Overview
Linac Complex (WBS 121.06.05)

S. Dixon

Requirements and Specifications Review

19 November 2019

In partnership with:
- India/DAE
- Italy/INFN
- UK/STFC
- France/CEA/Irfu, CNRS/IN2P3

Outline

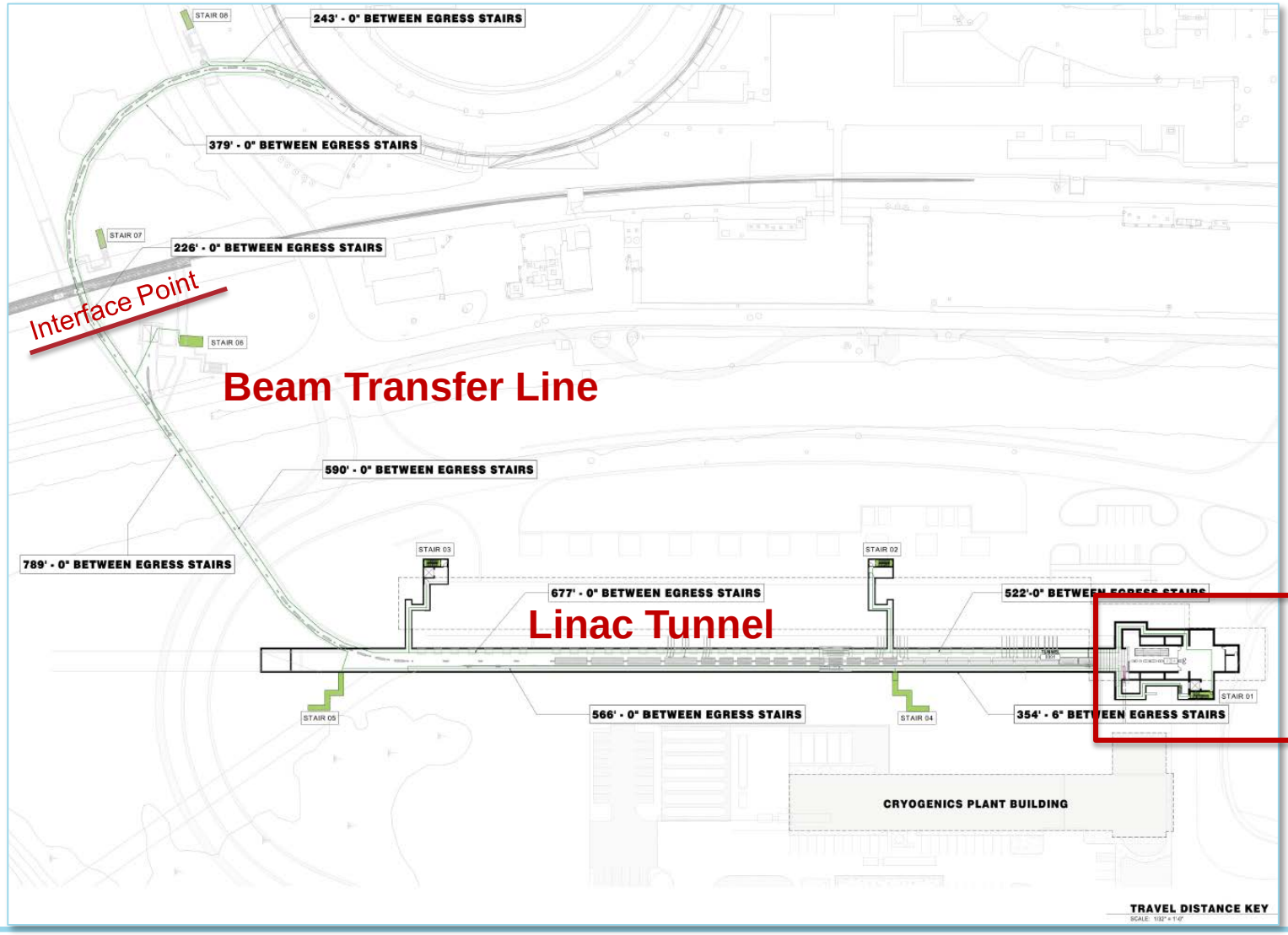
- Scope
- Requirements Basis
  - Functional Requirements Specification
  - Room Data Sheets
  - Technical Requirements Specification

Scope

Linac Complex is comprised of the following:

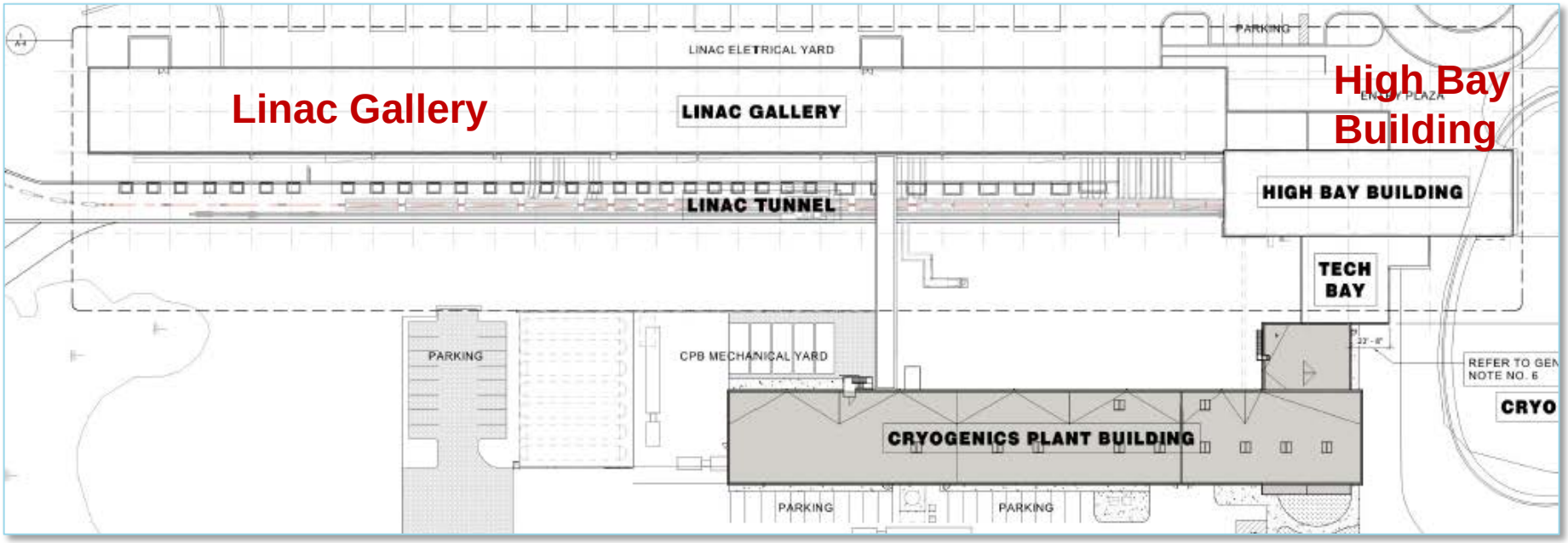
- The High Bay Building (HBB) includes the construction package including the below grade and above grade structures, mechanical, electrical, conveying systems and related support systems to house the Warm Front-End components and related infrastructure;
- The Linac Tunnel (LT) that includes the work required to install the below grade beamline enclosure to accommodate the beamline components and related support infrastructure;
- The Linac Gallery (LG) includes the above grade service building and associated infrastructure to support the technical equipment for the beamline components;
- The Beam Transfer Line (BTL) that includes the work required to install the below grade beamline enclosure from the downstream end of the LT to a point approximately 50 feet east of the existing Main Ring tunnel. The BTL will accommodate the beamline components, beam absorber and related support infrastructure.

Scope



High Bay Building

Scope


Linac Gallery
High Bay Building
LINAC ELETRICAL YARD
LINAC GALLERY
LINAC TUNNEL
HIGH BAY BUILDING
TECH BAY
PARKING
CPB MECHANICAL YARD
CRYOGENICS PLANT BUILDING
PARKING
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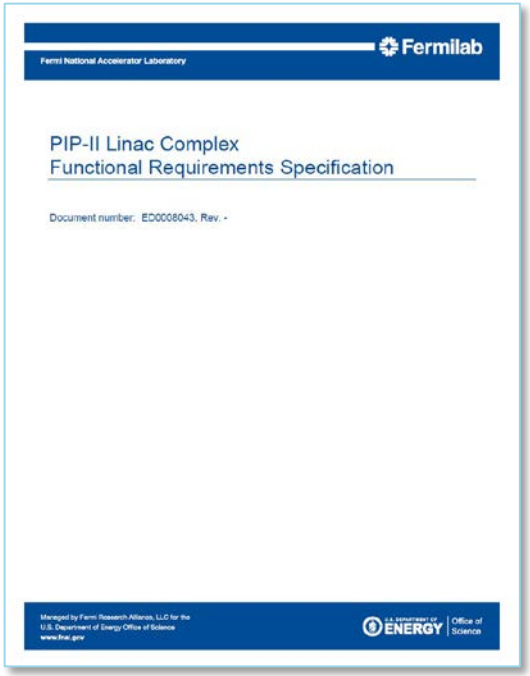
Requirement Basis

- Functional Requirements Specification

6. Functional Requirements

Requirement #	Requirement Statement
F-121.06.05-A001	The LC shall provide a safe environment for employees and the public.
F-121.06.05-A002	The LC-HBB shall provide space and infrastructure for the Warm Front-End components in a controlled environment.
F-121.06.05-A003	The LC-HBB shall provide space and infrastructure for unloading/loading activities.
F-121.06.05-A004	The LC-HBB shall include an overhead bridge crane for transporting equipment to the lower portion of the LC-HBB.
F-121.06.05-A005	The LC-HBB shall provide space for operating the Linac including commissioning space, meeting/planning space and support space.
F-121.06.05-A006	The LC-LT shall provide space for the installation, operation and maintenance of cryogenic beamline components.
F-121.06.05-A007	The LC-LT shall provide radiation shielding.
F-121.06.05-A008	The LC-BTL shall provide radiation shielding.
F-121.06.05-A009	The LC-LG shall house beamline support equipment.
F-121.06.05-A010	The LC-LG shall be located adjacent to the LC-LT to allow unrestricted access during beam operating conditions.
F-121.06.05-A011	The LC-LT shall be connected to the LC-HBB.
F-121.06.05-A012	The LC-LG shall house the beamline power supplies for the LC-BTL.
F-121.06.05-A013	The LC-LT shall connect to the CDS supply at the upstream end of the Linac upstream of the HWR.
	The LC shall provide penetrations to accommodate radio frequency waveguides



Teamcenter ED0008043

Requirement Basis

- Room Data Sheets

Fermilab

Room Data Sheet
PIP-II

= Denotes missing information
#N/A = These cells are automatically calculated, no input require
= Data cells not applicable

-> Enter only relevant fields for items that take up floor space, require environmental control, cooling water, AC power, a rack, or networking.

-> If equipment does not extend beyond the rack it does not need to be included. Including cables will allow us to determine equipment location based on access to power or networking.

-> If multiple cable types run to the same rack select the least flexible cable type going to the rack and provide the total number of all cables.

-> Columns D-H have a "red triangle" in the right-hand corner -- hoover the mouse over them to view addtional information.

Automatic filled out cells | Start Here ↓

										Design Uncertainty			Spatial Requir		
Identifier	WBS Level 2	WBS ID	WBS Name	Building	Space Designation Location	Sub-System	Component	Description	Quantity	Level of Design	Source of Requirements	Uncertainty Multiplier	Space Type	Length (in)	Width (in)
DM-001	121.03	121.03.07	Controls	LG	LG-BTL	Computers, Front End	Racks	Networking, permits etc	3	Preliminary	Off the Shelf	5%	Floor	30	
DM-002	121.03	121.03.08	SS	LG	LG-BTL	Interlocks	Racks	ESS interface	1	Preliminary	Off the Shelf	5%	Floor	30	
DM-003	121.3	121.3.06	Controls	F3	BTL-F3 Building	PLC/LCW Controls	Racks, Rittal	Rittal half size cabinet	1	Preliminary	Off the Shelf	5%			
DM-004	121.03	121.03.06	Vacuum	F3	BTL-F3 Building	Ion Pump PS System	Racks	Bulk, Ion pump PS, comm interface	2	Preliminary	Off the Shelf	5%	Floor	30	
DM-005	121.03	121.03.09	Instrumentation	LG	LG-BTL	BPM	Racks		2	Preliminary	Prototype-Testing	25%	Floor	30	
DM-006	121.03	121.03.09	Instrumentation	F3	BTL-F3 Building	BPM	Racks		1	Preliminary	Prototype-Testing	25%	Floor	30	
DM-007	121.05	121.05.04	BTLBAL	LG	LG-BTL	Collimator Controls	Racks	will this be needed??	1	Preliminary	Off the Shelf	5%	Floor	30	
DM-008	121.03	121.03.05	Magnets	F3	BTL-F3 Building	Fast Dipole Switch	Racks	Pulse Magnet Power Supply	1	Conceptual	Expert Opinion	50%	Floor	30	
DM-009	121.03	121.03.05	Magnets	LG	LG-BTL Power Supply	Fast Dipole Switch	Cables		8	Preliminary	Prototype-Testing	25%			
DM-010	121.03	121.03.05	Magnets	LG	LG-BTL Power Supply	Fast Dipole Switch	Magnets		1	Conceptual	Expert Opinion	50%			
DM-011	121.03	121.03.05	Magnets	F3	BTL-F3 Building	Magnets, Dipole	Power Supplies	TeV PS	1	Preliminary	Expert Opinion	50%	Floor	60	
DM-012	121.03	121.03.05	Magnets	Booster	Booster	Magnets, Dipole	Power Supplies	125KW Spange PS	2	Preliminary	Off the Shelf	5%	Floor	62	
DM-013	121.03	121.03.05	Magnets	BTL	BTL-Beamline Tunnel	Magnets, Dipole	Cables	Dipole cables	20	Preliminary	Off the Shelf	5%			
DM-014	121.03	121.03.05	Magnets	BTL	BTL-Beamline Tunnel	Magnets, Dipole	Cables	Dipole cables	16	Preliminary	Off the Shelf	5%			
DM-015	121.03	121.03.05	Magnets	F3	BTL-F3 Building	Magnets, Regular Quadrupole	Racks	Quadrupole Power Supplies	3	Preliminary	Off the Shelf	5%	Floor	30	
DM-016	121.03	121.03.05	Magnets	BTL	BTL-Beamline Tunnel	Magnets, Regular Quadrupole	Cables	Quad Cables	32	Conceptual	Off the Shelf	5%			
DM-017	121.03	121.03.05	Magnets	BTL	BTL-Beamline	Magnets, Regular	Magnets		57	Conceptual	Prototype-Testing	25%			

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PIP-II

Requirement Basis

- Technical Requirements Specification

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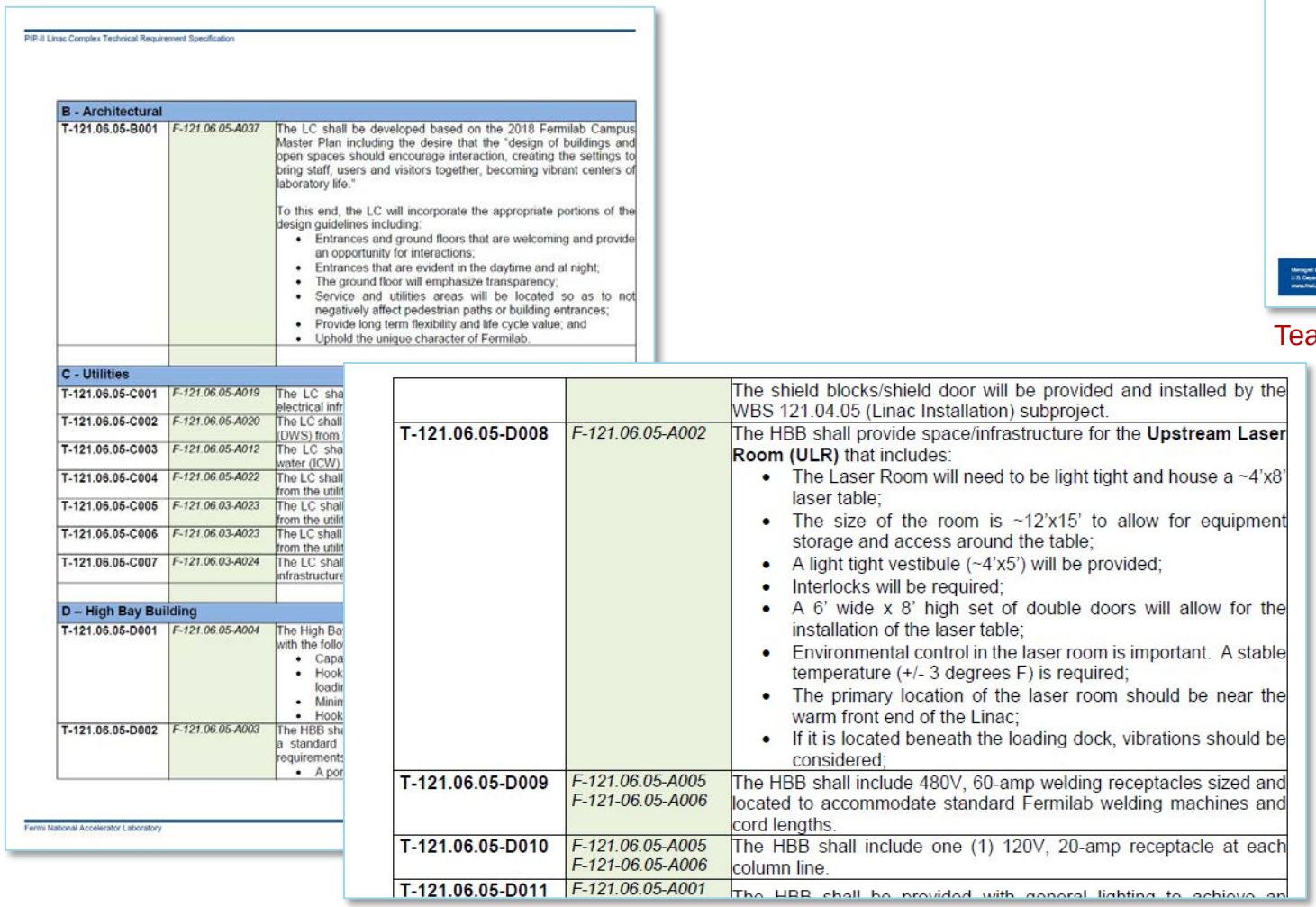

PIP-II Linac Complex Technical Requirement Specification

B - Architectural		
T-121.06.05-B001	*F-121.06.05-A037*	The LC shall be developed based on the 2018 Fermilab Campus Master Plan including the desire that the "design of buildings and open spaces should encourage interaction, creating the settings to bring staff, users and visitors together, becoming vibrant centers of laboratory life." To this end, the LC will incorporate the appropriate portions of the design guidelines including: • Entrances and ground floors that are welcoming and provide an opportunity for interactions; • Entrances that are evident in the daytime and at night; • The ground floor will emphasize transparency; • Service and utilities areas will be located so as to not negatively affect pedestrian paths or building entrances; • Provide long term flexibility and life cycle value; and • Uphold the unique character of Fermilab.
C - Utilities		
T-121.06.05-C001	*F-121.06.05-A019*	The LC sha electrical infr
T-121.06.05-C002	*F-121.06.05-A020*	The LC shall (DWS) from
T-121.06.05-C003	*F-121.06.05-A012*	The LC sha water (ICW)
T-121.06.05-C004	*F-121.06.05-A022*	The LC shall from the utilit
T-121.06.05-C005	*F-121.06.03-A023*	The LC shall from the utilit
T-121.06.05-C006	*F-121.06.03-A023*	The LC shall from the utilit
T-121.06.05-C007	*F-121.06.03-A024*	The LC shall infrastructure
D – High Bay Building		
T-121.06.05-D001	*F-121.06.05-A004*	The High Ba with the follo • Capa • Hook loadir • Minin • Hook
T-121.06.05-D002	*F-121.06.05-A003*	The HBB sha a standard requirements • A por

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		The shield blocks/shield door will be provided and installed by the WBS 121.04.05 (Linac Installation) subproject.
T-121.06.05-D008	*F-121.06.05-A002*	The HBB shall provide space/infrastructure for the **Upstream Laser Room (ULR)** that includes: • The Laser Room will need to be light tight and house a ~4'x8' laser table; • The size of the room is ~12'x15' to allow for equipment storage and access around the table; • A light tight vestibule (~4'x5') will be provided; • Interlocks will be required; • A 6' wide x 8' high set of double doors will allow for the installation of the laser table; • Environmental control in the laser room is important. A stable temperature (+/- 3 degrees F) is required; • The primary location of the laser room should be near the warm front end of the Linac; • If it is located beneath the loading dock, vibrations should be considered;
T-121.06.05-D009	*F-121.06.05-A005* *F-121.06.05-A006*	The HBB shall include 480V, 60-amp welding receptacles sized and located to accommodate standard Fermilab welding machines and cord lengths.
T-121.06.05-D010	*F-121.06.05-A005* *F-121.06.05-A006*	The HBB shall include one (1) 120V, 20-amp receptacle at each column line.
T-121.06.05-D011	*F-121.06.05-A001*	The HBB shall be provided with general lighting to achieve an

End