GEHC-EHS-MR512-SAFETY



Biological

- Cleaning certain biohazards are the responsibility of the hospital housekeeping personnel.
- Maintain Hepatitis-B and Tetanus vaccinations.
- Annual Blood Borne Pathogens training is a requirement for all field service employees.



Chemical

- Phantoms shipped with MR systems may contain hazardous chemicals. These phantoms are sealed containers and should not be opened. If they break open or spill, it should be disposed of properly.



Lifting

- Improper lifting can cause back injury and strained muscles.
- Two people are required to move cabinets.
- Use hoist provided to replace heavy modules.
- Do not stand under the crane when lifting any packaging.

Dollies

Dollies are built for specific equipment.

- Two or more people are typically required to move dollies except side enclosure dolly.
- Wear safety shoes.
- Travel slowly.
- Protect the floor when moving equipment.

Mechanical Pinch Points

- Tables, Bridges, phantoms and enclosure covers can pinch or crush fingers
- Wear gloves and follow safety guidelines in the service manual



Module 2 Installation

Learning Objectives

- How to get service manuals
- How to install the component. What component should be installed on Mechanical Install.
- Detailed installation flow
- Concealment cover cutting process
- Smart label information

Overview 1

The module discusses the positioning, mounting and alignment methods for MR system components. It does not replace the system installation manuals, rather it is intended to augment and clarify installation processes and practices.

The SIGNA Pioneer/Voyager manual is used in this module, but general MR system installation steps and tasks are similar as previous products.

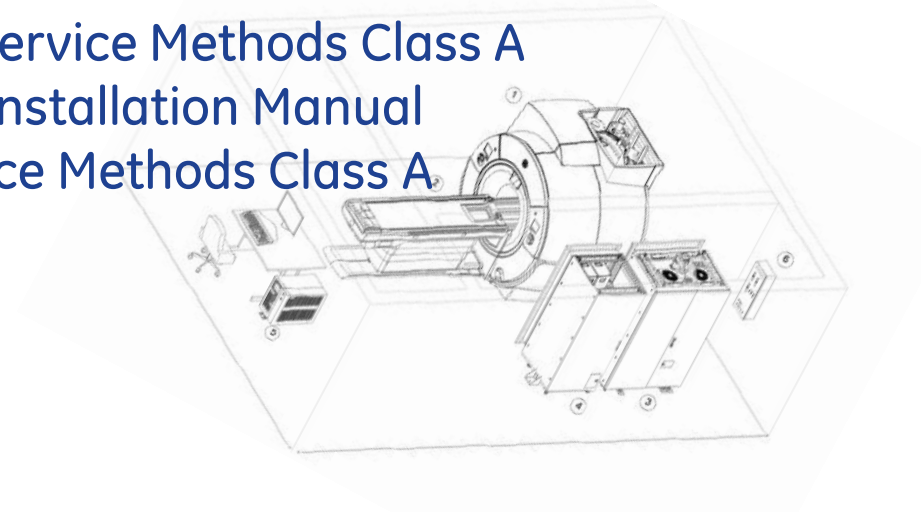
Installation manuals for MR system can be found in Common Documentation Library following link:
<http://olcweb.olc.med.ge.com:8020/servlet/ClientServletProp?REQ=Enter%20Documentation%20Library>

5680003-1EN SIGNA Pioneer 3.0T Pre-installation Manual

5680002-2EN SIGNA Pioneer 3.0T Service Methods Class A

5680008-1EN SIGNA Voyager Pre-Installation Manual

5680007-2EN SIGNA Voyager Service Methods Class A



Overview 2

Component installation is discussed in this module. Cabling will be discussed in module 3. This order was chosen to emphasize specific areas during the course. Actual installation task flow is outlined in the service documentation. Always follow the flowchart presented in the manual.

Topics covered in this module:

- Installation flowchart
- Magnet alignment process (incl. Dock frame installation)
- Mesh shield and Cabinets(incl. Cryo. Cooler compressor)
- OC
- Magnet
- Concealment frame/ cover
- Enclosures
- Patient table
- Penwall covers
- Smart label



Note: Install the magnet vent stack as soon as possible after magnet delivery. Use two clamps on top and bottom and two sheet metal screws between the clamps. Run the room ventilator any time cryogenics are being vented.

Overview 3

1. The customer must provide a shipping dock, or other staging for unloading system components, as well as access pathway to the installation site.
2. The shipper is responsible for unloading and moving all system components from the delivery truck or van to final locations in the MR suite. This includes:
 - >Door and other opening are sufficiently wide to allow passage
 - >Sufficient room is provided for any required components riggingDimension of cabinets and component is refer to Pre installation manual
3. The MR system must be shipped and stored within the environmental requirements – see next page:
 - >Some equipment is liquid cooled. After coolant is added, the equipment must be kept from freezing.

Transportation and Storage Environmental Conditions

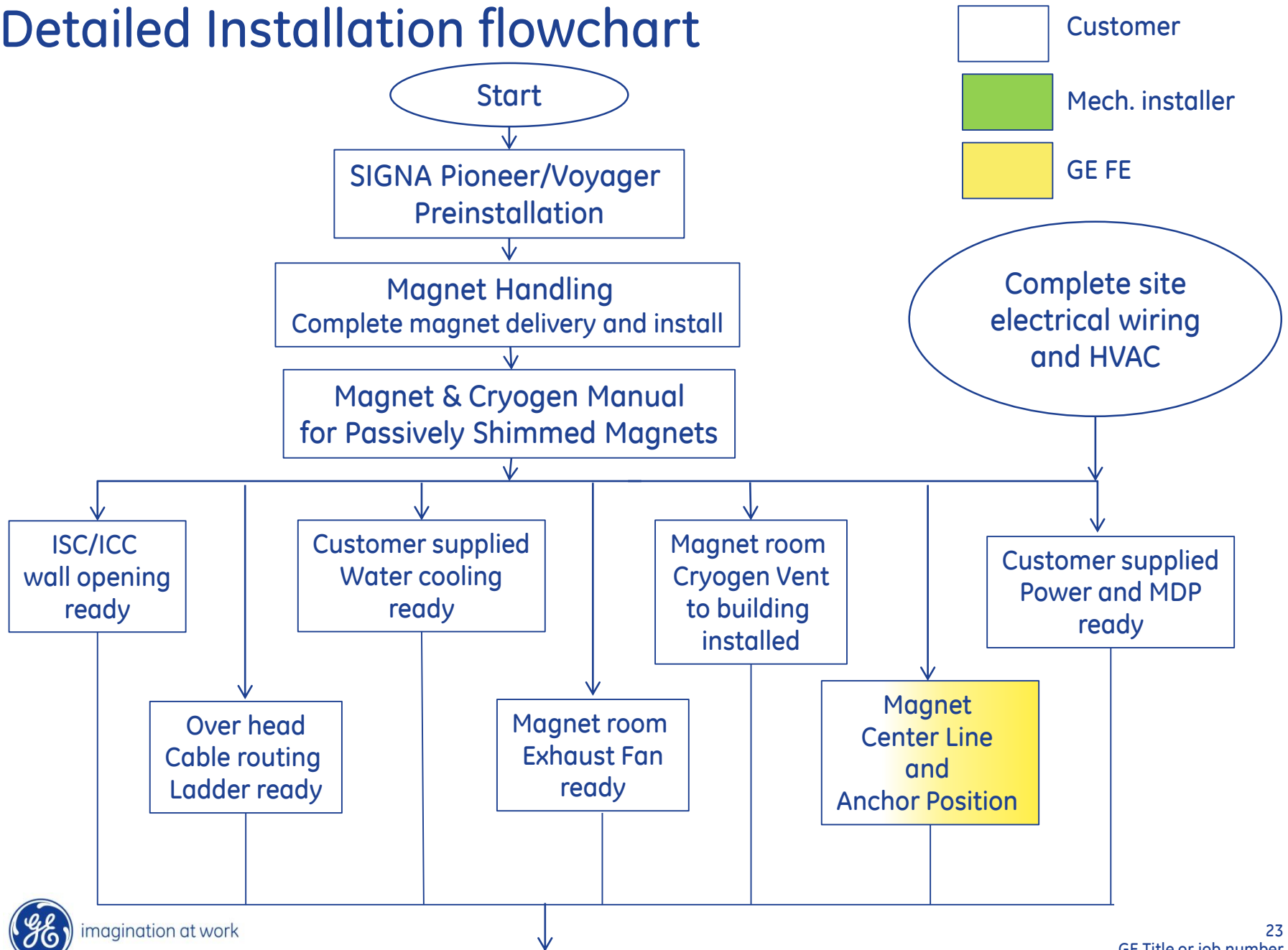
Transportation and Storage Environmental Conditions - Pioneer

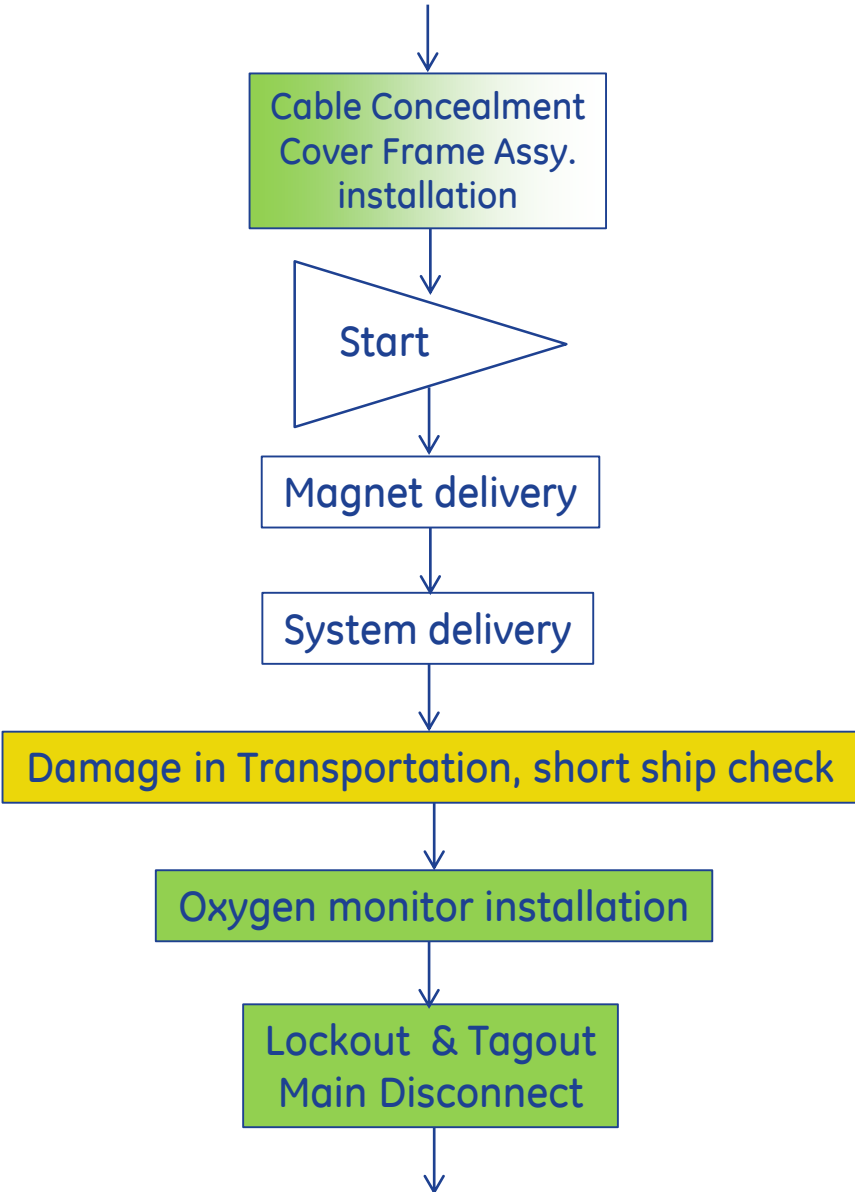
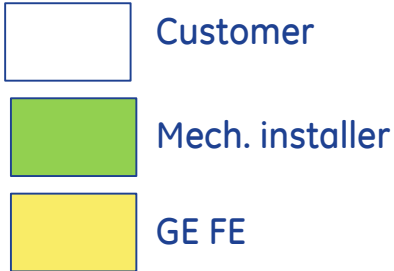
System Equipment	Temperature Range °F (°C)	Temperature Change °F/Hr (°C/Hr)	Relative Humidity %	Humidity Change %/Hr
Electronics Cabinets & equipment	-22 to 140 (-30 to 60)	68 (20)	8-90 non-condensing	30
Resonance Module	-22 to 122 (-30 to 50)	68 (20)	5-95 non-condensing	30
Surface Coil	-22 to 122 (-30 to 50)	68 (20)	10-95 non-condensing	30

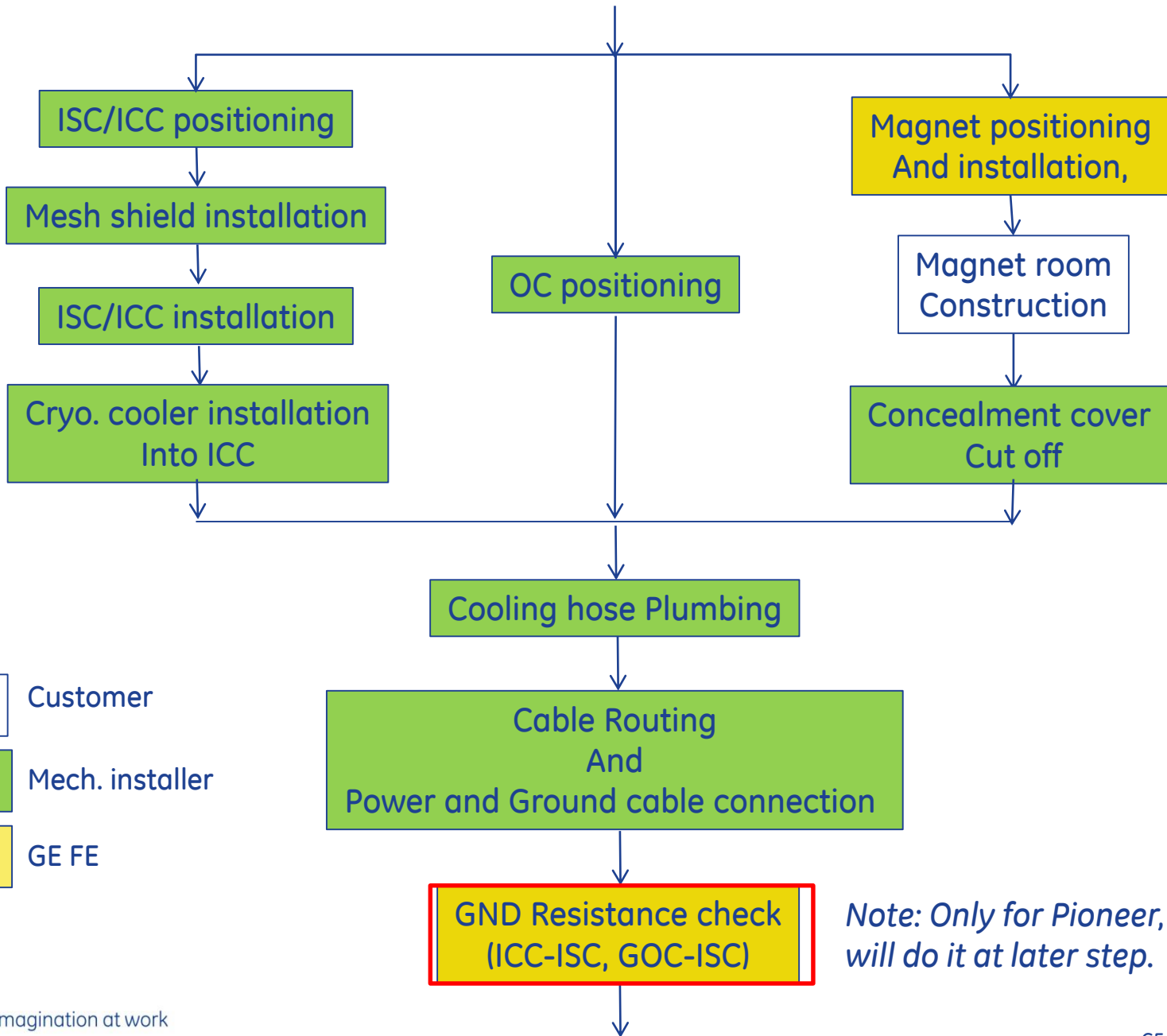
Transportation and Storage Environmental Conditions - Voyager

System Equipment	Temperature Range °F (°C)	Temperature Change °F/Hr (°C/Hr)	Relative Humidity %	Humidity Change %/Hr	Atmospheric Pressure/hPa
Electronics Cabinets & equipment	-22 to 140(-30 to 60)	68 (20)	10-90 non-condensing	30	1060-500
Resonance Module	-22 to 122(-30 to 50)	68 (20)	5-95 non-condensing	30	1012-525
Surface Coil	5 to 131(-15 to 55)	68 (20)	20-95 non-condensing	30	1013-860

Detailed Installation flowchart

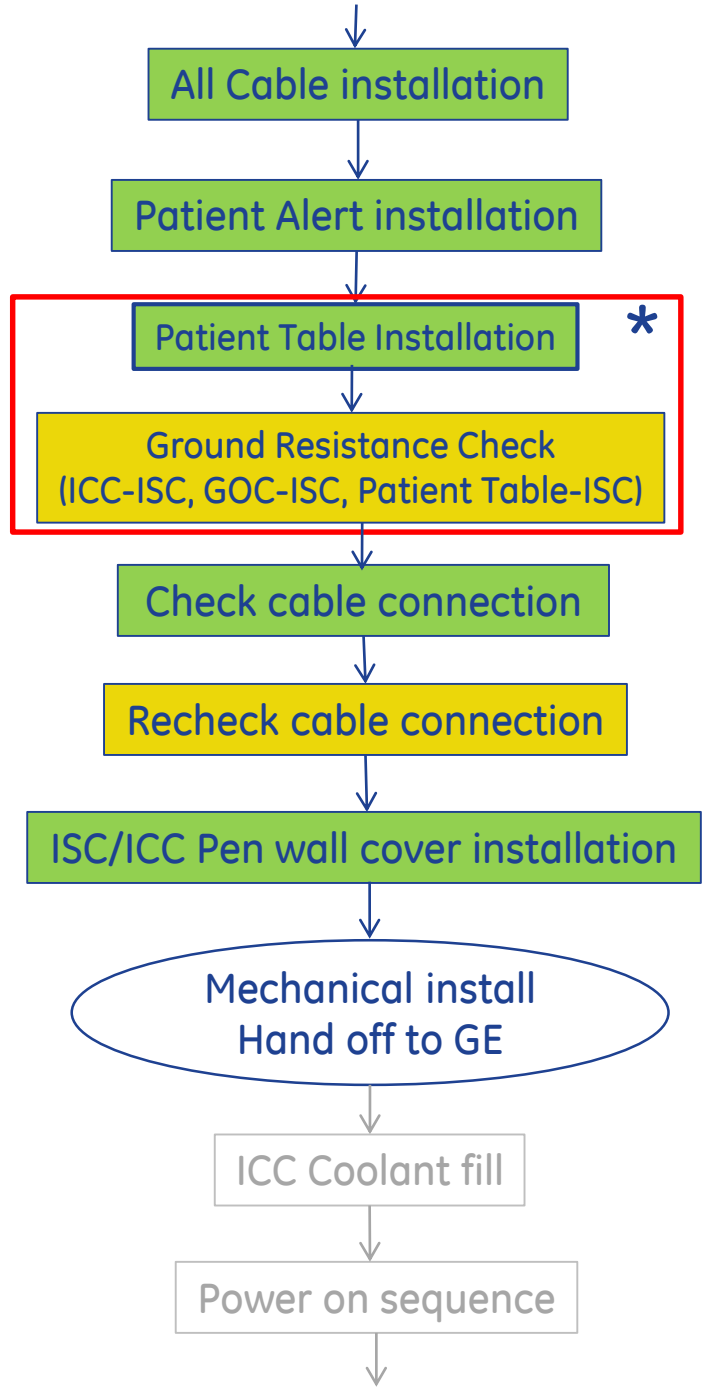






- Customer
- Mech. installer
- GE FE

Note: Only for Pioneer, Voyager will do it at later step.



- Customer
- Mech. installer
- GE FE

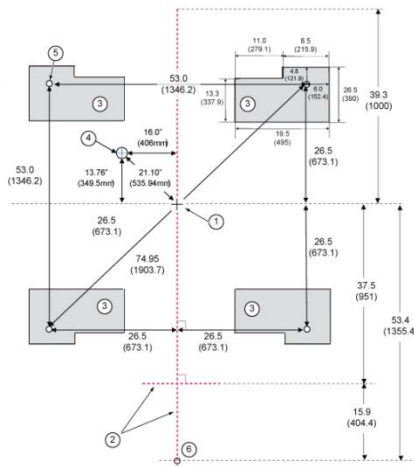
Note: Only for Voyager

Magnet and Dock Frame Position (Refer to Chapter2)

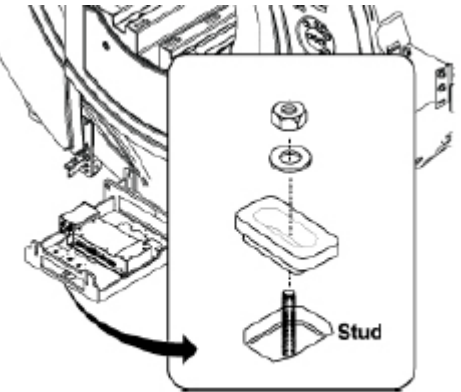
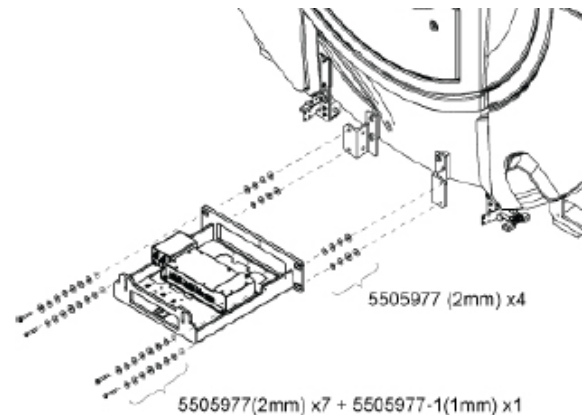
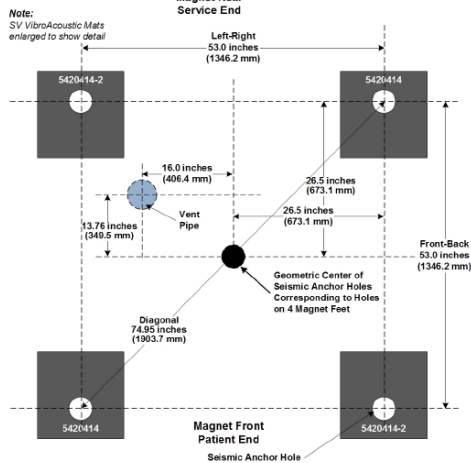
This task is not MI task. RF vender will take this.

Magnet and dock frame positioning process is changed from previous product. Magnet alignment line is drawn on the magnet room floor and anchor hole will be prepared BEFORE Magnet delivery. Magnet has to be positioned refer the line.

For Pioneer



For Voyager



Mesh Shield and MR Cabinets

(Chapter4 cabinet installation)

SIGNA Pioneer & Voyager have Two of major cabinets. They are installed to equipment room wall directory by Mesh Shield Tunnel. Integrated System Cabinet(ISC) and Integrated Cooling Cabinet(ICC). The two cabinets have some modules inside the cabinet as following:

- Integrated System Cabinet(ISC) – This is a dual bay cabinet. RF amplifier, Gradient amplifier, Gradient Power supply and Power monitor are left side. And PDU, ICE, DC Power supply and VRE are Right side. Mainly this cabinet controls the MR Scanner.
- Integrated Cooling Cabinet(ICC) – This is a single bay cabinet. This cabinet has all of cooling module of MR system inside; Cryo. cooler compressor, Gradient Cooling Unit, Cabinet Cooling Unit, Patient Blower, Body Coil Blower and Control Box.

Mesh Shield

Mesh shield is made with a mesh of copper, and they're weak in damage. When a big hole opens at mesh, it influences the shield performance. Be careful about handling.

Mesh shield installation is the first step.
And attach the cabinet to mesh shield
Frame is second step.



ISC/ICC

Positioning of cabinets is critical for installation cables, hoses and also post- installation operation. Refer to architectural site layout for:

- Location of ISC/ICC cabinet and related service foot print
- ISC/ICC position will be critical related to Mesh shield Tunnel
- Seismic anchoring (where required)



Caution: Equipment room cabinets must not be installed in an area with a high magnetic field. Refer to site layout plans for positioning of cabinets.



Warning: DUE TO WEIGHT OF CABINETS, AT LEAST TWO PEOPLE ARE REQUIRED TO MOVE ANY CABINET.



Hoist bar supporting material will be installed when service operation at post -installation. Do not make cross the cables upper the cabinet.

Cabling will be covered in Module3



ICC (refer to 4-3 ICC Installation in installation manual)

This cabinet contains cooling unit for cooling water, but is shipped with water is empty in the cooling unit. ICC will be delivered with ISC and magnet normally. ICC cabinet has casters to move to install.

And ICC package has a slope to down from pallet.

Do not handle by only One person, it is 350kg.

ICC is installed to penwall and attached to mesh shield at equipment room.

Cryo. cooler compressor will be installed into ICC.



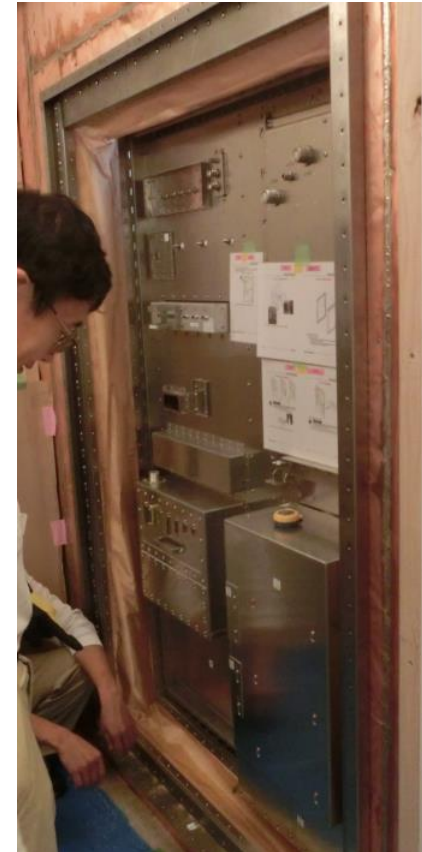
ISC (refer to 4-2 ISC Installation in installation manual)

ISC is a very heavy cabinet about 1.2tons. Don't move the cabinet by only One person. It will be needed two people at minimum.

And need rigger help unpacking and lift the cabinet when the ISC delivery. Or you can use cabinet dolly to down from pallet.

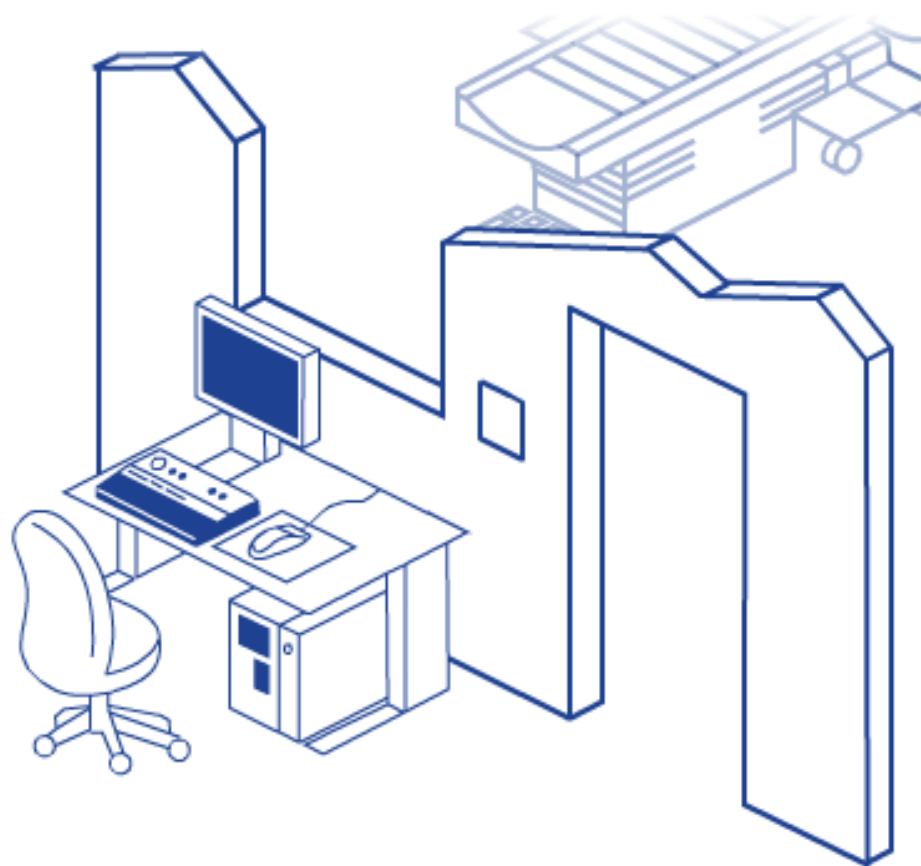
ISC has caster also to move on the ground.
ISC will be installed to penwall and attached to mesh shield too.

When push/pull process of cabinet
Don't push the center of cover. There are no frame. Please push frame
Position.



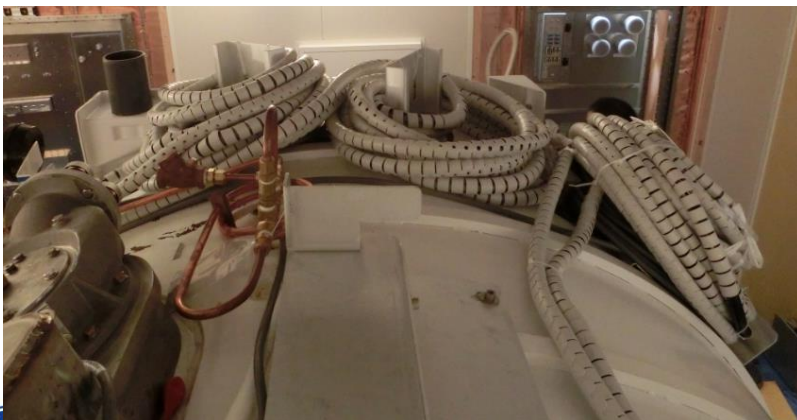
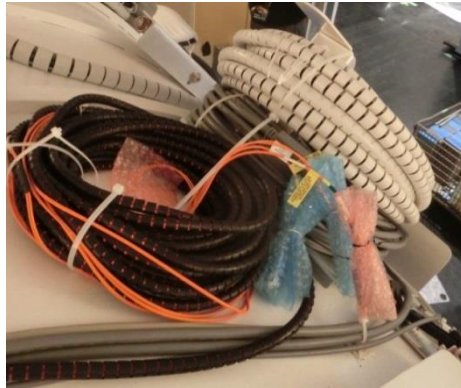
OC (refer to 3-1.2.2 GOC in installation manual)

The operator workspace consists of a Global Operator Console (GOC) and I/O devices such as a mouse, keyboard, and monitor. The GOC contains the host computer and communication links to the system. The main considerations when installing the workspace components are the operator's view of the patient and that the system cables reach the workspace area.



Magnet (Refer to 1-1.12.2 Magnet installation)

Magnet will be delivered with Pre attach cables, Enclosure and Heat exchanger. Need to take care of these material to prevent damaging during transportation. Several warning label will be stuck for caring point.



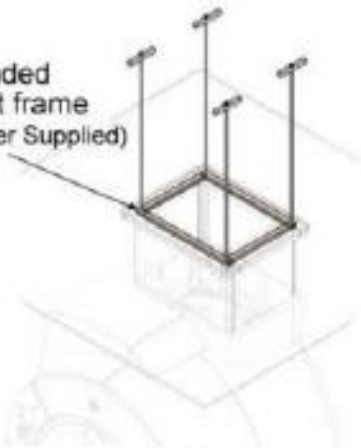
Concealment Cover Frame

Before the Magnet ramp up, Concealment cover frame should be installed.

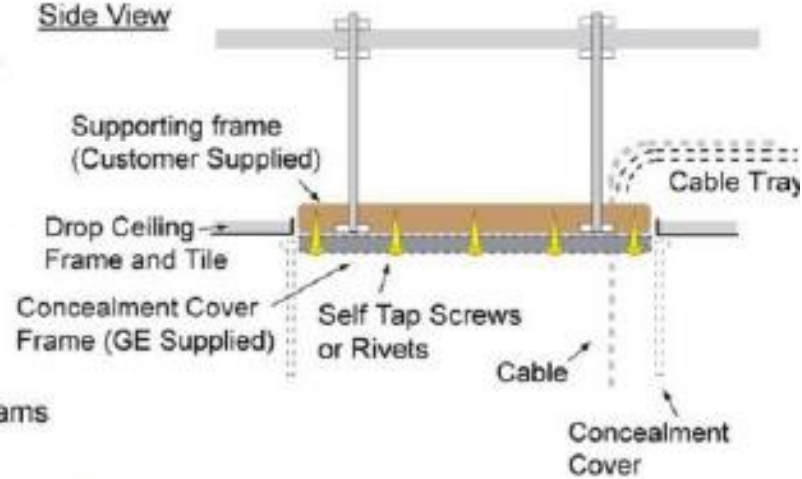


Example

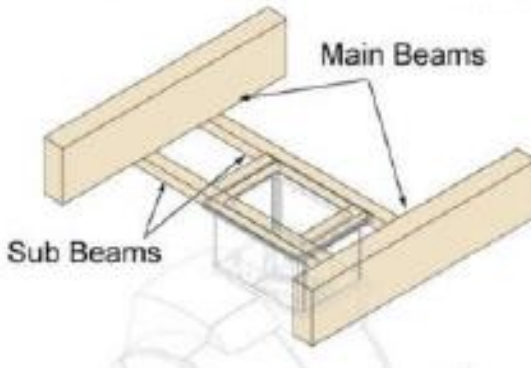
- 1 Suspended Support frame (Customer Supplied)



Side View

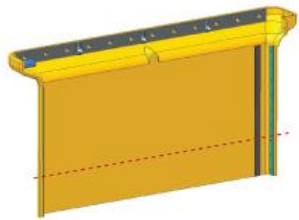


- 2

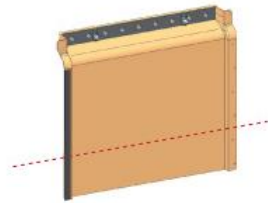


Concealment cover

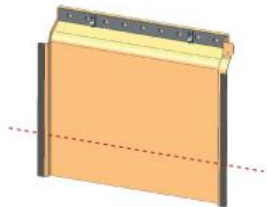
GE FE will install the concealment cover after ramp up the magnet. But, Mechanical installer should cut off the Concealment Cover to fit the room ceiling.



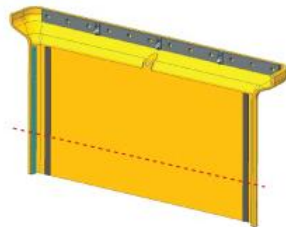
5599434: Chimney Cover Front ASSY



5599437: Chimney Cover Left ASSY



5599436: Chimney Cover Right ASSY



5599435: Chimney Cover Rear ASSY

Room height (mm)	CUT Dimension (mm)	Tolerance (mm)
3000	0	-
2900	100	+20/-10
2800	200	+20/-10
2700	300	+20/-10
2600	400	+20/-10
2500	500	



Enclosures (After magnet shimming task GE FE will do the installation)

Several magnet enclosure cover will be installed at manufacturing. After Cabling all side enclosures can be installed.

Front endbell and bridge will be removed when magnet ramping up and shimming process.



Only for Pioneer, MI Task in Voyager

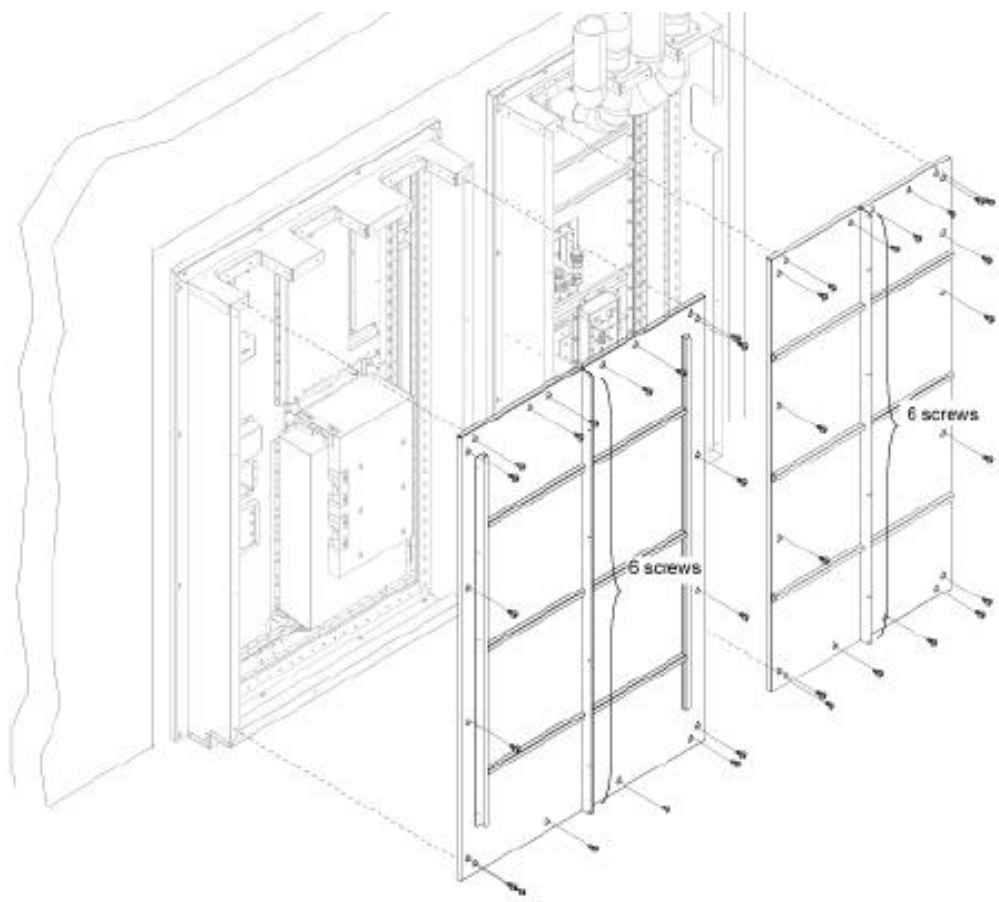
Patient Table (Patient Table installation task will be taken by GEFE)

Patient table has pre attach cable front lower end. Cables should be taken care of damage during Transportation. **Patient table it self should be installed at front of Magnet AFTER magnet shimming was complete.**



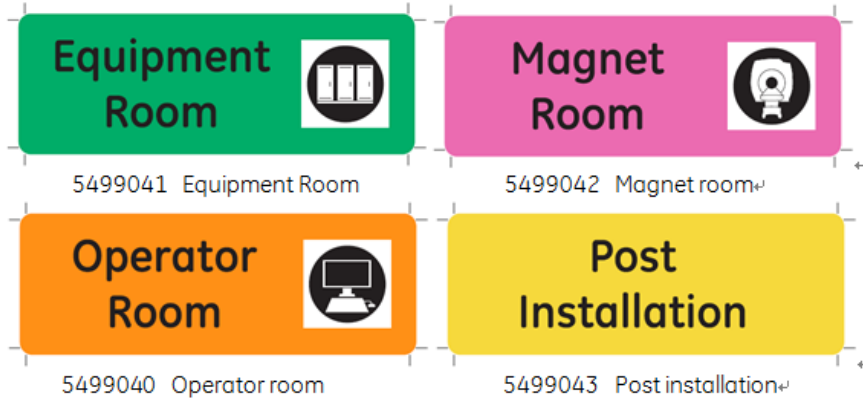
Penwall cover (Chapter 8 of installation manual)

After cabling is finished, Penwall covers should be installed on ISC PW and ICC PW.

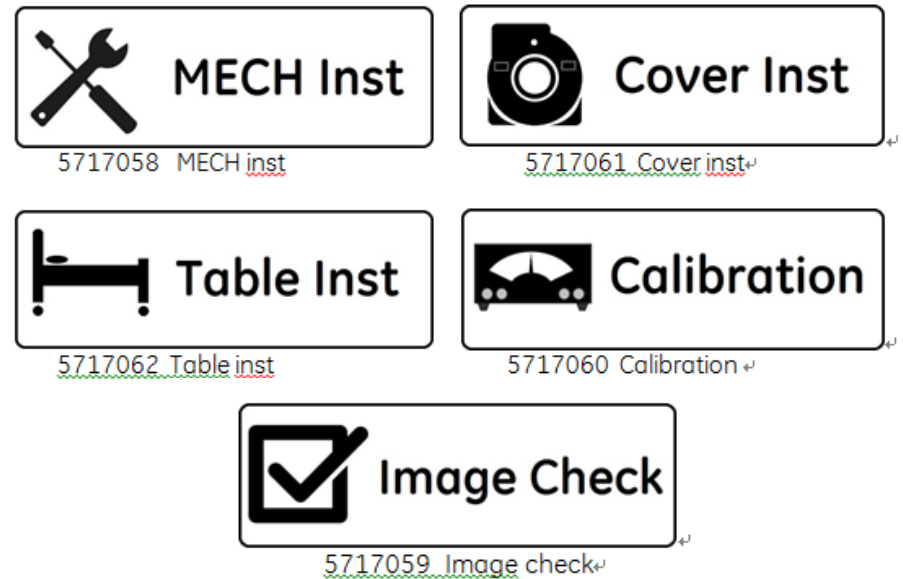


Smart Label (refer to 1.7.2 in installation manual)

Package of SIGNA Pioneer/Voyager has smart label. It will tell to FE when and where the package will be used. At delivery timing you can sort the packaging referring to the label.



Where Label



When Label

Summary

- The installation manuals for MR systems are found at common document liberally.
- Magnet alignment process and dock frame installation anchor hole process
- Cabinets should be installed with mesh shield
- Cryo. Cooler compressor is installed into ICC.
- Cabinet top needs space for Hoist tool.
- Need to take care of pre attached cable and materials to prevent damage during transportation
- Concealment cover is needed to cut for fitting to room ceiling.
- After cabling ISC/ICC PW will be covered.
- Smart label shows when and where the package will be used.

Module 3 Cabling

Learning objective

- Identify, Cable color coding.
- Identify, Pre attached Cables Technique
- Identify, Grouping cable Technique
- Excess cable storing technique and example
- Recognize damaged cable and connector

Overview

During MR installations, many tasks involve positioning and terminating interconnecting cables and tubing. Running stiff, heavy cables through overhead cable trays requires extra attention to ergonomic and ladder hazards.

Cable Overview (Common)

- Cable Types
- Cabling Guide
- Techniques
- Safety
- Excess cable storing
- Cables and Cooling hose routing

Cable types

MR systems installations use a wide variety of interconnection tubes and cables to transfer power, cooling and signals. This module discusses techniques and hazards associated with each, along with tips and suggestions to make the work simpler and safer.

Types of interconnects installed in MR systems:

Media	Carries	Installing	termination
Helium lines	He Gas	Stiff, abrasive	Fixed length
Gradient cables	Electrical	Stiff, Heavy	Fixed length (Two length)
RF Coaxial cables	Electrical	easily damaged, can be stiff	Fixed length
Coolant lines	water	Heavy, Easy damaged	Cut to length, Site terminated
Air hose	Air	Stiff	Cut to length, Site terminated
Signal	Electrical Fiber optical	small diameter, easy damaged	Fixed length, Pre-terminated
Power/ Ground	Electrical	Heavy	Fixed length, Pre-terminated

Grouping cable; Some signal cables are banding by spiral tube. It can be reduced cable routing time.

Cabling Guide (Refer to chapter 6 and 7)

This is the general step for interconnecting the SIGNA Pioneer/Voyager System. Cabling order will be changed site dependency.

1. Equipment room side

- Pull equipment room cables and sort ISC-ICC, ISC -OW1 and ICC -OW1
- Pull power cables, signal cables and water hoses in the place
- F/O cable should be pulled last time to void damage.
- Connect Power cables and Ground cables
- Measure Ground resistance between MDP-ISC, ISC -ICC and ISC-OW1
- Connect signal cables and water hose. Set up and install F-50 compressor into ICC.
- Verify all cable connection

2. Scan room side

- Pull scan room cables and sort. Grouping cable at Magnet side is already sorting. Remove pre attach cable bracket during cable routing from magnet.
- *For Pioneer, cables to Table I/F will be connected after magnet ramp up and shimming. For Voyager, they can be connected before.* These cables has to be secured from any damage. Use air cap or some appropriate material for this.
- Connect Ground cable to magnet and measure the resistance.
- Route and connect RF cable, Gradient cable and Air/Water hoses.
- Connect all of signal cable ISC/ICC side and Magnet side if applicable.



Technique

Before being to cable an area or component, unpack and sort all of the cables for the operation. Magnet room cables and hoses are generally run from magnet to the penwall panels. Most of magnet room cables are grouped and pre attached on the magnet. Those cables are already sorted. Think out the storage solution before running cables upper cable rack, side by penwall panel ..etc. Basically, SIGNA Pioneer and Voyager system that have no under-floor space.

All cable has color code which means to connected the which component as following:

Color code	Component
Brown	OW1
Yellow	ISC
Yellow/Green	ICC
Green/ Red	MAGMON
Orange/Greed	F-50 CRY
Blue/Red	Magnet side elec.
Blue/Orange	Magnet Cryo. I/F
Blue/Green	Patient Table

Excess cables can be stored on cable rack , side of penwall.
Refer to photo of Page 53.

Technique

Before starting to cable equipment room side, it is better to sort ISC-ICC cables and ISC/ICC to OW1. If ISC and ICC is not side by side ISC to OW1, ICC to OW1 are separately sorting will be better. Cables have color code and it will help to sort.

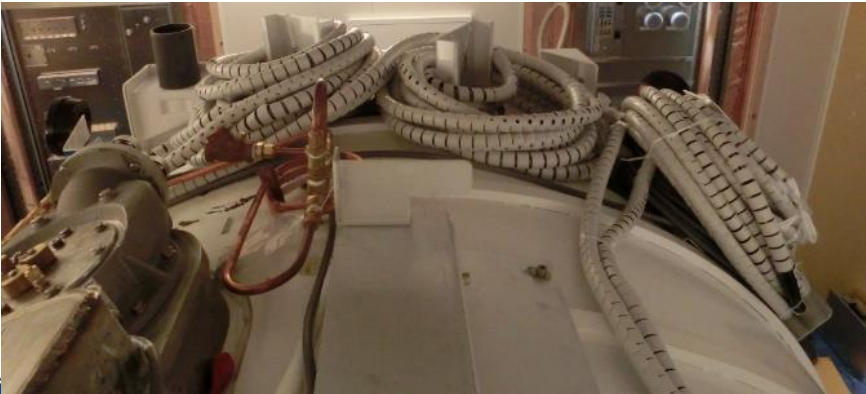
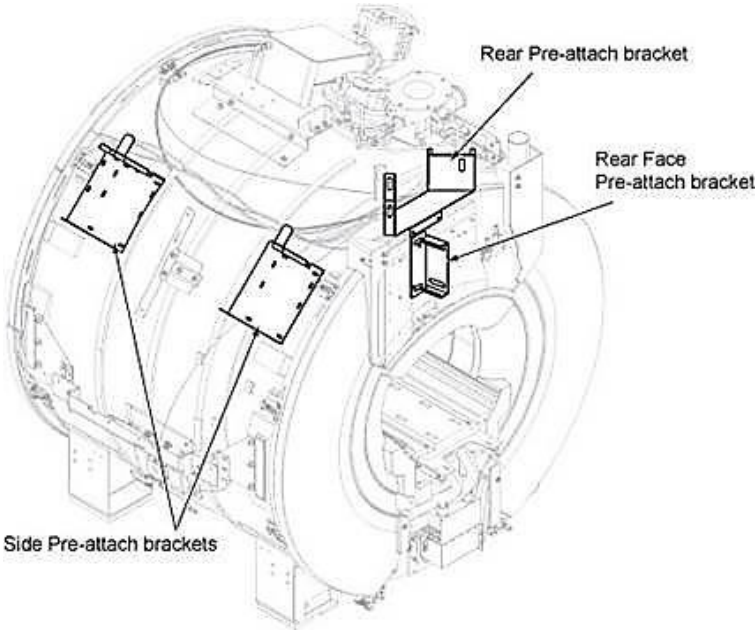
There are two of grouping cables for ISC to OW1 and ICC to OW1. ICC to OW1 is fiber optic cables banding. It should be first routing. Second routing is ISC to OW1 will be better.

Before connecting all connectors, think out to secure and path way to the interface of component.

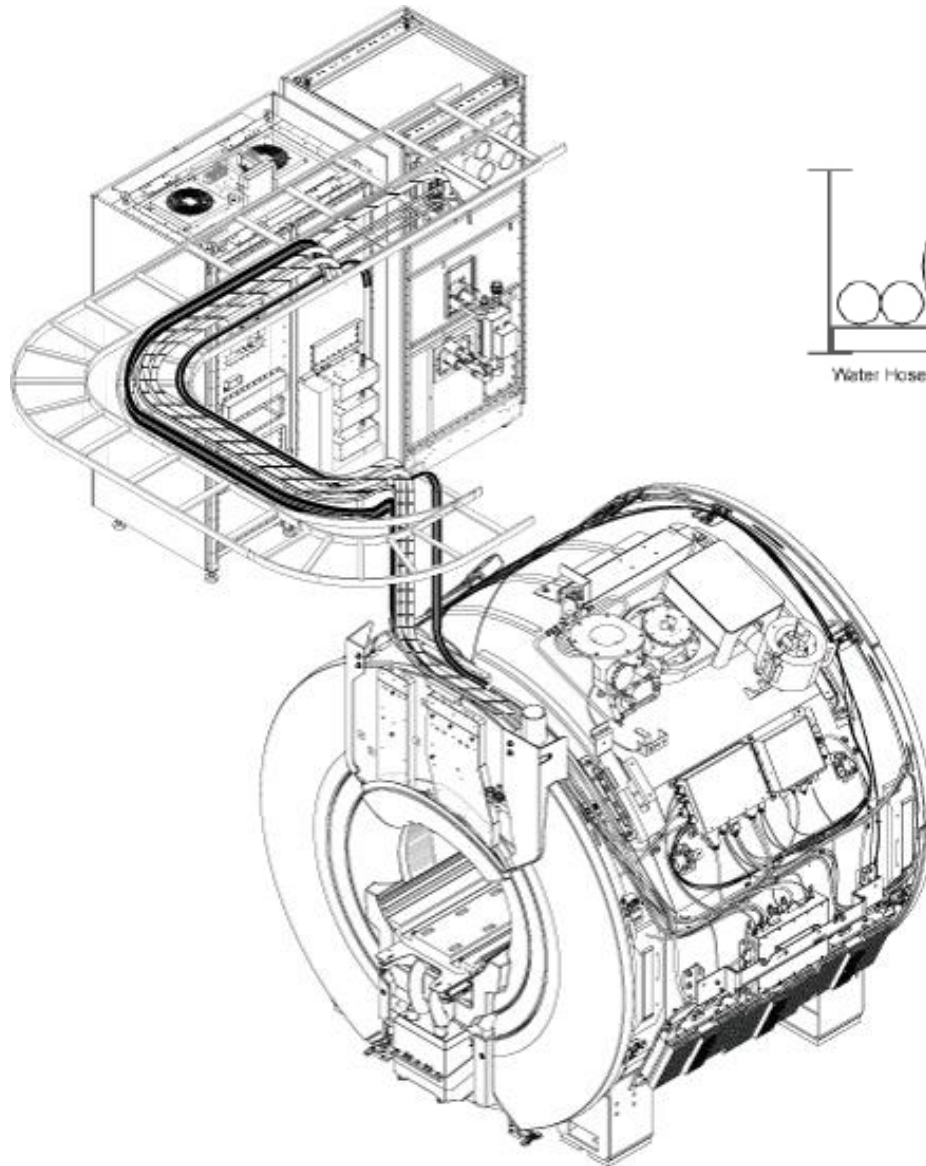
Use tie-wraps to secure cables neatly and safety. Always cut ends flush with the buckle to prevent injury.

Pre attach cables

Most cables of scan room side are pre attached on the magnet. Pull the grouping cables and route after removing them from pre-attach bracket.

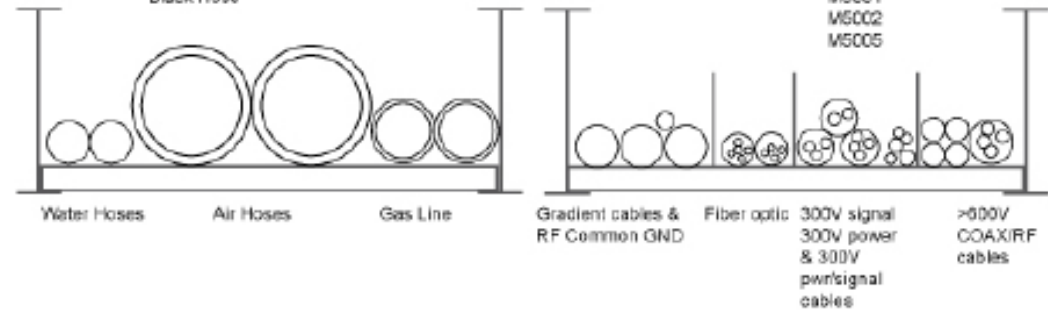


Electronic cables routing and connection



621 Cold Head gas line
 622 Cold Head gas line
 4Inch Air Supply - VRMA
 4Inch Air Supply - Patient Air
 Blue Hose
 Black Hose

M3317	P5001	624	M5003
M3318	M5005	M3023	M5004
M3319		M3022	M1305
M4005		M3339	M1350
		M3391	M1351
		M5001	
		M5002	
		M5005	

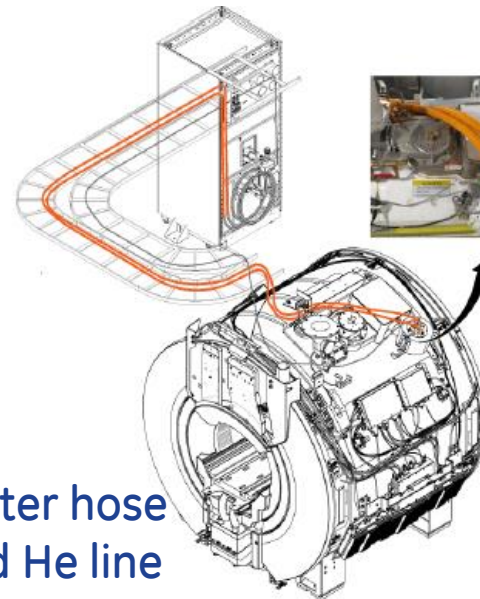
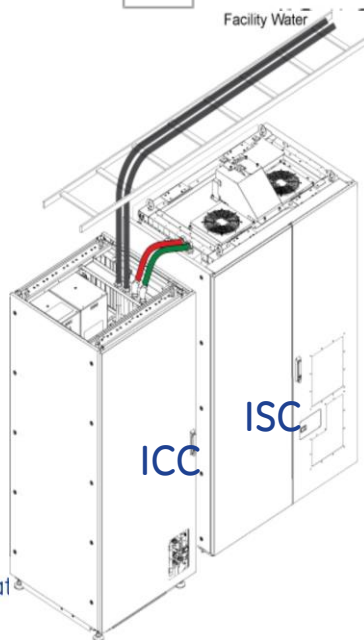
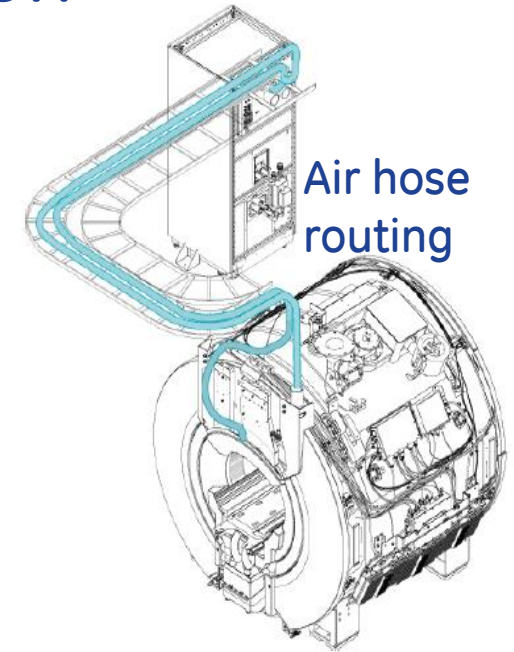
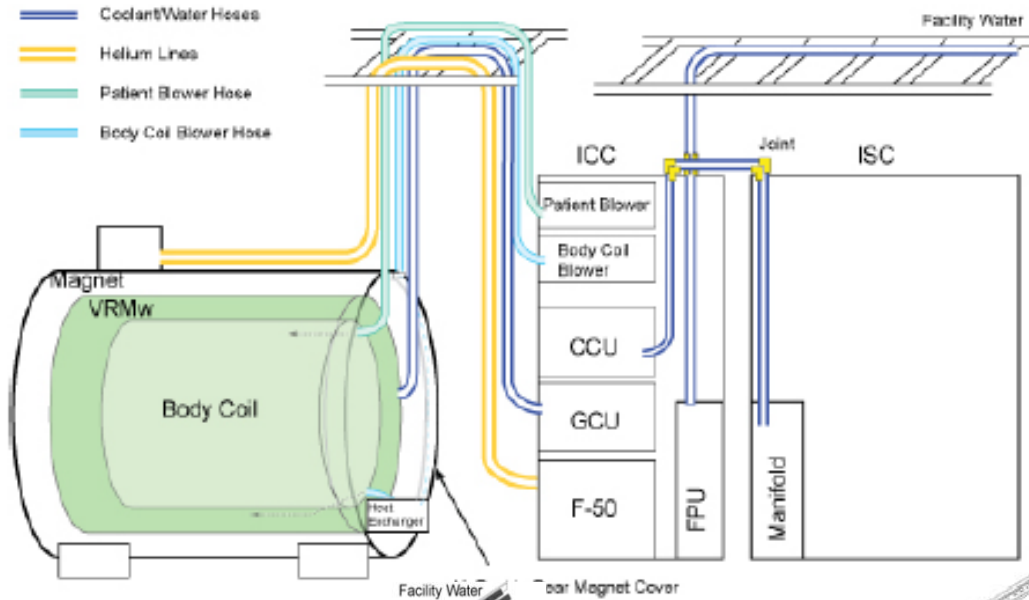


Scan Room Cable Tray Cross Section View.

Refer to example photo Page 53 for excess cables management



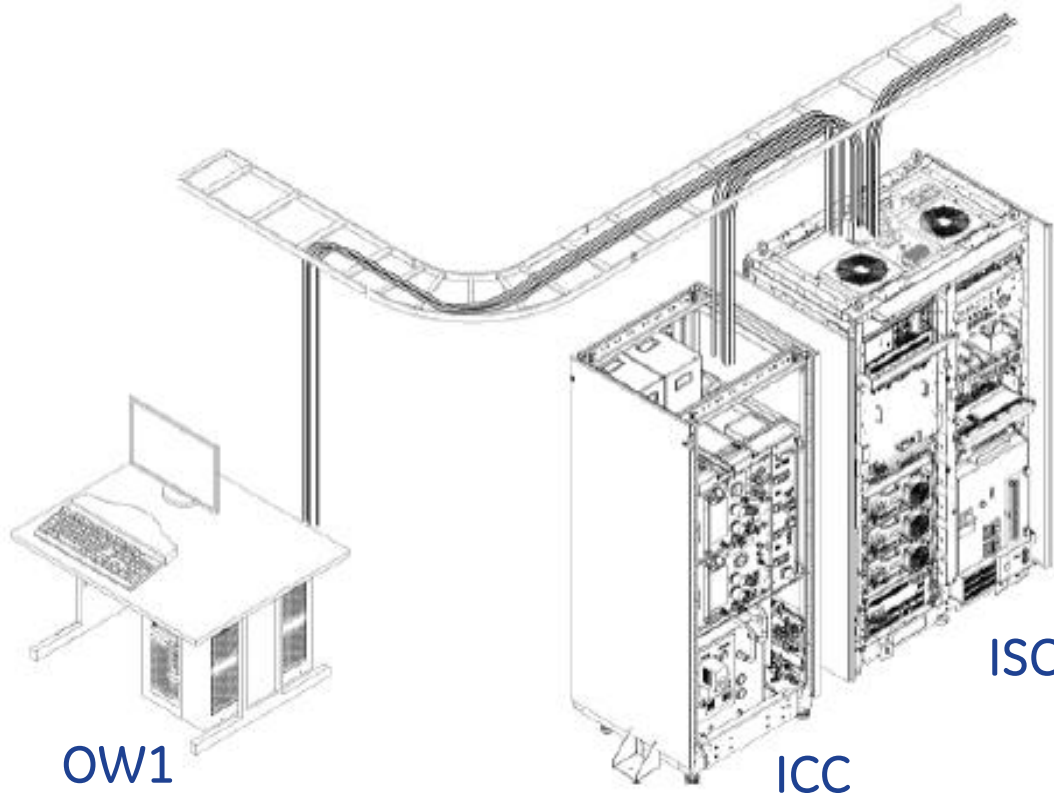
Cooling hose routing and connection



Excess He Line

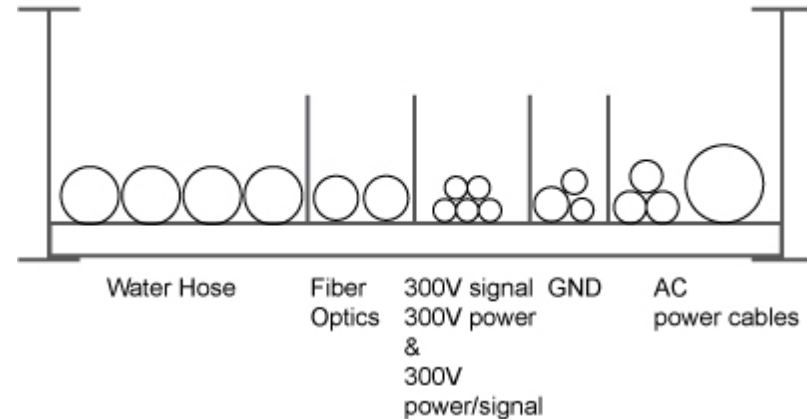


Electronic cable routing and connection Equipment room and OW1

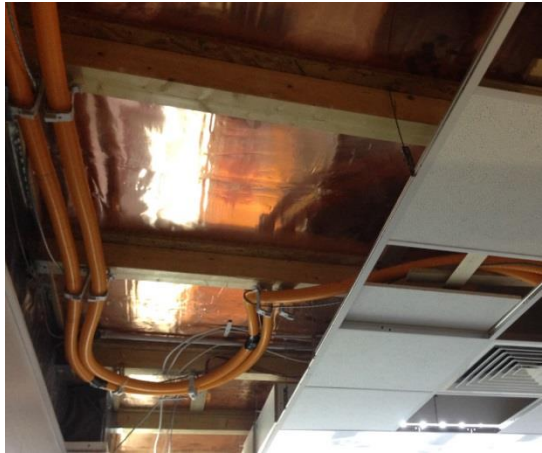


Equipment Room Cable Tray Cross Section View

	E3014	E****
Red Hose	E3020	E0003
Green Hose	E3041	E4007
Facility water supply	E5001	E4008
Facility water Return	E5002	MDP-ISC
		E0009
		E0010



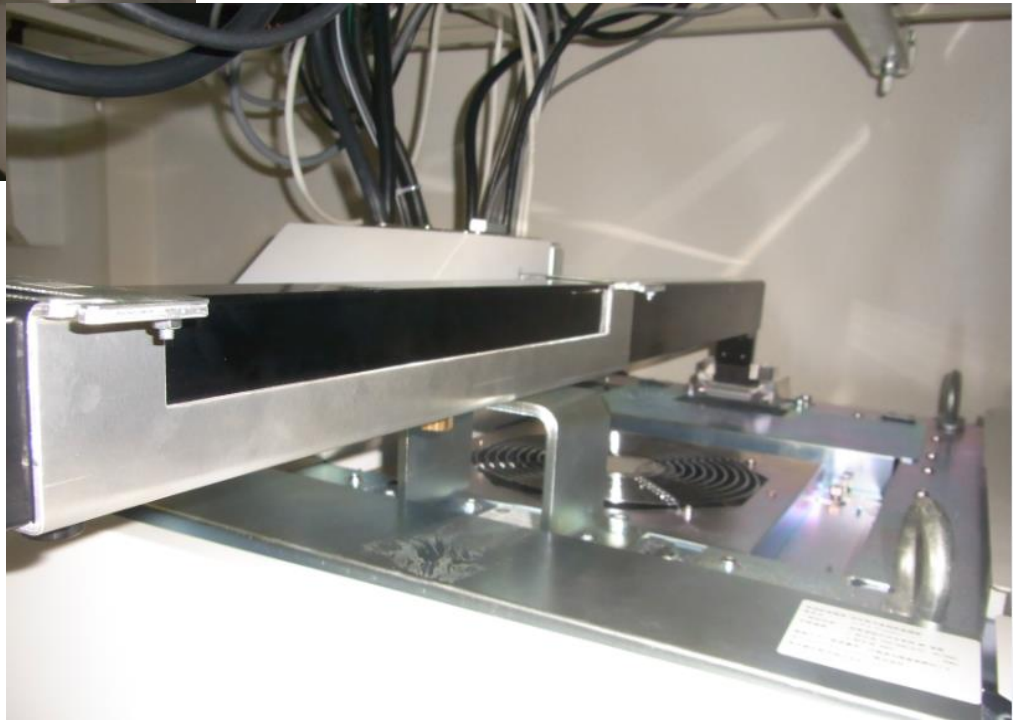
Example of Excess Cable Storage



Example of scan room



Example of Equipment room



Safety

As with all installations, there are risks associated with specific tasks to be performed. Read all Safety Risk Assessments (SRA) associated with the installation tasks before beginning to become familiar with precautions needed to proceed safely. MR systems with overhead cable platforms have additional risks because work is performed on ladders and some cables are heavy. SRA #87 specifically addresses overhead cable installation.

▶ PPE

- Safety shoes, gloves and arm covering should be worn for pulling cables. Use knee-pads when kneeling on the floor. When working on overhead cable trays, wear safety glasses - a hardhat is strongly recommended.



Caution: Cable trays and ceiling grid/obstructions have the potential for sharp contact points on upper torso, extremities and face - maintain situational awareness

▶ Ladders

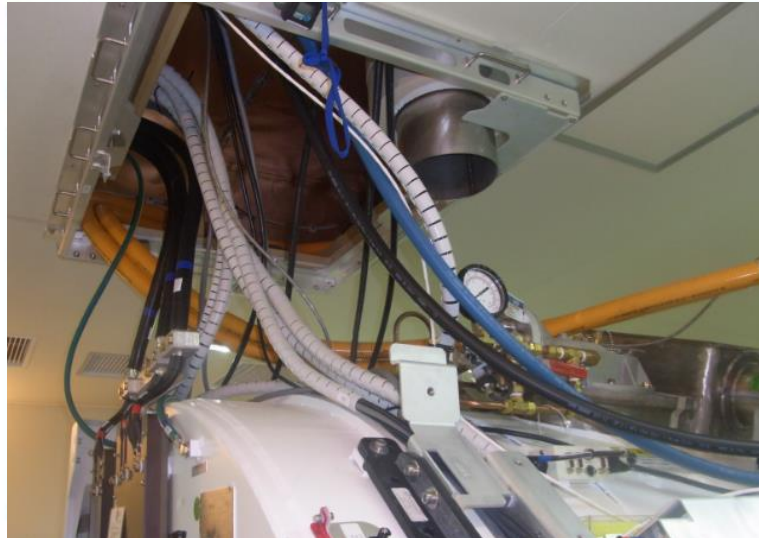
- Routing and terminating cables on the upper parts of the magnet and pulling cables through overhead cable trays will require ladders or working platform. Company or customer provided ladder may be used, but they must be fiberglass (ANSI A14.5) and be type IAA or IA (can support a minimum of 300 lbs). Most MR installations are sold with a GE service platform. This magnet service platform and certified ladders are the only service platforms that may be used.

Helium Lines

Helium lines are insulated braided stainless steel. They carry high pressure chilled helium gas between the shield cooler compressor and the magnet cold head. The ends are terminated with Aeroquip fittings that automatically seal when disconnected. They require special wrenches.

Wear gloves when handling helium lines to avoid puncturing or tearing hands on the stainless steel braiding. Although not particularly heavy, these lines are stiff and awkward to route. They can be damaged by crimping or bending around a radius of less than 6 inches. To avoid white pixel artifacts, they are usually covered during installation with a plastic corrugated sheath making them difficult to push or pull through cable troughs.

Helium lines should be in-place prior to main cabling activities.



Pioneer Cold head
-left/right open to shield

Voyager Cold head
-up/down open the shield



Gradient Cables and Filters

Gradient cables are basically fixed length cable and it is delivered with terminated. There are two length option when order the cables (Long and short). Gradient cables include the cables for X, Y and Z axis, which are routed between Magnet and Gradient filters at ISC penwall.

Gradient cable accessory kits are included in Gradient Cable Assembly (5554904 Rev2 or 5554906 Rev2) that shipped with the system, with this kit, gradient cable can be cut for the sites where there is no storage space for excess gradient cable.

When tightening the Gradient cables at Gradient filters, use 8 inch adjustable wrench and stop tightening when white block insulator start rotating.



RF cables

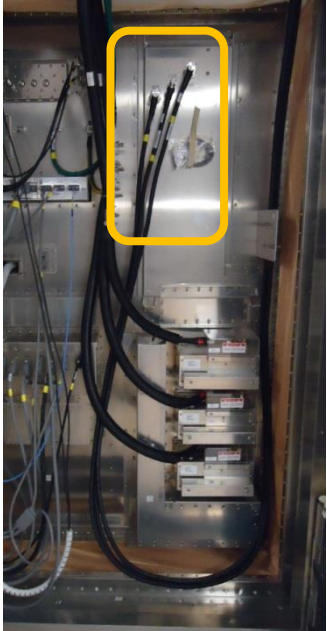
RF coaxial cables carry radio frequency signals from the RF amplifier in the ISC to RF coil in the magnet(for both Pioneer and Voyager) and Table interface (**ONLY for Pioneer**). All RF cables are delivered with terminated on SIGNA Pioneer/Voyager system.

High power transmit RF coaxial cables are stiff and should not be flexed excessively. They have a minimum bend radius of six inches and will be unusable if pinched or crimped.

One high power transmit cable is routed to Table I/F. (**ONLY for Pioneer**)



3 cables in Pioneer (2 body + head) and 2 cables in Voyager (body + head)

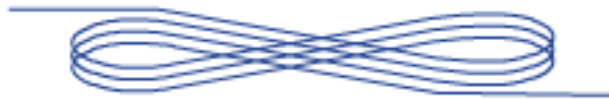


Signal cable

Copper signal cables, including network Connectivity are routed separately from high Energy cable such as Power, RF and Gradient.

Proper storage of Excess cables

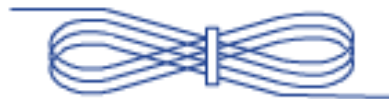
- Check all cables for damage.
- Use standard storage techniques for excess.



Excessive cable to be stored in cable trough must be routed in a "Figure Eight" pattern as shown. DO NOT COIL IN CIRCLES!



Dress and ty-wrap ends of looped cable.



Dress and ty-wrap middle of looped cable.

Summary

- Cables are marked with color code and identifying label to help you identify the room and components to which they attach.
- Most cables of magnet side are pre attached on magnet and some cables are bundled to reduce cable routing time.
- Gradient cables are heavy and require a minimum of two people for routing. Those cable are not pre attached on magnet.
- RF coaxial cables are stiff. Need to routed with minimum bent. RF coaxial cables are not pre attached, too.
- High power cables and signal cables have to be separately sitting.
- Can be used penwall side and on the cable rack for storing excess cables.

Appendix: Tools

These tool may be used in installation work..



Warning: Ferrous Material Hazard! If magnet is energized, tools and parts required for this installation that contain ferrous material and will be strongly attracted to magnet and may become dangerous projectiles. Keep all ferrous tools at least 10 feet away from the magnet.



Note: For complete list of tools see the Installation Manual.

ITEM	GE PART NUMBER	DESCRIPTION	X
1	---	Ramp for removing cabinets from pallets for International shipments (See Note 1)	
2	---	Wrecking bar	
3	---	Claw hammer, 3/4 lb.	
4	46-271138G1	Restricted Access Control Kit. Contains two plastic warning signs for posting at site during installation	
5		Aluminum platform ladder, 47.5 inches (1208.5mm) (See Note 1)	
6		Gradient Cable Crimper, Thomas & Betis TBM5 Gradient Cable Cutter, Greenlee 45207	
7	46-320273G3 or G4	Non-Magnetic Tool Kit - Universal (See Note 2)	
8	46-301450G1	Fiber optic connector repair kit (See Note 2)	
9	46-198094P1	Wrist grounding strap	
10	---	Volt Meter	
11	---	Extension cords, with ground conductor	
12	---	Power strip, grounded type, with minimum of five outlets	
13	---	Plastic or aluminum flashlight	
14	---	Assorted crimp tools	
15	---	Non-magnetic level, 2 foot length minimum	
16	---	Non-magnetic tape rule, 12 ft	
17	---	Assorted drill bits	
18	---	Inspection mirror	
19	---	Retractable utility knife	

Note 1 Supplied as part of Discovery.
 Note 2 Supplied by GE until turnover of system to customer, then available as part of a GE Cryogen and/or Service Contract.



image



imagination at work