



6.1 Plumbing and Drainage

6.1.1 Kitchen Indirect Waste Piping

Description/Design Approach:

- A. Kitchen sink waste shall be disposed of into the building sanitary drainage system via an indirect waste line fitted with a 10” deep sanitary receptor that has a dome and strainer. To achieve this, an air gap, that is at a minimum twice the diameter of the effective opening of the indirect waste pipe, shall be maintained between the bottom of the sink outlet pipe and the top (rim) of the sanitary receptor. In addition, the rim of the sanitary receptor shall be set one (1) inch above the kitchen finished floor level. Also, the sanitary receptor shall be placed below the sink in such a way that it does not become a tripping hazard. **The drainage pipe connection from each basin of a multiple compartment fixture shall be routed and discharged independently to a sanitary floor receptor as per Section PC 802.1.1 of the 2022 NYC Plumbing Code.****

- B. The size of the outlet pipe plus the trapping requirements for the floor receptor shall correspond to the pipe and trap sizes that are equivalent to the drainage fixture unit value outlined in Tables PC 709.1 & 709.2 of the 2022 NYC Plumbing Code. The minimum size for the outlet pipe and trap to the floor receptor shall be 3”.**

- C. Each sanitary receptor shall be individually trapped, vented and made accessible.**

- D. The above requirement for indirect waste piping for kitchen sinks applies to all kitchens, including warming pantries typically used in 3K centers. However, grease removal and grease trapping requirements do not apply to the floor drain located in the warming pantries of 3K facilities as these facilities only use food-heating cabinets and no cooking is involved. The DEP has granted an exemption to the SCA allowing the floor drain in a 3K warm-up kitchen to by-pass the grease interceptor.**

- E. Relevant Documents**
 - Letter from NYC Department of Environmental Protection outlining requirements for waiving of floor drains in warming pantries being connected to a grease interceptor, dated 6/16/2022.**

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



June 16, 2022

Rohit T. Aggarwala
Commissioner

Pam Elardo, P.E.
Deputy Commissioner
Bureau of Wastewater
Treatment

96-05 Horace Harding
Expressway
Corona, NY 11368

New York City School
Construction Authority
Standards & Technical Studio
Manager for Plumbing & Drainage
30-30 Thomson Avenue
Long Island City, NY 11101
Attn: Mr. Harry Cethoute, P.E.

Re: Warm Up Kitchens in 3-K School Facilities

Dear Mr. Cethoute,

We are in receipt of your request for a review of grease interceptor installation requirements for what you have designated as “warm up kitchens in 3-K school facilities,” all of which are to be of the same standard design and operating procedures. The New York City Department of Environmental Protection (DEP) is providing conditional grease interceptor approval for said design and procedures as described herein provided that these kitchens are found in conformity thereto upon inspection.

The standard design and operating procedures for said kitchens as described by you in your letter dated May 4, 2022, and your email dated May 17, 2022 (see attached) include the following:

- No ovens will be provided. There is no cooking at these premises. Meals are prepared off-site and will be brought-in for later distribution during lunch periods. The meals will be kept in heated stainless steel cabinets that are mobile. The food transport cabinet will be similar to a product made by Carter Hoffman, is electrical and operates on 120 volts. Typical cabinet size is 30 1/2” H x 30 5/8” W
- Hoods are not required and will not be installed.
- Only pre-cooked foods will come into the school in metal trays. Those trays will be washed in the single 2-compartment sink that is also provided. There will be no dishwasher.
- The only sink that will be installed will be a one two-compartment sink within the volume range of 1,540 to 21,560 cubic inches and will be connected to a 35gpm/ 70 lbs. capacity grease interceptor in accordance with 15 RCNY §19-11 *Best Management Practices (BMPs) for All Non-Residential Dischargers of Fat, Oil, and Grease to the Public Sewer System*, and Table I therein.

A conditional waiver of the grease interceptor installation requirement for a single floor drain in said warm up kitchens is also granted provided that the

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kitchen conforms to the standard design and operating procedures listed above.

The DEP may, at any time, order that different or additional grease interceptors be installed in accordance with 15 RCNY §19-11 if determined upon inspection that said standard design and operating procedures are not being adhered to, or other noncompliance with the applicable regulations is observed, including but not limited to floor spillage indicative of a potential for fat, oil, or grease to enter a floor drain that is not connected to a grease interceptor.

The applicant bears full responsibility for ensuring compliance. The Department, by this letter, shall not incur any liabilities or obligations for the failure of the effluent to comply with the Rules of the City of New York (Use of the Public Sewers) or any other laws, regulations, the Administrative Code, or any other document, and the applicant bears full responsibility for ensuring compliance thereto.

Submissions for each individual warm up kitchen must be in narrative form (diagrams are not required), and include at a minimum:

1. The designer’s official business name and address.
2. The school name, address, zip code, and block and lot number.
3. The size of the sink in inches as length x width x height = cubic inches.
4. The selected grease interceptor’s make, model, minimum flow rate in gallons per minute (gpm), and minimum grease retention capacity in pounds (lbs).
5. A statement indicating compliance with the standard design and operating conditions described above, and referring back to this letter (identifying it by date and subject matter), as DEP will not be providing separate responses for each submission.

If you have any questions regarding this matter, please contact Ms. Sophia Rabich by phone at (718) 595-4707 or email at sophiar@dep.nyc.gov.

Sincerely,

DocuSigned by:


Frances Leung, P.E., Chief
Division of Pollution Prevention and Monitoring
Bureau of Wastewater Treatment

enc: Letter from Harry Cethoute to Sophia Rabich dated May 4, 2022
Email from Harry Cethoute to Sophia Rabich dated May 17, 2022



6.1 Plumbing and Drainage

6.1.2 Acid Waste System – pH Neutralization

Description/Design Approach:

A. New Construction and Major Modernization

Acid waste disposal shall conform to an agreement between the SCA and the **NYC Department of Environmental Protection (DEP)**, which provides the following:

1. When the total number of acid using sinks in a school is **twenty-five (25)** or less, each sink’s waste may clear into an under-the-counter acid neutralization tank filled with limestone chips. Each sink is required to have a five-gallon acid neutralization tank. Every six (6) months, the limestone chips must be replenished to ensure that the pH value of the neutralized effluent from the tank remains within the approved limits. A maintenance log is required to be kept by the DOE for recording the dates of re-filling the tank with limestone chips, which must be made available at all times for inspection by the DEP.
 - a. Waste water from emergency showers and eyewash basins need not be connected to the acid neutralizing system and may discharge directly into the sanitary system.
 - b. Tri-facial sinks shall be considered as three (3) separate fixtures and thus the minimum volume of a stand-alone neutralizing tank that can treat wastewater from a tri-facial sink is 15 gallons.
2. If the total number of sinks in a school exceeds **twenty- five (25)** :
 - a. The acid drainage system shall consist of a common acid neutralization tank, a sampling tank, an alarm and a monitoring station, located at the lowest story above the house drains.
 - b. The system is to be sized in accordance with DEP guidelines for **acid neutralization requirements for schools as outlined in Table 1 below:**

Table 1	
Number of sinks	pH Neutralization Tank Capacity* (gal)
26-35	150
36-50	200
51-70	250
71-90	300

*Overall tank capacity without limestone chips.

- c. The tank shall be filled with limestone chips to maintain the neutralized effluent pH within the approved limits. A replenishment of the limestone chips, every six months, is also required.
- d. An independent 4” acid vent line is required for the system.

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- e. The acid neutralization tank shall be installed on a 3" high concrete pad and shall be placed in a room built with walls on 3" containment curb. Accidental spill during routine maintenance or tank replacement must be contained within the tank room. A water leak detection system installed in the room shall provide sounding alarms that a spill has occurred. Mechanical ventilation into the room shall be provided if a window is not available.
 - f. **Table 1 was formulated for sinks equipped with a single faucet, and it provides a corresponding tank size for such a scenario. When sinks are equipped with two (2) or three (3) faucets, they must respectively be counted as two (2) or three (3) sinks, resulting in the appropriate tank size being selected.**
 - g. **A cup sink under a hood vent shall be counted as a single sink.**
 - h. **Floor drains must not be included in the neutralization tank capacity.**
3. The plans for acid waste management shall be submitted for review and approval by the NYC DEP, Bureau of Wastewater Treatment (BWT).
4. Dark Room sinks are equipped with an under the counter neutralizing tank. As a result, conveyance of the wastewater from that fixture need not be tied into the acid waste system.
- B. Capital Improvement Program (CIP) Projects**
- 1. **If the total number of acid using sinks remaining after a renovation or the total number of additional acid using sinks is twenty-five (25) or less, an individual neutralization unit containing limestone chips may be installed under each sink. The school may continue to operate its existing pH system in parallel with the new individual neutralization units (s) if and only if one the following conditions is met:**
 - a. **The existing system was installed on or after January 1, 1993 and is operated and maintained in accordance with the pH neutralization standard outlined in Table 1.**
 - b. **The existing system was installed before January 1, 1993 and is operated and maintained in accordance with the manufacturer's specifications. In such a case, the existing system does not need to comply with the pH neutralization standard summarized in Table 1. However, the existing system must be upgraded to include a control panel, a pH meter and audio/visual alarms. In addition, only in-kind replacements of acid using tanks discharging into such an existing system will be permitted, provided that the sink locations remain the same**
 - c. **The limestone chips must be replaced at least every 6 months. DSF must maintain a log must be established and maintained for each acid-using sink to record the date of each chips replacement. Such log shall be available for inspection by the DEP at all times.**
 - d. **Tri-facial sinks shall be counted as three (3) separate sinks and shall require pH neutralization treating devices that are equivalent to 15 gallons.**
 - 2. **The SCA does not need to submit plans or obtain approval from the DEP/BWT if the remaining and/or added sinks after a renovation is twenty-five (25) or less. The SCA must submit a detailed and written narrative to the DEP/BWT. The narrative shall at a minimum include: the number of existing acid using sinks; a description of the pH**

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treatment system; an evaluation of the existing system; a description of the proposed modification; a description of proposed pH treatment system.

- a. If the existing system described in the narrative was installed prior to January 1, 1993, and it does not comply with the pH neutralization standard outlined in Table 1, the narrative must also contain a statement from the design professional certifying that the system was installed, is operating and is maintained in accordance with the manufacturer’s specifications
 - 3. If the total number of acid using sinks exceeds twenty-five (25), the sinks must discharge into either the existing centralized pH neutralization system, if such system was installed on or after January 1, 1993; or to a newly installed centralized pH neutralization system. The new centralized pH treatment system must be designed, installed, operated and maintained in accordance with the pH neutralization standard outlined in Table 1.
 - 4. Discharge from Dark Room sinks may flow directly into the sanitary system, as that fixture comes equipped with an under-the-counter neutralizing tank, and thus connection to the acid waste system is not needed.
- C. Neutralization of Acidic Condensate from Condensing Boilers and Flue Exhaust Vents Connected Thereto (**Note that the Authority’s new HVAC standards are to use heat pump systems and this requirement will not likely apply to many projects**).
- 1. Filing with the DEP is not required for the **pH neutralization device(s) or system required for condensate coming from condensing boilers and for the flue gas vent connections** to these boilers. The **pH treatment** system shall consist of: **acid** neutralizing tubes filled with calcium carbonate aggregates; floor-mounted supports, unions and traps. In addition, the system shall include trap-primer valves and pH sensors that are supplied and installed by the plumbing contractor. Neutralization system for condensing boilers shall be integrated with the building management system.
 - 2. Selection of the appropriate neutralizing tube(s) size shall be based on manufacturers’ suggestions and shall take into account the expected condensing rate of boilers. A separate neutralizing device shall be provided for each boiler. Likewise, flue exhaust vent **connector(s) attached** to condensing boilers shall require its/**their** own neutralizing tube.

D. Relevant Documents

- Letter from NYC Department of Environmental Protection outlining requirements acid waste systems, dated 12/21/22



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December 21, 2021

Vincent Sapienza, P.E.
Commissioner

New York City School
Construction Authority
Standards & Technical Studio
Manager for Plumbing & Drainage
30-30 Thomson Avenue
Long Island City, NY 11101
Attn: Mr. Harry Cethoute, P.E.

Re: Amendment to DEP's Acid Neutralization System Guidelines for New York City Public Schools

Pam Elardo, P.E.
Deputy Commissioner

Dear Mr. Cethoute:

Bureau of Wastewater
Treatment
96-05 Horace Harding
Expressway – 2nd Floor
Corona, NY 11368

This letter is an amendment to the New York City Department of Environmental Protection's guidelines regarding acid neutralization requirements for New York City public schools. It supersedes the letter dated February 5, 2007.

Effective March 21, 2022, the acid neutralization requirements for New York City public schools are as follows:

A. For new school designs submitted after effective date:

1. If the total number of laboratory sinks is twenty-five or less, an individual neutralization unit containing limestone chips may be installed under each sink rather than a centralized pH neutralization system.
2. The limestone chips must be replaced at least once every 6 months, or more frequently if required by the manufacturer's instructions. A paper or electronic logbook must be established and maintained for each laboratory sink to record the date of each replacement. Such logbooks shall be available for inspection by the Department of Environmental Protection (DEP) at all times.
3. If the total number of laboratory sinks is twenty-five or less, the School Construction Authority (SCA) is not required to submit plans to or obtain approval from DEP's Bureau of Wastewater Treatment (BWT). However, SCA must submit a detailed written narrative to BWT. Each narrative shall include, at a minimum, the number and location of laboratory sinks and a detailed description of the proposed pH neutralization units including but not limited to manufacturer, model number, and size.
4. If the total number of laboratory sinks exceeds twenty-five, a centralized pH neutralization system must be installed. The system must be installed, operated and maintained in accordance with the attached summary of the pH neutralization requirements, and sized in accordance with Table 1 below:



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Number of sinks	pH Neutralization Tank Capacity* (gal)
26-35	150
36-50	200
51-70	250
71-90	300

*Overall tank capacity without limestone chips.

5. The changes in the tank sizes reflected in Table 1 compared with previous requirements are based on a decreased faucet flow rates in recent years.
6. The number of sinks in Table 1 represents sinks with a single faucet. However, double-faucet sinks should be counted as two sinks, and triple-faucet sinks should be counted as three sinks. The requirement of counting faucets, and not drains, remains unchanged. A cup sink under the vent hood should continue to be counted as a single sink. Floor drains will continue to be excluded from the count.
7. If the total number of laboratory sinks exceeds twenty-five, SCA is required to submit plans, prepared by a licensed New York State Professional Engineer or Registered Architect, and obtain approval from BWT.

B. For existing schools, the requirements are as stated below:

1. If the total number of laboratory sinks remaining after a renovation or the total number of additional laboratory sinks is twenty-five or less, individual neutralization units containing limestone chips may be installed under each sink. The school may continue to operate its existing centralized pH neutralization system in parallel with the new individual neutralization units if the existing system is installed prior to March 21, 2022 and is operated and maintained in accordance with the pH Neutralization Requirements Summary included in the letter dated February 5, 2007.
2. The limestone chips must be replaced at least once every 6 months, or more frequently if required by the manufacturer’s instructions. A paper or electronic logbook must be established and maintained for each laboratory sink to record the date of each replacement. Such logbooks must be available for inspection by DEP at all times.
3. If the total number of laboratory sinks remaining after a renovation or the number of additional laboratory sinks is twenty-five or less, SCA is not required to submit plans to or obtain approval from BWT. However, SCA must submit to BWT a detailed written narrative. Each narrative shall include, at a minimum, the number of existing laboratory sinks, a description of the existing pH neutralization system, a description of proposed modifications, and a description of proposed additional pretreatment systems and/or proposed modifications to the existing system.
4. If the total number of additional laboratory sinks exceeds twenty-five, the sinks must discharge into either the school's existing centralized pH neutralization system or a newly installed centralized pH neutralization system. Any such centralized system must be properly sized,



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installed, operated and maintained in accordance with the attached pH Neutralization Requirements Summary.

- 5. If the total number of additional laboratory sinks exceeds twenty-five, SCA is required to submit plans and obtain approval from BWT.

The filing exemptions as described above only apply to fixtures within school laboratories. SCA may be required to submit plans and obtain approval from BWT for other types of renovation or capital improvement projects of existing schools.

New York State Licensed Professional Engineers and New York State Registered Architects may petition the Department in writing for acceptance of an alternative pretreatment device, technology, equipment or procedures varying from, but equivalent to, those described in this letter. Such a petition must contain detailed documentation and calculations substantiating their equivalency. In no event shall any alternative pretreatment device, technology, equipment or procedures be less effective than those described in this letter.

If you have any questions regarding this matter, please contact Ms. Sophia Rabich, Industrial Resource Management and Permitting Section, by phone at (718) 595-4707, or by email at sophiar@dep.nyc.gov.

Sincerely,

DocuSigned by:

4A1BE02E952A40B
 Frances Leung, P.E., Chief,
 Division of Pollution Prevention and
 Monitoring

Enclosed:

- 1. pH Neutralization Requirements Summary
- 2. Letter dated February 5, 2007 Re: Amendment to DEP's Acid Neutralization System Guidelines for New York City Public Schools



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February 5, 2007

Mr. Harry Cethoute, P.E.
Standards & Technical Studio
Manager for Plumbing & Drainage
New York City School
Construction Authority
30-30 Thomson Avenue
Long Island City, NY 11101

Re: Amendment to DEP's Acid
Neutralization System Guidelines
for New York City Public
Schools

Dear Mr. Cethoute:

This letter is an amendment to the New York City Department of Environmental Protection's guidelines regarding acid neutralization requirements for New York City public schools. It shall supersede the letter dated August 2, 2004.

Effective immediately, the acid neutralization requirements for New York City public schools are as follows:

- A. For new schools:
 - 1. If the total number of acid using sinks is twenty or less, an individual neutralization unit containing limestone chips may be installed under each sink rather than a centralized pH neutralization system.
 - 2. The limestone chips must be replaced at least once every 6 months. A log must be established and maintained for each acid-using sink to record the date of each replacement. Such log shall be available for inspection by the Department of Environmental Protection (DEP) at all times.
 - 3. If the total number of acid using sinks is twenty or less, the School Construction Authority (SCA) is not required to submit plans to or obtain approval from DEP's Bureau of Wastewater Treatment (BWT). However, SCA must submit to BWT a detailed written narrative. Each narrative shall include, at a minimum, the number of acid using sinks and a detailed description of the proposed pH pretreatment system.
 - 4. If the total number of acid using sinks exceeds twenty, a centralized pH neutralization system must be installed. The system must be installed, operated and maintained in accordance with the attached summary of the pH neutralization requirements.
 - 5. If the total number of acid using sinks exceeds twenty, SCA is required to

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submit plans, prepared by a licensed New York State Professional Engineer or Registered Architect, to and obtain approval from BWT.

- B. For existing schools:
1. If the total number of acid using sinks remaining after a renovation or the total number of additional acid using sinks is twenty or less, an individual neutralization unit containing limestone chips may be installed under each sink. The school may continue to operate its existing pH system in parallel with the new individual neutralization unit(s) if and only if one of the following conditions is met:
 - a) The existing system is installed on or after January 1, 1993 and is operated and maintained in accordance with the attached summary of pH neutralization requirements.
 - b) The existing system is installed before January 1, 1993 and is operated and maintained in accordance with the manufacturer's specifications. In such case, the existing system does not need to comply with the attached summary of pH neutralization requirements. However, the existing system must be upgraded to include a control panel, a pH meter and audio/visual alarms. In addition, only in-kind replacements of acid using sinks discharging into such an existing system will be permitted, provided that the sink locations remain the same.
 2. The limestone chips must be replaced at least once every 6 months. A log must be established and maintained for each acid-using sink to record the date of each replacement. Such log shall be available for inspection by DEP at all times.
 3. If the total number of acid using sinks remaining after a renovation or the number of additional acid using sinks is twenty or less, SCA is not required to submit plans to or obtain approval from BWT. However, SCA must submit to BWT a detailed written narrative. Each narrative shall include, at a minimum, the number of existing acid using sinks, a description of the existing pH pretreatment system, an evaluation of the existing system, a description of proposed modification, a description of proposed additional pretreatment system(s) and/or proposed modification to the existing system. If the existing system described in the narrative is installed prior to January 1, 1993 and it does not comply with the attached summary of pH neutralization requirements, the narrative must also contain a statement certifying that the system has been installed, operated and maintained in accordance to manufacturer's specifications.
 4. If the total number of additional acid using sinks exceeds twenty, the sinks must discharge into either the school's existing centralized pH neutralization system that is installed on or after January 1, 1993, if any; or a newly installed centralized pH neutralization system. Any such centralized system must be installed, operated and maintained in accordance with the attached summary of pH neutralization requirements.
 5. If the total number of additional acid using sinks exceeds twenty, SCA is required to submit plans to and obtain approval from BWT.

The filing exemptions as described above only apply to fixtures within school laboratories. SCA may be

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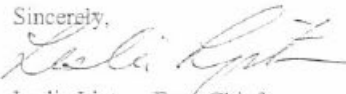


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required to submit plans to and obtain approval from BWT for other types of renovation or capital improvement projects of existing schools.

Attached is a table summarizing the pH neutralization requirements.

If you have any questions regarding this matter, please telephone Ms. Frances Leung, P.E., Chief, IPP Inspection and Permit Section at (718) 595-4763.

Sincerely,

Leslie Lipton, Esq., Chief
Division of Pollution Control
and Monitoring

FL/fl

Enc: pH Neutralization Requirements
Figure 1: pH Neutralization Tank Capacity Requirements

cc: Lipton/Leung/Islam/Castro



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pH Neutralization Requirements

School Construction Authority Projects

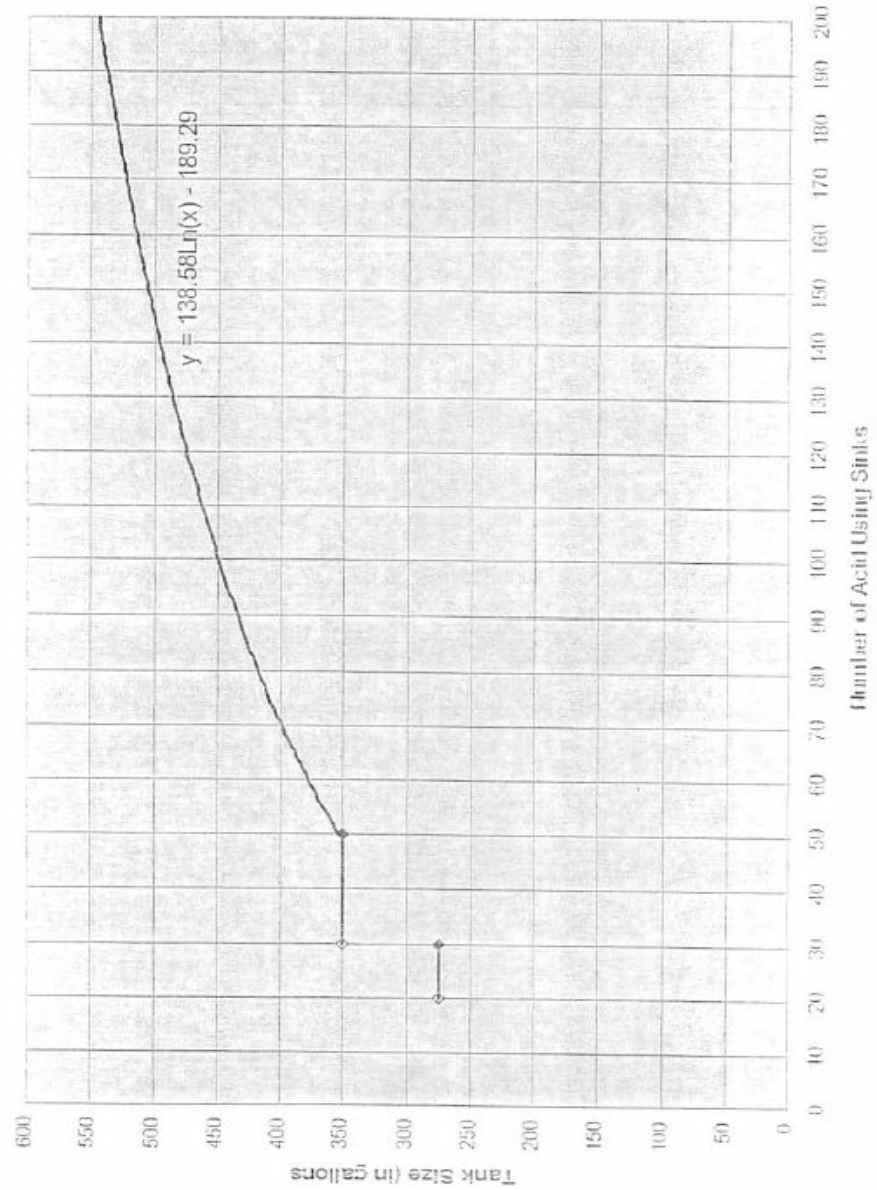
1. If the total number of acid using sinks is twenty or less, an individual neutralization unit containing limestone chips may be installed under each sink.
2. Applicant must determine the adequate capacity for the centralized system from Figure 1 when there are over 20 laboratory sinks.
3. Centralized pH tank capacity is calculated without any limestone chips added to the tank.
4. The volume of limestone chips shall not occupy more than a third of the total overall tank volume.
5. Centralized system must have a control panel, a pH meter and audio/visual alarms.
6. The above requirements may not necessarily apply to laboratories that may be used for research or commercial purposes, or for college level courses. In such cases, DEP's approval of the pH neutralization system is required.
7. The limestone chips must be replaced at least once every 6 months. A log must be established and maintained to record the date of each replacement. Such log shall be available for inspection by the DEP at all times.
8. All pH neutralization tanks must be designed in accordance with the New York City Building Code.

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Figure 1: pH Neutralization Tank Capacity Requirement



Requirement Applies to: New Construction Major Modernizations Capital Improvement Projects



Piping System	Location	Requirement
Storm piping	Interior (above ground)	Service Weight Cast Iron (SVCI) No-Hub with mechanical stainless steel couplings. Galvanized steel pipe schedule 40, with threaded drainage fittings allowed for 3" dia. and smaller.
	Interior (Underground)	Service Weight Cast Iron bell and spigot with lead and oakum joints.
	Exterior (Yard drainage)	1. Service Weight Cast Iron (SVCI) bell and spigot with lead & oakum joints. 2. Ductile Iron (DI) Class 51 for all sizes with push-on joints. 3. Precast Reinforced Concrete Pipe with rubber gasket watertight joint. 4. High Density Polyethylene (HDPE) piping, bell and spigot, watertight joints.
	Exterior (house drain & house sewer)	Service Weight Cast Iron (SVCI) bell and spigot with lead & oakum joints, Ductile Iron Class 51 for all sizes with push-on joints.
Sanitary piping (waste & vent)	Interior (above ground and house drain lines)	Service Weight Cast Iron (SVCI) No-Hub with mechanical stainless steel couplings. Galvanized steel pipe schedule 40, with threaded drainage fittings allowed for 3" diameter and smaller.
	Interior (pump discharge)	Galvanized steel pipe schedule 40, with threaded drainage fittings, Victaulic fitting in conjunction with groove pipe, 2" and larger is permitted.
	Interior (Underground)	Service Weight Cast Iron bell and spigot with lead and oakum joints.
	Exterior (House sewer / underground)	Ductile iron Pipe Class 56 with push-on joint
ACID WASTE/ VENT	Interior	Polypropylene Plastic Pipe, drum trap and fittings, flame retardant, schedule 40 with electrical fusion coils joint. Silicon Iron Pipe, bell & spigot with caulked joint will be used for acid vent extensions above roof. Polyvinylidene Difluoride (PVDF)
Domestic Water [Hot & Cold]	Interior (above ground)	Copper tubing, Type L (blue color bar), with wrought copper solder joint fittings suitable for soft soldering. Brass, seamless drawn pipe, regular weight with cast Bronze fitting. Chrome plating for exposed piping or traps in kitchen area. Groove copper pipe with Victaulic fitting is allowed for 2" and larger diameter piping. Copper tubing for short branch connection to plumbing fixture.
	Interior (underground)	Copper tubing, Type K (green color bar), with cast bronze solder joints fittings (150 psi) suitable for lead free soldering.
	Exterior (Service/ underground)	Ductile Iron, Class 52 for 3" & 4" pipe diameter and Class 56 for 6" & larger pipe sizes. Fitted with mechanical joints. The use of Brass, seamless drawn pipe threaded fittings and Type K Copper tubing is allowed for services up to 3" in size.
Vacuum & Compressed Air Piping	Interior	Black steel pipe with malleable iron fittings, type L copper tubing with wrought copper solder joint fittings.

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Piping System	Location	Requirement
Gas Piping	Interior (above ground)	Standard weight, Schedule 40, Black Steel pipe: a) Threaded or welded joint – for pipe dia. 4” and under if gas service line pressure is 1/2” psig or (14” w.c) b) Welded joints – over 4” pipe dia. if gas service line pressure is 1/2” psig or (14” w.c) c) Threaded or welded joints – for pipe dia. under 3” if gas service line pressure is over 1/2” psig but less than 5 psig d) Welded joints – for pipe dia. 3” and over if gas service line pressure is over 1/2” psig but less than 5 psig e) Welded joints – All pipe dia. if the gas service line pressure is over 5 psig
	Exterior (above & below grade)	Standard weight, Schedule 40, Black Steel Pipe.
	Building Expansion Joint & Foundation Wall	Braided Stainless Steel Flexible Multi-Legs Hose Pipe Assembly that is listed and labeled to UL 536-2003

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.4 Water Services for Domestic, Sprinkler and Standpipe Systems

Description/Design Approach:

A. Services Required - General

1. For school buildings with a combination manual wet standpipe and sprinkler system, or sprinkler system alone, two (2) water services shall be brought into the building. The services shall consist of one dedicated to domestic use and one for the fire protection system. A secondary/back-up domestic water supply drawn from a combined water service can no longer be provided since the DEP has changed the rule that previously permitted for interconnecting and tapping off water services for the fire protection system that provided a secondary water source for domestic need.
2. For school buildings with a combination automatic wet standpipe and sprinkler system, three (3) water services must be brought into such buildings. The water services shall be as follows: one dedicated to domestic use and two (2) that are strictly for the fire protection system. The DEP no longer allows for provision of a secondary domestic water service.
3. **Prior to submitting a request for new water services for domestic and fire protection and before filing the Application for Approval of Backflow Prevention Assemblies, the EOR shall be in advance communication with the DEP Cross-Connection Control Unit in regards to proposed wet tap service connections into existing street water mains and the construction pipe material of such mains. The intent of this pre-design interaction with the DEP is to help in identifying at an early stage cast iron water mains and dead-end connections, which are to be avoided and from which the proposed and new water service connections shall not be made. In addition, the aim behind this intervention is to provide early notification to the DEP about the imminent construction of a new school and to give time to that agency to develop and to implement any plan of its own to replace or to build new water mains in the adjoining streets to the new school.**

B. Domestic Water Service

1. Generally, the service pipe size for the domestic water system shall be a 4" diameter pipe. However, water pipe sizing shall be based upon water demand load, friction losses, the desired and the available street water pressures. Calculations for water service pipe sizing shall follow the procedure outlined in Appendix E of the 2022 NYC Plumbing code.
2. Provide a building-wide water filtration system as per Section 15419. The filtration system shall be located downstream of the backflow prevention device fitted into the domestic water service.

C. Water Service to Combination Manual Wet Standpipe & Sprinkler Systems or Sprinkler System with or without a Sprinkler Booster Pump

1. Per Appendix Q, Section Q102 (NFPA 13-16), of the 2022 NYC Building Code, stand-alone sprinkler systems installed in occupancy group E (schools), and not categorized as high-

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



rise building, shall require one (1) automatic source of water. A water service for the fire system shall supply water for sprinklers.

2. After calculating the water demand for the fire protection system, the designer shall consult Table #3 in Chapter 20 of the DEP Rules Governing and Restricting the Use and Supply of Water to determine the appropriate size of the corporation stop or wet connection (aka tap) as well as that of the service pipe that can supply the system water demand. The designer shall be mindful that sizes for a water tap may differ from that of the service pipe. Sizes for a tap or a wet connection to the city water main and the service pipe size shall be specifically indicated in the design documents. The designer is to also note that the minimum pipe size for the main of a sprinkler system is 6" pipe diameter.
3. There are instances when water supply for sprinklers might have to come from gravity tanks or a pressure tank. The following restrictions to the water supply shall apply in such cases:
 - a. The domestic water supply line from a tank or street supply shall be at least the size of the sprinkler line and the capacity available shall be at least equal to the capacity required for the sprinklers (i.e., Water Demand Requirements for Hydraulically Calculated System Design):
 - 1) Light hazard – total combined inside & outside hose (100 gpm); duration (30 min)
 - 2) Ordinary hazard – total combined inside & outside hose (250 gpm); duration (60-90 min)
 - 3) Extra hazard – total combined inside & outside hose (500 gpm); duration (90-120 min)
 - b. The domestic water supply line from a tank or street shall have the required pressure as provided in NFPA 13-16 (i.e., the minimum operating of any sprinkler shall be 7 psi for Hydraulically Calculated System Design and 15 psi for Pipe Schedule sprinkler system. Note the SCA standard is for a hydraulically calculated system).
 - c. The domestic water supply line shall be of nonferrous material except when the domestic water supply is 4" or more.
 - d. An O.S & Y valve or other listed valve having visual indication and sealed open shall be installed in the sprinkler supply branch, or such other valve arrangement as may be provided in NFPA 13-16 as modified per Section Q102, as applicable.
 - e. The number of limited area sprinkler heads in each fire section shall not exceed 6, when connected to a domestic water riser.
 - f. The connection shall be made at the supply or riser side of any domestic branch control valve.
 - g. A check valve shall be installed on the sprinkler supply branch.
4. In addition to the above, electrical devices supervising the operation of valves controlling the water supply to the sprinkler system shall be provided and a signal shall be transmitted to the fire alarm system.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



5. Sprinkler systems installed in high-rise buildings sited in Seismic Design category C as defined in the NYC Building Code, or in any high-rise building with occupied floors located more than 500 feet above the lowest level of fire department vehicle access, shall require a secondary on-site water source. A holding tank, which is seismically restrained and having a storage capacity that, at a minimum, is equivalent to 30 minutes worth of the hydraulically calculated sprinkler water demand as determined by the occupancy hazard and in accordance with NFPA 13-16, shall constitute the secondary on-site water source. The tank shall be supplied from the domestic service.

D. Water Services to Combination Automatic Wet Standpipe & Sprinkler System with Fire Pumps

1. When an automatic fire pump is required to enhance the water pressure to a standpipe or a combination automatic wet standpipe and sprinkler system, it shall connect to two (2) dedicated fire services. The two (2) services shall draw water from two (2) different street water mains.
2. Should the two (2) different street water mains lack the required capacity or not be available, a suction tank shall be provided. The storage capacity of the suction tank shall be equivalent to 30 minutes worth of the calculated water demand for the fire pump based on the pump's rated capacity.
3. A minimum 6-inch line shall connect the suction tank to the street water supply. Emergency drains, overflow pipe and protection against freezing or means for heating up the water inside the tank shall also be provided.
4. After calculating the water demand for the fire protection system, the designer shall consult Table #3 in Chapter 20 of the DEP Rules Governing and Restricting the Use and Supply of Water to determine the appropriate size of the corporation stop or wet connection (aka tap) as well as that of the service pipe that can supply the system water demand. The designer shall take note that sizes for the tap and the service pipe may differ. Sizes for the tap or wet connection to the city water main and the service pipe shall be specifically indicated in the design documents.
5. Valves controlling the water supply to the fire protection system shall be electrically supervised and a signal shall be transferred to the fire alarm system in case of tampering with valve's open position.
6. If due to siting conditions a secondary on-site water source is required for the sprinkler system (See item C.5 above), the designer is to determine the more economical way of providing either tank(s) to satisfy both the standpipe and sprinkler demands or in the alternative by calling for two (2) water services for the fire pump and a tank sized strictly for the sprinkler demand.

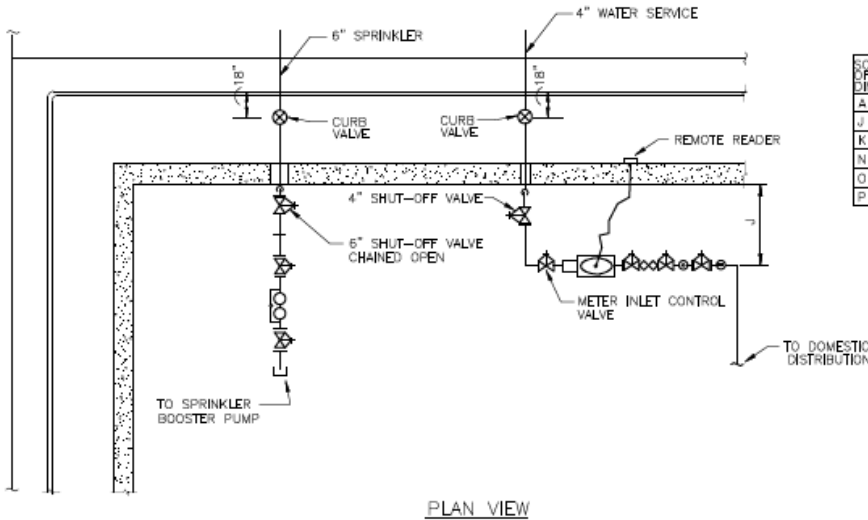
F. Relevant Documents

- Header Schematic for Domestic and Sprinkler Services Requiring a Sprinkler Booster Pump
- Header Schematic for Domestic and Fire Services Requiring a Fire Pump

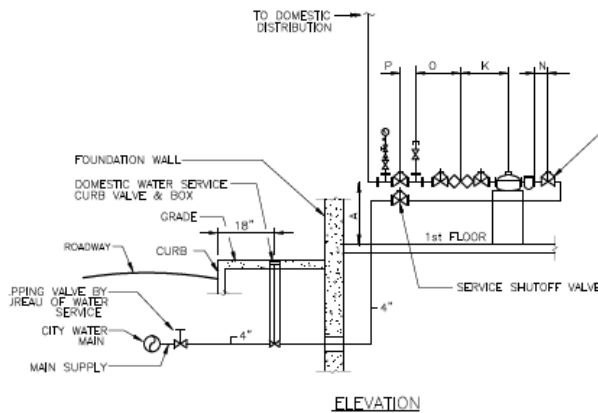
Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



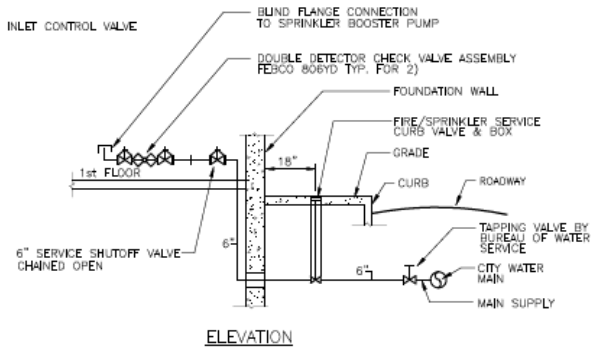
Header Schematic for Domestic and Sprinkler Services Requiring a Sprinkler Booster Pump



SCHEDULE OF DIMENSIONS	REMARKS
A	2'-6" BASED ON FEBCO 825YD DEP PREFERRED ELEVATION
J	3'-0" MAXIMUM, BUILDING CODE, RS 16, P107.3, b
K	10'-0" MAXIMUM PERMITTED HORIZONTAL DISTANCE
N	2'-10" BASED ON 4" WATER SERVICE
O	4'-0" AS REQUIRED FOR INSTALLATION
P	1'-1" AS REQUIRED FOR INSTALLATION



HEADER SCHEMATIC OF DOMESTIC WATER SERVICE
NOT TO SCALE

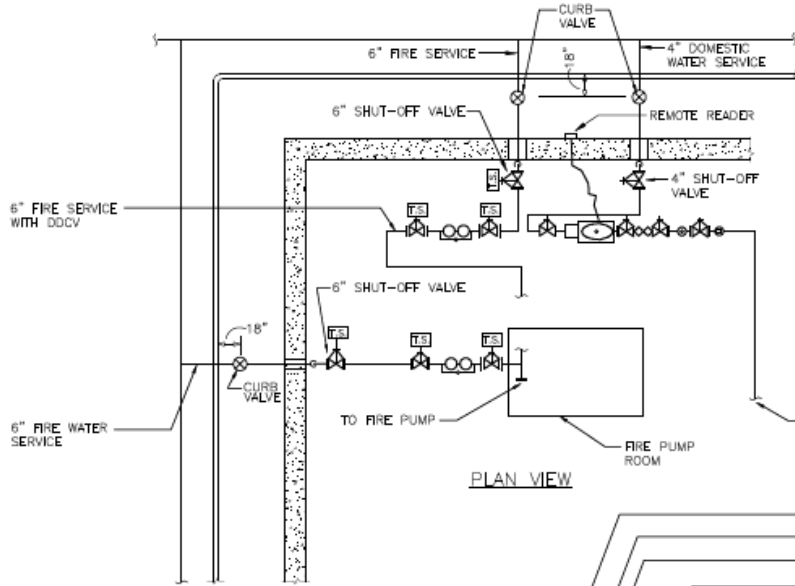


HEADER SCHEMATIC OF WATER SERVICE FOR SPRINKLER SYSTEM WITH A BOOSTER PUMP
NOT TO SCALE

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



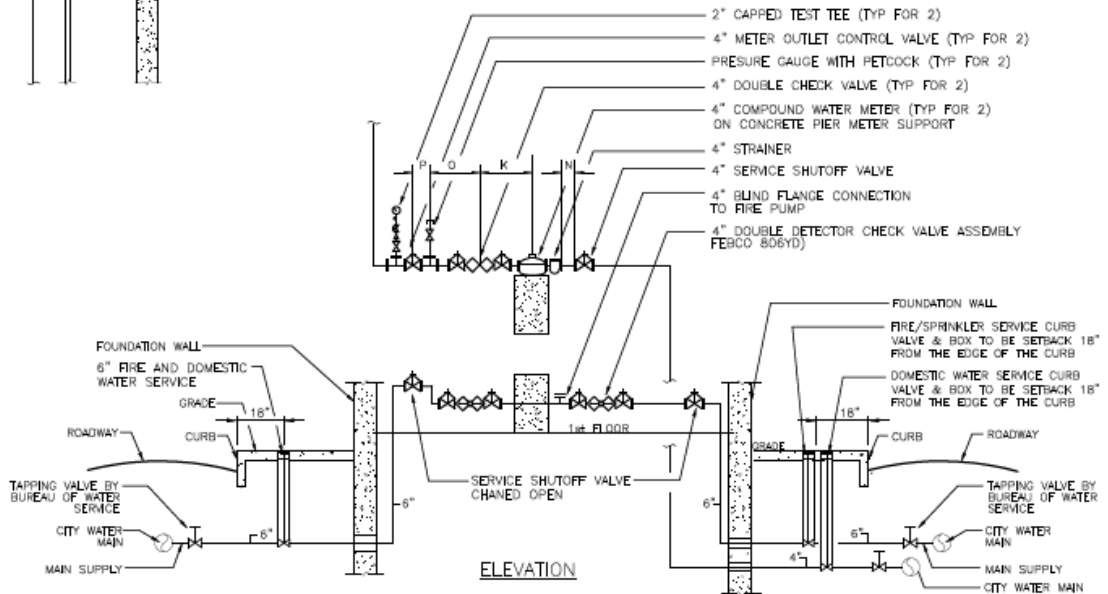
Header Schematic for Domestic and Fire Services Requiring a Fire Pump



SCHEDULE OF DIMENSIONS	REMARKS
A	2'-6" DEP. PREFERRED ELEVATION
J	3'-0" MAXIMUM, BUILDING CODE, RS 16, P107.3, b
K	10'-0" MAXIMUM PERMITTED HORIZONTAL DISTANCE
N	2'-10" BASED ON 4" WATER SERVICE
O	4'-0" AS REQUIRED FOR INSTALLATION
P	1'-11" AS REQUIRED FOR INSTALLATION

NOTES:

1. THE CONTRACTOR MUST INSTALL TAMPER SWITCHES FOR SUPERVISION OF VALVES CONTROLLING WATER SUPPLY TO THE FIRE PROTECTION SYSTEM.
2. COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR INTERLOCKING TAMPER SWITCHES WITH THE FIRE ALARM SYSTEM.



Requirement Applies to: New Construction Major Modernizations Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.5 Water Heaters

Description/Design Approach:

A. New Construction, Existing Construction Major Modernization and CIP Projects

1. Domestic hot water (DHW) shall be provided to the designated areas as per the schedule in part C. DHW is to be generated from either a central unit or a number of integrated heat pump domestic water heaters per Design Requirement 6.1.23, **except when approved otherwise as indicated in Section B below.**
2. The water heater equipment is to supply hot water at 140°F. Hot water distributed to the kitchen and appliances is to be drawn from the heater at the 140°F temperature.
3. A master thermostatic mixing valve that complies with ASSE 1017 and installed near the heater shall be employed for supplying and distributing 120°F hot water to the domestic hot water system except for the kitchen as mentioned in item 2 above. As per Sections PC 607.1, PC 424.3 & PC 424.4 of the 2022 NYC Plumbing Code, tempered water for hand-washing, cleansing and building maintenance shall be delivered via a thermostatic point-of-use mixing valve that conforms to ASSE 1070, which is to be 90°F for most applications. Refer to schedule in part C.
4. For compliance with Sections PC 607.3 and PC 607.3.2, an expansion tank must be provided to manage thermal expansion and pressure increase in the heated water vessel.
5. Sizing of heat pump water heaters is to be as per DR 6.1.23.
6. Point-of use instantaneous electrical units shall be provided for delivering DHW to remote plumbing fixtures that require excessive runs of piping from a central water heater.
7. Point-of-use electric water heaters if proposed and accepted by the Authority, must be strategically located under the lavatories in order to comply with maximum allowable pipe length rules as outlined in Section C404.5.1 and Table C404.5.1 of the 2020 NYC Energy Conservation Code. If rules relating to maximum allowable pipe length are not adhered to, a temperature maintenance system will be required.

B. Capital Improvement Program (CIP) Projects

1. Existing gas-fired domestic water heaters that require replacement **are to be replaced** with heat pump water heaters (**Refer to DR 6.1.23**), unless **the Authority approves, due to unusual circumstances, installation of a gas-fired water heater** for boiler replacement projects and for existing water heaters that are beyond repair and **must be replaced. If approved, provide** a gas-fired unit consisting of a separate storage tank and heater assembly on a skid, typically vented through the existing chimney. Units are to be the conventional type if placed in the same existing room. If a new room is being provided, a condensing type may be more appropriate as it allows for direct intake of combustion and exhaust air. This shall be discussed with the Authority prior to design.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



2. For compliance with Sections PC 607.3 and PC 607.3.2, an expansion tank must be provided to manage thermal expansion and pressure increase in the heated water vessel.
3. The gas fired-heater, the circulating pump as well as the near-piping between the storage tank and the heating coils shall be pre-assembled and shall come from a single manufacturer. The heater section and the storage tank need not be located on the same floor. If project field conditions do not allow, the units may need to be installed in separate sections but all components shall be from one manufacturer.
4. Determination of the size of the gas-fired heater and the storage tank for CIP projects shall not be based on ASHRAE sizing guideline, but must adhere strictly to the empirical design information that the Authority has collected over the years. Sizing of the heater and the storage tank shall be based on the following:
 - a. For all schools with a full cooking-kitchen (not a warming pantry), the capacity (recovery) of the heater is to be based on 70% of the total hot water load for the plumbing fixtures installed in the kitchen only.
 - b. The size of the storage tank shall be 200 gallons

Exceptions:

- a. In schools with warming pantries, a heater with a recovery of 100 gallon per hour (gph) and a 100-gallon storage tank shall be provided.
- b. Additional allowances shall be made in the recovery rate for the water heater in schools with gang-showers (typically high schools and schools with natatoriums). The hot water load for gang-showers must be added to that of the cooking-kitchen. The storage tank size shall be based on 70% of the recovery, with a maximum tank size of 400 gallons.

C. Schedule

HOT WATER REQUIREMENTS SCHEDULE

Location	Temperature Requirement
Storage Tank	140°F water from water heater.
Kitchen - 3-compartment sanitizing sink	Sanitizing/Rinsing - Water supplied at 140°F. Temperature in sterilizing compartment is raised to 180°F by means of a booster heater element within the sink compartment.
All plumbing fixtures	Central mixing valve to deliver 120°F hot water for distribution to the domestic hot water system and thermostatic point-of-use mixing valve to supply 90°F tempered water to faucets.
Science Labs	Central mixing valve to deliver 120°F hot water for distribution to the domestic hot water system and thermostatic point-of-use mixing valve to supply 85°F–90°F tepid water to sinks, eye wash, and shower.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



Design Requirements

Mechanical Services - Section 6.0

Showers	Central mixing valve to deliver 120°F hot water for distribution to the domestic hot water system and thermostatic point-of-use mixing valve to supply 110°F tempered water to showers.
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Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.6 Backflow Prevention Devices - Reduced Pressure Zone (RPZ)

Description/Design Approach:

A. General

1. A backflow prevention device selected from a list of approved cross-containment devices published by the NY State Dept. of Health shall be installed into the header service piping for the domestic water system. The installed device shall be a Reduced Pressure Zone type (RPZ).
2. **Where it is challenging to comply with the DEP regulation requiring an 8-hour containment for the water discharged from a RPZ device installed below grade, the design shall provide for a double check valve in conjunction with local RPZs as a means for preventing cross-contamination in the potable water system. This arrangement is only permitted for schools with a warming pantry and no science rooms.**

B. Location

1. Where the water meter assembly is located above grade in a room with at least one exterior wall, a regular RPZ device without an integral water shut-off means shall be provided. The relief port of the RPZ shall convey its emergency water discharge through an opening in the exterior wall and out to grade. **A floor drain shall also be provided.** For aesthetic and for pest control reasons, the drainage pipe protruding through the wall shall be provided with a perforated cover.
2. Where the water meter assembly is located above grade in an interior room, the RPZ device shall be of a type that includes integral water management capability for emergency discharge. The unique feature of this type of RPZ device is that it will turn off the water supply in case of a catastrophic discharge and water accumulation. In addition, a floor drain shall be provided
3. Where the water meter assembly is located below grade, the RPZ device shall be of a type that includes integral water management capability for emergency discharge. In addition, DEP rules require that there be 8-hour containment provided for protection against submerging the relief port of the RPZ. If the floor drains in the room with an RPZ conveys water to a sump pit for discharge, the sump pump(s) must be connected to an emergency power source.
4. As per appendix G of the **2022 NYC Building Code**, water service piping including the RPZ must be located above the Design Flood Elevation (DFE).

C. Documents to be Filed

1. Drawings that must be filed with the SCA's Building Code Compliance Division (BCC) or DOB as well as DEP shall include elevation and plan views for the installation of the backflow prevention devices. In addition, details and notes on the drawings shall show: the water meter, the house control valve, the meter inlet control valve, the backflow prevention

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



device, a test tee, and the required clearances between exterior walls and valves or between the device and any obstruction or walls. All required distances shall be as per DEP's recommendations.

2. Forms GEN 236 and NYC GEN 215B must be filed with the DEP and a copy of the document with an approved DEP seal must be submitted for Building Department filing before final approval can be given.

D. Inspection

A New York State certified tester employed by a New York City licensed plumber, which is the responsibility of the Department of Education to arrange, must test RPZ devices annually.

E. Relevant Documents - None



6.1 Plumbing and Drainage

6.1.7 Wall Hydrant Requirements for Window Washing and General Maintenance

Description/Design Approach:

A frost-proof wall hydrant shall be provided every 100 feet length of the building façade so that hoses, with maximum length of 50 feet, can service the entire facility. Provide a minimum of one frost-proof wall hydrant on each wall façade.

For roofs that house mechanical equipment, provide at least one frost-proof wall hydrant to wash-down condensers to DX units and/or air-cooled chillers.

The wall hydrant shall be located on an outside wall to the roof bulkhead and its water supply outlet shall terminate at a minimum 18 inches above the roof.



- 1) One utility meter dedicated strictly for gas distribution to boilers and roof top units. Provide one gas submeter directly after the utility meter to monitor gas usage by boilers and rooftop units.
 - 2) One utility meter with other ancillaries such as gas pressure regulator and gas overpressure protecting device dedicated to water heater and/or kitchen/science lab equipment. Provide a gas sub-meter for gas-fired water heaters and a separate gas sub-meter for gas-using appliances in the kitchen/science lab.
2. Gas pressure less than 1/2" (low-pressure gas service) in the serving utility's street piping network

For all projects, the request for service shall be for one (1) utility gas meter. Typically, a low-pressure gas service requires the installation of a gas booster pump to supply the appropriate gas pressure to operate boilers and gas-fired rooftop units, which will provide the whole building gas usage monitoring. Provide separate gas sub-meters to monitor gas usage by water heaters and kitchen/science lab appliances.

D. Integration with Building Management System (BMS)

Gas sub-meters and counter integral to the gas booster pump control panel (if applicable) must be connected to the BMS. Readings obtained from sub-meters and counter from the booster shall be totaled for determining building wide gas usage.

E. The designer shall file with the DOB (BCC) gas sub-meter(s) that are included in the project. The filed schedule B and the plumbing drawings shall show a gas riser diagram that indicates all gas submeters.

1. An attachment to the schedule B shall document, through calculations, the gas-carrying capacity and the required gas pressure to supply to equipment. Pressure loss in the gas distribution piping shall be based upon pressure drops established in Tables FGC 402.4(1) and 402.4(2). In addition, the designer shall also account for the pressure drop across the sub-meter(s).
2. The designer shall ensure that utility gas meter rooms comply with Appendix E of the NYC Fuel Gas Code i.e. provide a minimum 3 feet distance between sub-meter and heating boiler or any other source of ignition or ventilation. Provide a minimum 50-square inch duct for room ventilation purposes in the utility meter room or provide a louvered opening to the outside air in the exterior wall with a minimum free area of not less than 30 square inches per Section E.4 of the Appendix. Due to untampered air entering the room, walls to an interior gas meter room must be insulated to keep the meter room outside the thermal boundary as per the 2020 NYC Energy Code.

F. When the gas pressure in the utility's street piping network is greater than 1/2 psig, the utility company will determine and make available a service pressure regulator at each meter. Selection of each service regulator is based on the specified gas pressure(s) and gas flow requirements outlined in the gas load letter.

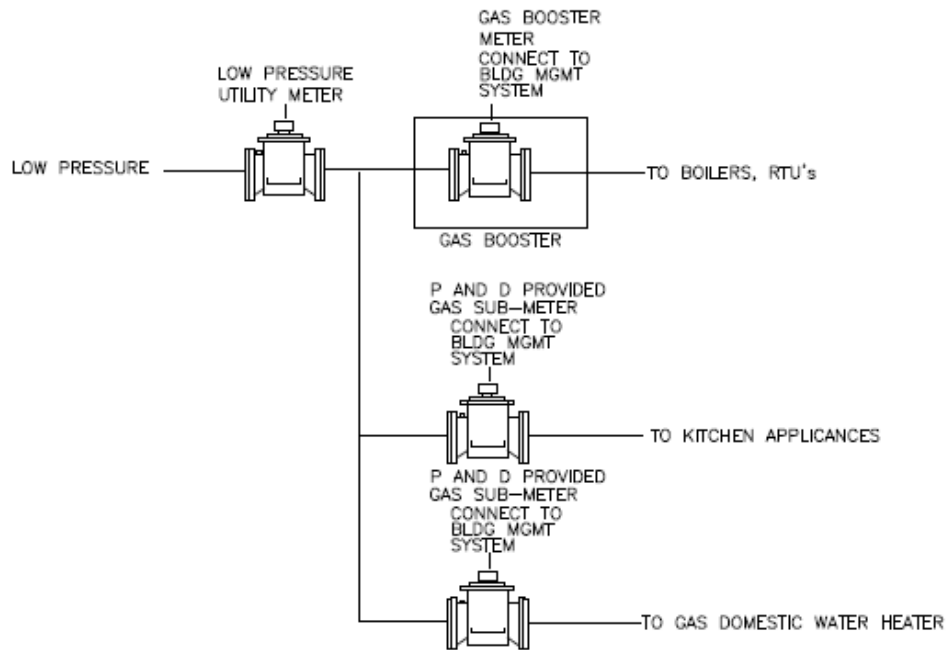
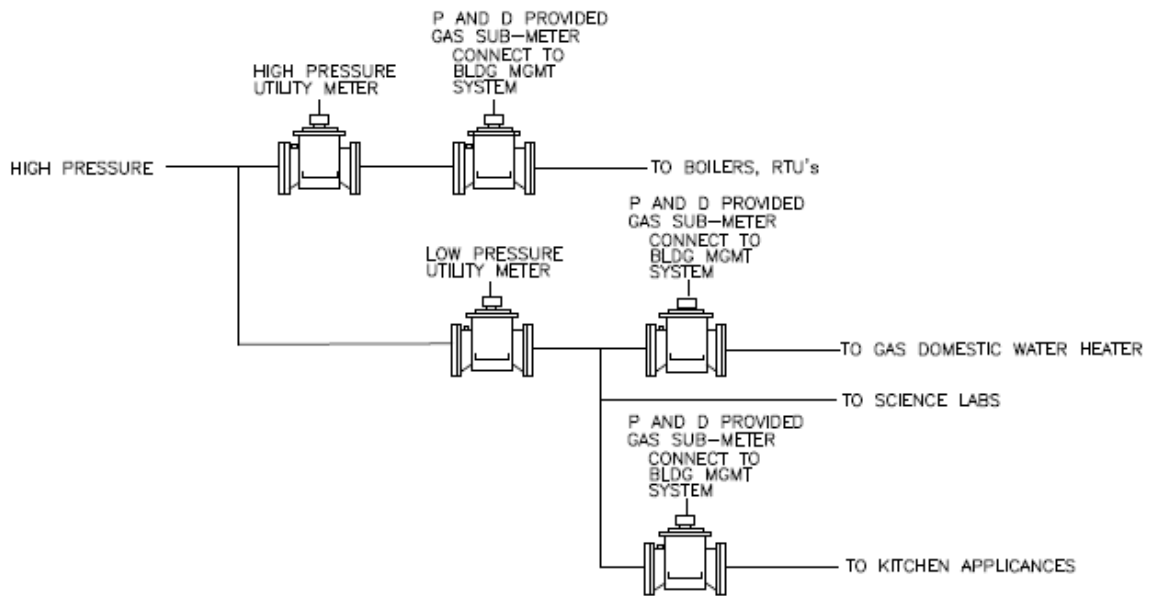
1. The joints of all gas distribution pipe 3" dia. or greater shall be welded. All applicable SCA requirements related to welded gas pipe shall apply. All piping within chases shall be welded regardless of diameter.



2. The service regulator controlling gas distribution lines supplying HVAC equipment (boilers, RTUs and air handling units) is to be set generally for 1/2 psig (14" w.c.) maximum. However, per Section FGC 402.6, a maximum of five psig is allowed if the fuel requirements for commercial appliances exceed 4,000 cubic feet per hour and such large volume use is supplied through separate gas distribution piping. The service regulator associated with gas supply lines to the gas-fired water heater (if provided), gas kitchen appliances (if provided) and science lab equipment (if provided) is to be set for 7" w.c.
 3. To protect HVAC equipment (boilers, RTUs and any gas fired air handling units) against elevated gas pressure, the design shall provide for a line pressure gas regulator fitted in the near-by gas supply piping to each appliance. This regulator shall be rated for emergency gas exposure of at least two psig. Outlet pressure from the gas regulator shall be set at 14" w.c. (or as permitted above by Section FGC 402.6).
 4. Interior mounted gas regulators require vent piping routed to the outside as well as isolation valves for service and maintenance of the regulators. These ancillary items as well as the regulators shall be shown on the gas riser diagram and plans.
 5. Selection of the appropriate line pressure regulators shall be based on the device performance rating and the required outlet gas pressure and BTU requirements for the appliance connected thereafter.
- G. The point of entry of gas service inside the building shall be designed as close as possible to the street gas main to minimize connection charges assessed by the utility company.
1. When gas pressure in the utility company's street piping network is less than or equal to 1/2 psig and thus a gas booster pump is required, it shall be installed on a concrete pad, outside the building, with a NEMA 4X control panel enclosure. Gas booster can only be installed inside the building if the building is on a lot line and if so installed, utilize a NEMA 7 for the control panel enclosure. Refer to DR 6.1.15 for gas booster system requirements.

H. Relevant Documents

- Gas Submetering Schematic Diagram



* METERS ARE SHOWN FOR BUILDING MANAGEMENT INTERFACE. FOR SCHEMATIC REFERENCE ONLY. REGULATORS AND OTHER PIPING SPECIALTIES HAVE BEEN REMOVED FOR CLARITY. DESIGNER SHOULD CONSULT THE CONTRACT PIPING AND SCHEMATICS PROVIDED BY THE UTILITY FOR A COMPLETE BILL OF MATERIALS NECESSARY FOR INSTALLATION

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.9 Gas Valves/Master Gas Control Valve

Description/Design Approach:

A. Applicability: The new SCA standard for both heating and domestic hot water is the use of electric heat pumps, as well as the use of electric kitchen equipment and lab equipment. This Design Requirement would only be applicable where there is a reason that such electrification cannot occur and the SCA has approved the use of gas for the system.

B. General

1. Gas valves shall include, but not be limited to the following:

- Master Gas Control Valves (MGCV) - for shutting down of gas supply in the kitchen and culinary arts room(s). If gas is provided in specialty shops and/or in science labs that have received project specific approval by the Department of Education for gas use, a MGCV is to be provided in those spaces.
- Lubricated Plug Valve – associated with gas service, meter and distribution piping
- Gas Cock – used for manual isolation of gas-burning equipment
- Safety Shut-Off Valve – electrically operated and used for turning off gas service to the building.
- Mechanically operated valve tied to kitchen exhaust hood fire suppression system.

2. Gas valves shall be installed in wall enclosures, pipe spaces or other recesses. The enclosure and spaces must be vented to an adjoining ventilated area.

3. Gas valves shall not be installed above ceilings or be concealed.

C. Master Gas Control Valve

1. A Master Gas Control Valve (MGCV) apparatus, consisting of solenoid valves, a relay control panel/master control station, and remote control station(s) with mushroom pushbutton and the words 'Emergency Stop', is required for controlling gas supply to gas-fired appliances in kitchens, culinary arts rooms, and other designated locations.

2. Location - One MGCV must be provided in the following areas:

a. Kitchens - The Relay Control Panel shall be AC type since there is no concern over AC humming. The Relay Control Panel shall be placed underneath the MGCV. A Master Control Station shall be located near the kitchen entrance door (door from corridor to kitchen) Remote Control Stations shall be placed on interior walls leading to other entrance(s) or exit(s) to the kitchen.

b. Culinary Art Rooms - The Relay Control Panel shall be DC type to avoid the concern of humming of an AC type. The Relay Control Panel with its key-operated switch and

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



- pushbuttons shall be placed underneath the MGCV. Remote Control Station(s) shall be placed on interior walls leading to entrance(s) or exit(s) to the room.
- c. Science Rooms - While science prep, demonstration and labs are currently being equipped with electrically operated Bunsen burners per SCA and DOE standards, a MGCV is to be provided if the Department of Education grants authorization for the use of gas in such rooms due to a school's special focus on science subjects. The Relay Control Panel shall be DC type to avoid the concern of humming of an AC type. The Relay Control Panel with its key-operated switch and pushbuttons shall be placed underneath the MGCV.
 - 1) Laboratory: Provide a remote control station with the words "Emergency Stop" on each of the other three walls not including the wall that has the Relay Control Panel.
 - 2) Demonstration Room: Provide a remote control station on each of the other three walls not including the wall that has the Relay Control Panel.
 - 3) Preparation Room: Provide a remote control station near the door(s).
 - d. Shops - The Relay Control Panel shall be DC type to avoid the concern of humming of an AC type. The Relay Control Panel with its key-operated switch and pushbuttons shall be placed underneath the MGCV. Provide a remote control station on each of the three walls not including the wall that has the Relay Control Panel.
- 3. The solenoid valves, relay control panel, master control stations and remote control stations will be wired by the electrical contractor but must be furnished as part of the plumbing work. The wiring for the relay panel, master control and remote stations shall be shown on the electrical drawings.
 - 4. The MGCV shall be normally closed and shall provide automatic shut-off of gas supply in the event of a power failure. The MGCV shall function as a manually operated emergency gas shut-off, and shall not be interlocked with other systems.
 - 5. Provide a vented cabinet or ventilated enclosure for the MGCV. Locating the valve inside a hung ceiling is not permitted. Ideally, the valve cabinet shall be set at 5 ft. or more above the finished floor in a recessed ventilated cabinet. An exception to the above-described location for the valve cabinet will be made if accommodation can only be provided in a nearby room in the floor below.
 - 6. When a surface mounted cabinet is used (renovations only), the enclosure shall be mounted at approximately 8 feet above the floor within the room it is serving.



6.1 Plumbing and Drainage

6.1.10 Plumbing Fixture Mounting Heights

Description/Design Approach:

- A. The mounting height for plumbing fixtures shall adhere to the schedule listed below and shall be shown on the Drawings. The final installation height shall be taken from the finish floor to the rim of the fixture, unless otherwise noted.
- B. Where a fixture type indicates only an accessible fixture with no non-accessible corresponding fixture, the intent is for that fixture type to be mounted at that **accessible** height for all applications for that grade level.
- C. Mounting heights of accessible fixtures must meet the requirements of ICC A117.1-2009 and ADA 2010.
 - 1. Mounting heights for fixtures within rooms of instruction to be based on grade level of users.
 - 2. Mounting heights for fixtures in common areas to be based on grade level of the predominant users of that space.
 - 3. For a school **that is a PS/IS (PreK through 8th or 9th)**:
 - a. Mounting height for accessible WC's located in multi-stall toilets located on floors that include public assembly spaces (i.e. cafeteria, cafetorium, gymnasium, gymnasium or auditorium) shall be 18" **to top of seat** (6th – 12th grade height).
 - b. Mounting heights for non-accessible WC's located in multi-stall toilets located on floors that include public assembly spaces (i.e. cafeteria, cafetorium, gymnasium, gymnasium or auditorium) shall be 16" **to top of seat** (6th – 12th grade height).
 - c. Countertop heights for lavatories located in multi-stall toilets located on floors that include public assembly spaces (i.e. cafeteria, cafetorium, gymnasium, gymnasium or auditorium) shall be as follows:
 - 1) Provide 50% of lavatories at accessible height of 29" and the other at 50% at accessible height of 33"
 - 2) For an odd number of lavatories, provide the extra lavatory at the accessible height of 33"

Note that this will require that the countertops be at two different heights.



Design Requirements

Mechanical Services – Section 6.0

D. Fixture Mounting Height Schedule

Fixture Type	3K & PK	K	1 st & 2 nd	3 rd - 5 th	6 th -12 th and Adult
Lavatories, non-accessible	24"	27"	27"	27"	31"
Lavatories, accessible (hgt to rim/knee clearance)	24"/NA	29"/24"	29"/24"	29"/24"	33"/28"
Drinking Fountain, accessible – standing (hgt to spout)	40"	40"	40"	40"	40"
Drinking Fountain, accessible wheelchair - side approach (hgt to spout)	**29	**29	**29	**29	---
Drinking Fountains with Bottle Filler, accessible wheelchair - front approach (hgt to spout/knee clearance)	34"/28"	34"/28"	34"/28"	34"/28"	34"/28"
Standalone Bottle Filler, accessible (ht to activation sensor)	33"	33"	---	---	---
Electric Water Cooler, accessible - standing	---	---	---	---	40"
Electric Water Cooler, accessible - wheelchair	---	---	---	---	34"/ 28"
Combination Sink & Bubbler accessible (hgt to counter top/knee clearance)	24"/NA	29"/24"	29"/24"	29"/24"	---
Washfountain, accessible (hgt to rim/knee clearance)	30"/24"	30"/24"	30"/24"	30"/24"	---
Sinks, non-accessible	24"	28"	28"	30"	36"
Sinks, accessible (hgt to rim/knee clearance)	24"/NA	29"/24"	29"/24"	29"/24"	33"/28"
Art Room Trough Sink, non-accessible	---	---	30"	30"	36"
Sink in Culinary Arts Classroom, non-accessible	---	---	---	---	34"
Sink in Culinary Arts Classroom, accessible (hgt to rim/knee clearance)	---	---	---	---	34"/28"
Water Closet, non-accessible (hgt to top of seat)	---	---	---	---	16"
Water Closet, accessible (hgt to top of seat)	12"	15"	15"	15"	18"
Urinals, non-accessible	---	---	---	---	24"
Urinals, accessible	---	---	16"	16"	16"
Shower, Seat Changing Bench in D75 toilet, accessible	---	---	18"	18"	18"
Shower, Seat, at accessible stalls only	---	---	---	---	18"
Shower head discharge height, non-accessible*	---	---	---	---	6'-0"
Shower, Bottom of Controls, accessible*	---	---	---	---	38" min
Shower, Top of Controls, accessible*	---	---	---	---	48" max

Notes:

* Shower head and shower controls are all part of a singular panel. For accessible stalls, the control mounting heights govern.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.11 Storm Water Management

Description/Design Approach:

A. On-site storm water management must meet the NYC DEP requirements for both storm water quantity and storm water quality as mandated by the Unified Storm Water Rule (USWR). As installation of photovoltaics onto roofs has first priority and given that the Authority is still investigating design strategies that would combine installation of green roofs with roof-mounted solar panels, the designer is to consider green infrastructures drainage solutions plus on-site detention system as first option for storm water management, and if necessary, to look at providing for a green roof in conjunction with roof detention to meet the USWR requirements.

B. Rooftop Detention

1. Where rooftop detention is utilized, the following guidelines are to be followed, while adhering to the allowable storm flow rate set by DEP.

- Containment of an average of 3” of storm water build-up, with a maximum 4” at the drain for a roof with a 2” rise, shall be by means of roof drains fitted with control flow devices. The 2” rise is to provide a minimal pitch to the drain and is to avoid water stagnating on the roof.
- The exact number of control flow devices that are to be provided shall be based upon a drain down time of less than 24 hours. For design purposes, the drain down time is the time required for the complete removal of storm water off the roof following a rain event that has a 100-year return period and a 3” rainfall intensity per hour. The final storm drainage calculation shall include controlled as well as uncontrolled flow contributions. (See equation used for calculating uncontrolled flow through seepage holes provided in the extended ring of the drain assembly).
- The structural integrity of the roof shall not be compromised due to the temporary detention of the rainwater being held thereon. To that end, the roof structural design shall include an increased live load as specified in D.R 3.1.2, which is equivalent, in depth, to 9” inches of water. Pavers shall be such as to keep the insulation from floating, weighing 5 lbs per inch of insulation with an additional 10% safety.
- The placement of drains from the roof’s edge shall not exceed 50 ft. travel distance and the spacing between drains shall not be more than 200 ft.
- To augment bonding between the waterproof liquid membrane and the drains, the selected drain shall be equipped with a wide body flange. The enlarged portion of the drain body provides a greater area for application of the rubberized liquid membrane material.
- The structural roof deck will expand and contract. As a result, the drains including the piping connected therefrom will shift. A design allowance to compensate for the movement of the drainage piping shall include horizontal offsets between the drain outlet

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and the vertical leader. If provision of the horizontal offset is impractical, then a flexible connection shall be placed between the drain outlet and the leader.

- If trapezoidal weirs are selected as control flow devices, and a PRMA roofing system is employed, the weir's bottom shall coincide with the top level of the insulation and the amount of uncontrolled flow shall be accounted for in the final calculation for storm drainage using:

$$Q = 450 C_d A \sqrt{2gh}$$

where: Q = the flow rate in gpm
 $C_d = .513$ (a constant)
 A = total area of all holes in square feet (24 holes with 0.25" in diameter)
 G = 32.2 ft/sec² (gravity)
 H = head in feet (4" or .33 ft)

Refer to SCA Standard Details for 'Type – D' control flow drain.

2. In addition to **primary roof drains**, a relief system consisting of scupper or **secondary roof drains** shall be provided. The preferred option is to provide roof scuppers of 4" minimum diameter. If the building is **sited in such a way** that scuppers would discharge directly onto **an** adjoining property, a secondary roof drain system shall be installed, with the piping system combined and sized accordingly as per PC **1108.3**
3. Invert of scupper shall be placed 1" above the average water level, which will meet the 2" or 4" above low point of adjacent surface as per PC **1108.1** For Protected Membrane Roofing Assembly, the top of insulation (or paver if ballasts with all pavers) is considered the top of roof surface.
4. The storm run-off contribution from the relief system shall not be included in the site connection proposal that is filed with the DEP.



6.1 Plumbing and Drainage

6.1.12 Gas Load Letter

Description/Design Approach:

- A. Applicability:** The new SCA standard for both heating and domestic hot water is the use of electric heat pumps, as well as the use of electric kitchen equipment and lab equipment. This Design Requirement would only be applicable where there is a reason that such electrification cannot occur and the SCA has approved the use of gas for the system.
- B.** Upon approval of a building scheme, the designer shall issue a load letter to the utility company outlining the gas requirements for the school. The letter is to include the following:
1. The location of the school including a site plan.
 2. Proposed exterior location for the gas meter and appurtenances
 3. The gas input per unit of equipment
 4. Operating hours and mode of operation
 5. Firm gas requirements
 6. Low/High fire rate of modulating equipment
 7. Pilot gas requirements
 8. Gas pressure requirements
 9. Miscellaneous (e.g. SCA responsibilities vs. the utility company's obligations, gas pipe sizing, etc.)
 10. Request utility company charges, if any, for providing service.
 11. Ensure that the load letter written and transmitted to the utility company clearly establishes that this will be a public school project that belongs to the SCA. In addition, the name of the CPO for the borough in which the project is located as well as DM and DPM shall appear in the cc list.
- C. Relevant Conceptual Sketches:**
- See next page for sample Load Letter.



Sincerely,

XXXXXXXX

cc: SCA DPM
SCA DM
SCA CPO



6.1 Plumbing and Drainage

6.1.13 P&D Seismic Design Criteria

Description/Design Approach:

- A. As per Section BC 1613.1 of the **2022** NYC Building Code, every new school building structure, and portions thereof, including nonstructural components (architectural, MEP, fire protection) along with their permanent attachments and supports to the structure, shall be designed and constructed to resist the ground motion resulting from earthquake events in accordance with ASCE 7–**16**, excluding Chapter 14 and appendix 11A. The Seismic Design Category will be determined by the structural Engineer of Record and indicated on the structural drawings.

- B. Per Section BC 1601.2.3, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 NYC Building Code and interpretations by the Department of Buildings relating to such determinations. Refer to Local Law 17/1995 and TPPN 4/99. Any applicable seismic loads and requirements, including for the bracing of plumbing and fuel gas systems and equipment, shall be permitted to be determined in accordance with Chapter 16 of the **2022** NYC Building Code or reference standard RS 9-6 of the 1968 NYC Building Code.
 - 1. If an existing building is required to meet seismic requirements as per the criteria described in DR 3.1.3 and a waiver from the Department of Buildings (DOB) cannot be obtained, the Plumbing and Drainage retrofit work must then meet such requirements.

- C. For new addition projects, any plumbing/drainage item in the existing building that is integrated with the systems in the new addition that is required to function after an earthquake shall also meet the seismic requirements of the addition. All systems (equipment and distribution lines) in the existing building utilizing gas shall be seismically braced. This includes gas meter room and gas booster pump room equipment and piping, water heaters etc. Existing bolting of equipment to its pad and doweling of pad to floor slab shall be analyzed. Kitchen equipment and Science Lab gas equipment are not mandated to be braced.

- D. New School Buildings and Additions constructed after LL17/1995 went into effect are subject to the seismic requirements of the New York City Construction Codes and are considered /Risk Category III, “Buildings and other structures that represent a substantial hazard to human life in the event of failure” for seismic design as per BC Table 1604.5.
 - 1. Seismic Design Category shall be determined by the project structural engineer. The Seismic Design Category for a structure is determined in accordance with Section BC 1613. The Seismic Design Category is to be indicated on the Structural Drawings (Refer to Detail 0100054a) and Component Importance Factors related to P&D shall be indicated on the P&D drawings. (Refer to Standard Detail 1540301a).
 - 2. Component Importance Factors (I_p) are prescribed in **Chapter 13 of ASCE 7-16**. The default value for typical components in normal service is $I_p=1.0$. The following components have $I_p=1.5$ (Refer to Standard Details 1540301a for a specific listing of common items):
 - a. Life safety components required to function after an earthquake. This includes the water supply for the fire protection systems, etc. Functioning after an earthquake means just

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long enough to evacuate the building as opposed to functioning as a disaster relief center. Per Section 13.2.2, **of ASCE7-16**, active plumbing equipment that must remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5, analysis or experience data in accordance with Section 13.2.6, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval by the SCA after review and acceptance by the Contractor's registered design professional.

- b. Components with hazardous content. This includes materials that are highly toxic or potentially explosive and in sufficient quantity to pose a significant life safety threat to the general public if uncontrolled release were to occur. Schools typically do not contain these materials, but for seismic purpose (calculation of the seismic design force, restraint and anchorage design) natural gas, acid waste system, water heaters etc., are to be designed as such.
 - c. Components containing hazardous or flammable materials in excess of the maximum allowable quantities for open systems listed in Section BC 307.
 - d. Components with $I_p=1.0$ located above or in proximity to components of MEP items with $I_p=1.5$ which could damage the $I_p=1.5$ equipment shall be braced.
3. For Seismic Design Category B, all plumbing & drainage components are exempt from the seismic requirements.
 4. For Seismic Design Category C, all plumbing & drainage components with $I_p=1.0$ are exempt from the seismic requirements.
 5. For Seismic Design Category C, all plumbing & drainage components with $I_p=1.5$ shall be designed and constructed to the seismic requirements.
 6. Appropriate seismic coefficients to be utilized in the design of seismic resistance for the plumbing/drainage system shall be those listed in Table 13.6-1 of ASCE 7-16.
 8. Piping systems components like plumbing & drainage along with their attachments or supports to the structure shall be designed in accordance with Section 13.4 of ASCE 7-16. They shall be bolted, welded or otherwise positively fastened without consideration of the frictional resistance produced by the effects of gravity. A continuous load path of sufficient strength and stiffness between the component and the supporting structure shall be provided. The component forces shall be those as determined by the calculations outlined in Section 13.3.1.
 9. Piping systems components of plumbing & drainage shall be designed as per Section 13.6.7 **of ASCE 7-16** in that the seismic resistance force for the plumbing/drainage system component shall match the seismic forces and the relative displacement as prescribed by the calculations outlined in Section 13.3.
 10. For pressure piping systems, including their supports, the force and displacement requirements of Section 13.3 of ASCE 7-16 shall be used. Materials meeting the toughness

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requirements of ASME B31 shall be considered high-deformability materials (Section 13.6.7.1).

11. Piping support components shall be designed by either load rating (i.e. testing) or for the calculated seismic forces (Section 13.6.4.1 of **ASCE 7-16**). In addition, the stiffness of the support, where appropriate, shall be designed such that the seismic load path for the component performs its intended function.
12. When seismic design is required, generic seismic restraint details shall be shown on the contract drawing bid set. A note shall be added stating, "Details are shown to illustrate the scope of work. Contractor's registered professional engineer shall provide calculations and be responsible for providing signed/sealed coordinated shop drawings indicating locations of seismic restraints and the required connection details to file with the DOB/BCC".
13. All bracing devices shall be qualified either through analysis or be tested and certified in accordance with ICC-ES AC 156. Local NYC accelerations are to be used when computing seismic inertia forces. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to seismic bracing designs must be stamped by the Contractor's Registered Professional Engineer with at least five years of seismic design experience in non-structural building components in New York State.
14. All attachments of hangers and bracing shall be positive attachments that shall be cast-in-place anchors, drill-in wedge anchors, or a welded or bolted connection to structure. Drill-in wedge anchors shall be epoxy adhesive base and shall have an evaluation report number from ICC-ES verifying their allowable loads. Anchors must be certified for use in cracked concrete.

E. The following note is to be included on the plumbing & drainage drawings:

"For all items that are required to have seismic supports or restraints, seismic plans and seismic restraint calculations shall be prepared, sealed, and submitted by a Professional Engineer licensed in the State of New York engaged by the Contractor. The Engineer shall provide installation supervision of all seismic supports and restraints. The Contractor's Registered Professional Engineer shall submit signed and sealed affidavit stating that the installation is in full compliance with the signed/sealed shop drawings."



6.1 Plumbing and Drainage

6.1.14 Grease Interceptors and Oil Separators

Description/Design Approach:

A. Grease Interceptors

1. In accordance with DEP's *Sewer Use Regulations*, a grease interceptor or automatic grease removal device shall be provided for the disposal of wastewater from plumbing fixtures that may carry fats, oil and grease to the sanitary sewer system. The SCA/DOE standard is to use a manufactured grease interceptor. These fixtures include, but are not limited to, cooking sinks (including the 3rd compartment sterilization sink of a 3-compartment sink), can wash area drains, floor drains, tilting braising pan trough, milk disposal sinks, etc.
2. Selected grease interceptors shall comply with Best Management Practice (BMP) regulations that are enforced by the Industrial & Acid Waste Unit at the DEP, and shall also conform to code provisions laid out in Section PC 1003 of the **2022** NYC Plumbing Code. The code requirements as well as guidelines from the *Sewer Use Regulations* address referencing standards for the design and the testing of grease interceptors that are consistent with PDI G101, ASME A112.14.3 and/or ASME A112.14.4.
3. Sizing of grease interceptors must comply with Table I or II contained in DEP guidelines published for *Sewer Use Regulations*. Tables I & II outline the aggregate volume in cubic inches of sinks and the corresponding flow rate in gallons per minute (gpm) for a suitable grease interceptor and the retention grease capacity in lbs.
4. The grease interceptor shall be located as close as possible to the fixture(s) that it serves. A drainage pipe run from the fixtures' tail waste to interceptor's inlet that exceeds 25 linear feet shall not be permitted.
5. **Grease removal and grease trapping requirements do not apply to the floor drain located in warming pantries such as those typically provided in 3-K facilities, as these facilities only use food-heating cabinets and no cooking is involved. This is all pursuant to an exemption that the DEP has granted to the SCA. The sink in warming pantries are required to be connected to a surface installed grease trap**

B. Oil Separators

Oil separators shall be provided as per **Section** PC 1003.4 to prevent the discharge of oil into the building drainage system. An oil separator is not required for hydraulic elevator **sumps**, as a submersible sump pump equipped with oil monitoring probes, which shut down the pump when oil is detected, and conveys wastewater to the sanitary system via an air break shall be installed. **Operation/functionality of the oil monitoring system shall not interfere with the readiness of pumps utilized for operating elevators used by fire fighters during emergencies.**

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C. Relevant Documents

- Letter from NYC Department of Environmental Protection outlining requirements for waiving of floor drains in warming pantries being connected to a grease interceptor, dated 6/16/2022.



June 16, 2022

Rohit T. Aggarwala
Commissioner

Pam Elardo, P.E.
Deputy Commissioner
Bureau of Wastewater
Treatment

96-05 Horace Harding
Expressway
Corona, NY 11368

New York City School
Construction Authority
Standards & Technical Studio
Manager for Plumbing & Drainage
30-30 Thomson Avenue
Long Island City, NY 11101
Attn: Mr. Harry Cethoute, P.E.

Re: Warm Up Kitchens in 3-K School Facilities

Dear Mr. Cethoute,

We are in receipt of your request for a review of grease interceptor installation requirements for what you have designated as “warm up kitchens in 3-K school facilities,” all of which are to be of the same standard design and operating procedures. The New York City Department of Environmental Protection (DEP) is providing conditional grease interceptor approval for said design and procedures as described herein provided that these kitchens are found in conformity thereto upon inspection.

The standard design and operating procedures for said kitchens as described by you in your letter dated May 4, 2022, and your email dated May 17, 2022 (see attached) include the following:

- No ovens will be provided. There is no cooking at these premises. Meals are prepared off-site and will be brought-in for later distribution during lunch periods. The meals will be kept in heated stainless steel cabinets that are mobile. The food transport cabinet will be similar to a product made by Carter Hoffman, is electrical and operates on 120 volts. Typical cabinet size is 30 1/2” H x 30 5/8” W
- Hoods are not required and will not be installed.
- Only pre-cooked foods will come into the school in metal trays. Those trays will be washed in the single 2-compartment sink that is also provided. There will be no dishwasher.
- The only sink that will be installed will be a one two-compartment sink within the volume range of 1,540 to 21,560 cubic inches and will be connected to a 35gpm/ 70 lbs. capacity grease interceptor in accordance with 15 RCNY §19-11 *Best Management Practices (BMPs) for All Non-Residential Dischargers of Fat, Oil, and Grease to the Public Sewer System*, and Table I therein.

A conditional waiver of the grease interceptor installation requirement for a single floor drain in said warm up kitchens is also granted provided that the

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



kitchen conforms to the standard design and operating procedures listed above.

The DEP may, at any time, order that different or additional grease interceptors be installed in accordance with 15 RCNY §19-11 if determined upon inspection that said standard design and operating procedures are not being adhered to, or other noncompliance with the applicable regulations is observed, including but not limited to floor spillage indicative of a potential for fat, oil, or grease to enter a floor drain that is not connected to a grease interceptor.

The applicant bears full responsibility for ensuring compliance. The Department, by this letter, shall not incur any liabilities or obligations for the failure of the effluent to comply with the Rules of the City of New York (Use of the Public Sewers) or any other laws, regulations, the Administrative Code, or any other document, and the applicant bears full responsibility for ensuring compliance thereto.

Submissions for each individual warm up kitchen must be in narrative form (diagrams are not required), and include at a minimum:

1. The designer's official business name and address.
2. The school name, address, zip code, and block and lot number.
3. The size of the sink in inches as length x width x height = cubic inches.
4. The selected grease interceptor's make, model, minimum flow rate in gallons per minute (gpm), and minimum grease retention capacity in pounds (lbs).
5. A statement indicating compliance with the standard design and operating conditions described above, and referring back to this letter (identifying it by date and subject matter), as DEP will not be providing separate responses for each submission.

If you have any questions regarding this matter, please contact Ms. Sophia Rabich by phone at (718) 595-4707 or email at sophiar@dep.nyc.gov.

Sincerely,

DocuSigned by:

Frances Leung

4A1BEC2E952A40B

Frances Leung, P.E., Chief
Division of Pollution Prevention and Monitoring
Bureau of Wastewater Treatment

enc: Letter from Harry Cethoute to Sophia Rabich dated May 4, 2022
Email from Harry Cethoute to Sophia Rabich dated May 17, 2022



6.1 Plumbing and Drainage

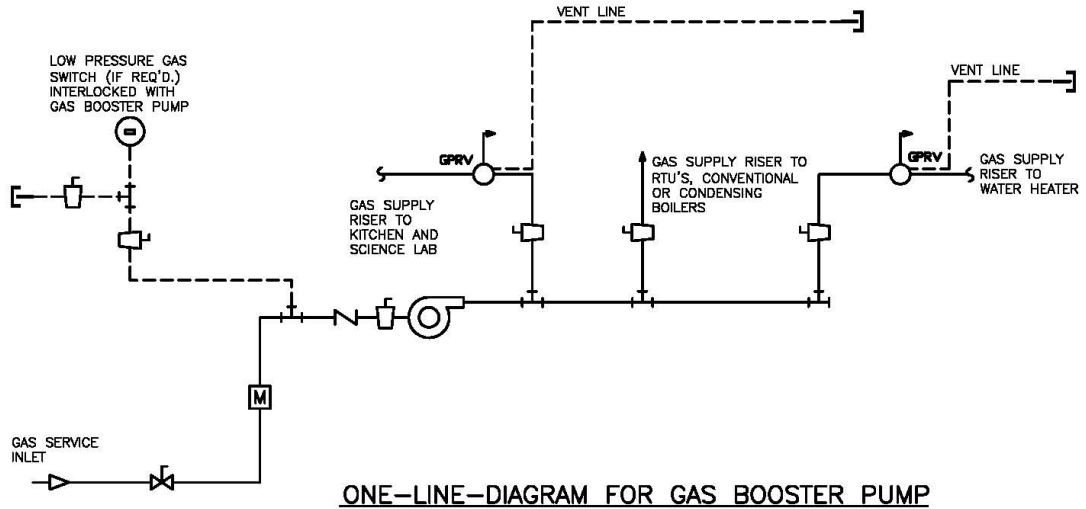
6.1.15 Gas Boosting System

Description/Design Approach:

- A. Applicability:** This Design Requirement would apply only to those cases where new gas-fired equipment has been approved for use by the SCA, as the SCA standard is to employ air source heat pumps systems for heating and domestic hot water.
- B.** When the gas utility company supplies low-pressure gas to a school and a commitment is made to guarantee only 4 inches w.c. of gas pressure at the head of service valve, the gas distribution system shall be designed with booster pumps, regulators and other accessories.
- C.** The boosting system shall provide for the required gas pressure and volume that all gas-burning equipment and appliances, including Bunsen burners (when approved for use as the SCA standard is to use electric units), **need to operate**. In schools designed **with gas-fired** rooftop units and boilers that are used for space heating, the boosting system shall consist of duplex pumps, heat exchanger, re-circulation loop piping and other accessories. The duplex pumps shall alternate and shall sequence based on time of operation, **the** temperature of gas flowing through the system and **a** failure mode.
- D.** **The** gas-riser diagram **for typical gas-fired appliances** shall indicate three (3) separate **risers**: one for the boilers and rooftop units, a second for the water heater and a third for cooking appliances **(if used, as the SCA's standard is the use of electric kitchen equipment)** and the science labs. **To avoid gas pressure creep from affecting the normal operation of mechanical equipment, appliance pressure regulators shall be provided for each individual appliance.** Line pressure regulators **shall be vented and the vent piping** extended to the building exterior (see attached one-line-diagram).
- E.** The **designer shall determine the capacity and size of gas pressure regulators based on gas input requirements for the appliances connected thereto.**
- F.** Metering equipment, including the actual number of required gas meters, and the associated piping that relates to the gas boosting system shall be based on the gas load letter and the requirements of the serving utility company.









G. Relevant Documents

Gas Booster Pump One-line Diagram



EQUIPMENT LIST

LEGEND:

- | | |
|---|---|
|  METER ASSEMBLY WITH PROPER SUPPORTS |  GAS PRESSURE REGULATOR VALVE (GPRV) |
|  CHECK VALVE |  GAS BOOSTER PUMP |
|  RISER VALVE/ LUBRICATED PLUG TYPE |  SERVICE HEAD VALVE |
|  LOW PRESSURE GAS SWITCH |  PLUGGED CONNECTION |

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6.1 Plumbing and Drainage

6.1.16 Potable Water Reduction – Compliance with LL51/23

Description/Design Approach:

- A. The design of plumbing and drainage systems in all new capacity **projects** and CIP projects that involve the installation or replacement of plumbing systems that include the replacement of fixtures shall achieve potable water savings as legislated by Local Law **51/23**.

- B. The law requires that construction projects with an estimated cost of two million (\$2,000,000.00) dollars and above involving the construction of new buildings, additions to existing buildings, and capital improvement projects involving the installation or replacement of plumbing fixtures with an estimated construction cost of five hundred thousand (\$500,000.00) dollars or more, **must** be designed and constructed in such a way that potable water consumption is reduced. The legislation mandates, at a minimum, 30% water savings. The methodology for determining potable water reduction shall not be less stringent than that prescribed by LEED (Leadership in Energy and Environmental Design). Water performance ratings for plumbing fixtures that were established by the Energy Policy Act of 1992 (EPAct 1992, and as amended), and the later EPAct of 2005 shall be incorporated into the methodology used to determine potable water estimated usage.

- C. The designer shall utilize the “Water Use Reduction Form” that is found in the “NYC Green Schools Guide” to demonstrate compliance in the design case with the minimum 30% water saving. For Capacity projects other than 3K and UPK projects, which don’t utilize many urinals, the water savings will typically be at 35%. The calculations used to document reduction in the volume of potable water consumed in schools shall take into account the following: number of male and female occupants, frequency of daily usage for relevant plumbing fixtures by male and female occupants, duration of use, volume of water per use, number of school days in one year and water performance rating for flush and flow types fixtures. The designer shall further assume in his/or her “Water Use Calculations” that male occupants use water closets once and urinals twice daily. The “Water Use Calculations” shall also be based on the assumption that female occupants use water closets three times daily.

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Design Requirements

Mechanical Services – Section 6.0

6.1 Plumbing and Drainage

6.1.17 Conveyance of Sanitary Waste from Plumbing Fixtures and Drains Located in Basement or Cellar Floors

Description/Design Approach:

A. Intent

To reduce or eliminate the risks of public sewage backing up into a school and overflowing from plumbing fixtures or drains onto basement or cellar floors.

B. Design Approach

- Elevating drainage lines associated with plumbing fixtures installed in a basement or cellar and using mechanical means to pump the sanitary waste shall be the design solution for conveying sewage from the basement **or cellar** into the building drain pipe. Duplex type sewer ejector pumps, in conjunction with a receiving tank, shall be included in the drainage plan for discharging the sanitary waste from the basement or cellar. The selection of the sewer ejector pumps shall be based upon the number of water closets that a single pump can support (**see table below**), while sizing of the receiving tank shall be formulated on the basis of one fixture unit (FU) for each gpm.

Number of water closets handled	Pump capacity (gpm)
1	50
2 or 3	75
4 or 5	100
6 or 7	125
8 to 10	150
11 to 15	200
16 to 20	250
21 to 25	300

- Where appropriate, a sizing method for sewage or ejector pump that is based on the diameter of the discharge pipe, and is consistent with Section PC 712.4.1 of the 2022 NYC plumbing Code, shall be employed. The selected pump capacity shall not be less than that indicated below:

Minimum Capacity of Sewage Pump or Sewage Ejector	
Diameter of the discharge pipe (inches)	Capacity of Pump or Ejector (gpm)
2	21
2½	30
3	46

- As per NY City Plumbing Code, tying of the elevated drainage line from the sewer ejector pumps into the building drain pipe shall be made after the house trap or on the street side of the sewer pipe joining the building drain to the public sewer. Conveyance of sanitary waste from plumbing fixtures located on floors above the basement level shall follow a gravity flow drainage design.

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6.1 Plumbing and Drainage

6.1.19 Management of Silver Halide Discharged from Plumbing Fixtures Located in Dark Rooms

Description/Design Approach:

Silver halide recovery units shall be provided in Dark Rooms where film developing, photo finishing and printing are conducted. The photographic wastes discharged from sinks, tables and processors used during picture developing contain silver halide, the release of which is governed by an understanding between the DEP and the SCA. The agreement letter dated 5/22/2013 between the Authority and the DEP calls for harvesting silver halide in the following manner:

1. The SCA design strategy to capture silver halide must follow the criteria laid out in Use of Public Sewers for discharges of less than 100 gallons per day of total silver halide in process wastewater. A silver recovery unit capable of removing 90% of silver salts shall be fitted in the sanitary waste piping to tables, sinks and processors. The silver recovery device must be placed upstream of an acid neutralizing tank.
2. The designer of a silver halide control system must submit to the DEP a letter of intention indicating that proposed recovery units satisfy the requirements for mitigation of silver halide release as laid out in the DEP letter to the SCA dated 5/22/2013 (the “agreement”). The letter of intention must be signed and sealed by the designer (EOR). It must indicate the following.
 - a. The influent and effluent from the silver recovery unit will be tested by the Department of Education. Every 3-month interval, the test will be conducted on a day that is representative of normal operation of film development or photo finishing.
 - b. Maintenance and replacement of the silver recovery unit will be done in accordance with an established protocol requiring the vendor to re-claim the unit when the filter is full. The filter must not be changed nor be replaced in the field.
 - c. Daily measurement of the quantity of total silver halide process wastewater discharged to the public sewer will be performed
 - d. Records will be kept to document when silver recovery units are either installed or replaced. These records will remain at the school site for at least one (1) year.

3. Relevant Documents

Department of Environmental Protection letter of 5/22/2013



School Construction Authority
Architecture & Engineering



Carter H. Strickland, Jr.
Commissioner

Vincent Sapienza
Deputy Commissioner
Bureau of Wastewater
Treatment
vsapienza@dep.nyc.gov

96-05 Horace Harding
Expressway
Corona, NY 11368
T: (718) 595-4906
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May 22, 2013

New York City School
Construction Authority
30-30 Thomson Avenue
Long Island City, NY 11101
Attn: Mr. Harry Cethoute, P.E., LEED AP BD+C
Managing Engineer

Re: Silver Halide Process Wastewater Discharge
NYC Public Schools

Dear Mr. Cethoute:

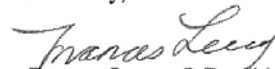
Please be advised that the Silver Halide Process Wastewater discharge from NYC Public Schools must fully comply with New York City Sewer Use Regulations which include but not limited to RCNY Title 15, §19-07, Best Managing Practices Plans (BMPPs) for Persons Discharging Total Silver Halide Process Wastewater to the Public Sewer System.

In lieu of submitting engineering drawings for new construction, renovation or capital improvement projects, the applicant may submit a letter (signed and sealed by Professional Engineer or Registered Architect licensed in the State of New York) indicating that the proposed school will comply with the above mentioned BMPPs as outlined in your letter dated May 4, 2013 (attached).

The filing exemption as described above applies only to silver halide discharges from NYC public schools. SCA may be required to submit plans to and obtain approval from DEP Bureau of Wastewater Treatment for other types of renovation or capital improvement projects.

If you have any questions regarding this matter, please contact Ms. Sophia Rabich, Associate Project Manager, by phone (718) 595-4707 or by email srabich@dep.nyc.gov.

Sincerely,


Frances Leung, P.E., Chief
Industrial Inspections &
Permitting Section

enc: Letter dated 05/06/2013 from Mr. Harry Cethoute, P.E.



6.1 Plumbing and Drainage

6.1.20 Overpressure Protection Devices Stemming from Elevated Gas Pressure by the Serving Utility

Description/Design Approach:

- A. Applicability:** This Design Requirement would apply only to those cases where new gas-fired equipment has been approved for use by the SCA, as the SCA standard is to employ air source heat pumps systems for space heating and domestic hot water production.
- B.** In accordance with Section FGC 416 of the **2022 NYC Fuel Gas Code**, the design of gas systems shall provide for overpressure protection in the piping **system for** preventing gas pressure **from** exceeding a pressure that would cause **the** unsafe operation of any appliance connected to the system. **Besides the service or line pressure gas regulators, protection devices intended for controlling gas pressure creep in the down fed gas-fired appliances shall be provided and shall do the following:**
 - 1. Each device **shall** limit the **gas** pressure to a value that does not exceed the maximum working pressure of the downstream system
 - 2. The individual failure of either device shall not result in the over-pressurization of the downstream system.
- C.** Provision of the overpressure protection device is required **by the 2022 NYC Fuel Gas Code** for **cases where the serving utility delivers gas at a pressure greater than 2 psig. However, the overprotection device must be provided whether the appliances are operating with inlet gas pressure at 14” w.c. or less or at a pressure greater than 14” w.c. While many manufacturers have internal overpressure protection devices for their equipment, some do not guarantee their performance and thus for added safety the overpressure protection device is to be provided regardless of individual manufacturer’s recommendations to not require such.**
- D.** The gas overpressure protection device shall be a monitoring **gas** regulator installed in series with a service or line pressure regulator and set to shutoff when the pressure on the downstream piping system reaches the maximum working pressure or some other pre-determined pressure less than the maximum working pressure.
- E.** Vent piping for overpressure protection devices shall be directed to the outside. Designers shall show overpressure protection devices in the gas riser diagram and include in the drawings notes asking the Contractor to exercise care and to protect vent piping against water entry or blockage by insects or other foreign materials.
- F.** Overpressure protecting devices are required to be maintained and inspected every 2 years by a Licensed Master Plumber, with the inspection records kept by the Department of Education and made available to the DOB. If the gas pressure is 15 psig or more, the maintenance and inspection requirements are for once a year.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.21 Miscellaneous P&D Drawing Requirements

Description/Design Approach:

- A. The following items shall be shown or taken into account on the P&D Drawings:
1. Ensure that sanitary lines are not shown being routed over the kitchen. If there is no other option, obtain approval from the SCA to utilize panning and other means to collect drips from the piping. When checking shop drawings, ensure the Contractor does not route such lines over the kitchen.
 2. Per Section 110.26(E) of the NYC Electrical Code and the Building Code, ensure that plumbing and sanitary/storm lines are not shown being routed over electrical/telecommunication rooms and closets as well as elevator machine rooms. When reviewing coordination and shop drawings, ensure the Contractor does not route such lines over the spaces.
 3. Avoid routing water pipe risers and sanitary/storm water pipe risers in the demising wall between electrical/telecommunication/elevator machine rooms and other rooms.
 4. Ensure that a floor drain is provided under the mobile hot food counter and the mobile counter/table in the server area. Ensure the drain lines for the mobile counters are placed such that they will not be in walkways, as well as condensate lines that shall be placed so as to not create a tripping hazard. Coordinate all drain line locations with the Kitchen Consultant and Architect.
 5. In boiler rooms, locate the RPZ device and the drainage line from the discharge port of the RPZ away from electrical panels.
 6. Do not provide a floor drain in the acid storage room, except for acid drainage piping that discharges into centralized acid tanks. A centralized acid neutralization system is typically provided in high schools where the number of acid sinks exceeds 25, and the installation of a centralized system must facilitate easy routing for piping and connection to floor drainage pipe. The local acid neutralizing canister is not appropriate for connection of floor drainage pipe to the device.
 7. The cable actuated gas valve shutoff (when electric cooking equipment is not used, which is the SCA standard) for the kitchen hood fire suppression system is provided in Section 11400 and the Kitchen Contractor is required to file the plumbing work type for the valve as part of the overall fire suppression system filing. The Engineer of Record is to show the valve on the Drawings and provide a note that says, "Refer to Section 11400 for fire suppression system gas shut off valve." For CIP projects, the plumbing engineer is to investigate the gas system piping and include a plumbing work type, as testing of the gas system will be needed as well as piping installation.
 8. Ensure that power to the Maxon valve has been coordinated with the electrical designer and the required wiring and relays are included on the electrical drawings.

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9. Ensure that the pit for the house trap has been dimensioned on the Contract Drawings and is of a size to allow working access to the trap and will fit in the required location.
10. Ensure that floor drains and floor sinks are not in circulating pathways in kitchens. Graphically, floor drains and floor sinks shall be layered onto the kitchen drawings from the plumbing drawings so they are coordinated. Coordinate with the Kitchen Consultant and Architect. With Section PC 802.1.1 of the 2022 NYC Plumbing Code prohibiting the manifolding of waste piping below multiple compartment fixtures and thus the requirement for independent waste pipe connection for each sink, ensure that the tie-in with a floor waste receptor and a grease interceptor is coordinated.
11. Graphically, grease traps shall be layered onto the kitchen layout drawings from the plumbing drawings, so they are coordinated. Coordinate with the Kitchen Consultant and Architect.
12. Provide a separate floor sink for the sanitizing sink compartment of the pot sink that bypasses the grease interceptor. Coordinate with the Kitchen Consultant and Architect.
13. Provide shut-off valves for the can wash/mop sink unit in the Can Wash Room of the Kitchen recessed in the wall at 48" above finished floor, with an access door for easier shut off of the water feeding the can wash/mop sink unit.
14. Ensure that BMS control diagrams show the connection to the dry contacts of the potable water filtration system control panel (as defined in Sections 15419 and 15970) as well as all connections to all gas submeters (as applicable) as defined in Section 15970.
15. Ensure that the drainage line running from the Con Edison electric vault to the street sewer is shown on the Drawings. The installation of this drainage pipe will be done either by the General Contractor or by Con Edison. At the beginning of design, the CPO/SPO will determine, based on the proposed location for the vault, if the installation of the electrical vault and the storm line from the vault to the sewer is to be installed by the SCA Contractor or by Con Edison. In either case, Con Edison will file the SD1 and SD2 application with DEP for the drainage work related to the electrical vault. Storm lines should not be shown in the sewer application proposal submitted to the DEP or on the DOB filed drawings, but they are to be shown connected directly to the street sewer on the Contract Documents as follows:
 - a. If the vault and storm line is to be installed by the SCA's Contractor, CM will pursue a Developers Agreement with Con Edison and the Contract Drawings shall show the storm line pipe size, corresponding to that shown on the SD1 & SD2, on the separate drawing indicating the storm line to be installed by the Contractor, with final location based on DEP approval obtained by Con Edison.
 - b. If the vault is to be installed by Con Edison, show the storm line on the separate drawing with a note that states the installation of the storm line is not in contract and will be installed by Con Edison.
16. Designers must be aware that many older schools have cinder concrete framed slabs and this is to be investigated with the structural engineer. It is not permitted to use post-installed anchors in cinder concrete, and thus drawings should clearly take into account that support of piping, etc. is to be from the structural beams either by direct connection to the beams or

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from installation of 'unistrut' type supports running between beams. Indicate removal and repair of the beam encasement to facilitate the attachment.

17. Water sub-meters provided for Kitchens shall be located up high against the finished ceiling in the Dietician's office. This specific location for the sub-meters was requested by OSFNS for ease of activities within their control and operation.
18. Ensure that both a vacuum breaker and a check valve downstream of the vacuum breaker are provided for each of the combi ovens in the kitchen. In addition, each combi oven gets a filtered and unfiltered water connection.
19. Locate gas meter rig and main gas pipe such that pipe is a minimum of 2'-0" from any wall.
20. A milk sink is not considered a food preparation sink and thus does not require an indirect connection, which causes odor concerns in a cafeteria.

21. Athletic Fieldhouse Concession Stand:

- a. **Concession stand is open to the outdoors, so when the Athletic Fieldhouse building is fully sprinklered, the Concession Stand interior area can be protected by a dry sprinkler head. Otherwise, provide a suitable (ABC, K) portable fire extinguisher(s) in the Concession Stand.**
- b. **Provide a hose bib and floor drain equipped with a trap primer. Provide a hand washing sink dispensing both hot and cold potable water.**

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.22 Domestic Hot Water Supply Piping - Maximum Length Requirements

Description/Design Approach:

Hot water supply pipe that connects a plumbing fixture to a “*heated water source*” shall be designed and installed as per the limits placed on the length of such piping in accordance with Section C404.5.1 and Table C404.5.1 of the **2020** NYC Energy Conservation Code (NYCECC). Pipe with heat-tracing cable, hot water return system (heated water circulating system) and water heaters are regarded as “*heated water source*”.

The designer shall consider either extending the hot water return pipe loop or heat tracing a hot water supply branch pipe in situations where the location of public lavatories or other plumbing fixtures makes it a challenge for complying with the maximum allowable length of the hot water supply pipe as measured from a fixture’s terminating water supply pipe (fixture’s angle stop valve to faucet water inlet) to a “*heated water source*”. Extending the hot water return pipe is the SCA preferred design option. The engineer is to discuss with A&E cases on the project where pipe heat tracing might be the most viable option and obtain approval from A&E for utilizing heat tracing-cable.

As a quick reference to Table C404.5.1, which outlines the maximum allowed pipe lengths, the acceptable pipe run-out for the typical 1/2” and 3/4” pipe diameters that connect a public lavatory faucet to a heated source are 2 feet and 0.5 foot respectively. For other fixtures and plumbing appliances, the maximum pipe lengths are 43 feet for 1/2” and 21 feet for 3/4” pipe sizes.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.1 Plumbing and Drainage

6.1.23 Heat Pump Water Heaters

Description/Design Approach:

- A. Generation of domestic hot water in school designs shall transition from using gas-fired water heaters and shall be electrified by providing integrated heat pump water heaters (HPWH) or central air-source HPWHs backed up by a supplemental electric water heater, **unless there are stated conditions that a gas-fired water heater is specifically approved for use by the SCA.**
- B. Selection of either integrated heat pump water heaters or central air-source heat pump units with auxiliary back-up electric water heaters shall be contingent upon, among other factors, the total domestic hot water demand (aka peak load, the number of peak loads, and the first-hour rating or the first-hour delivery). Use the following formulas:
 - 1. Total Peak Load (Total Hot Water Demand) in GPH (gallons/hour) = [estimated hot water demand for hand-washing X Diversity Factor + estimated hot water demand for kitchen appliances X Diversity Factor + estimated hot water demand for showers X Diversity Factor + estimated hot water demand for Janitor Sink Closet X Diversity Factor], with diversity factor considering the number of peak loads.
 - 2. Diversity Factor = 0.4 for classroom sinks and lavatories, 0.5 for showers, .4 for Janitor Sink Closet (JSC) and 0.70 for kitchen fixtures.
 - 3. Estimated hot water demand for hand-washing in GPH = estimated hot water demand of sinks/lavatories X number of sinks/lavatories.
 - 4. Estimated hot water demand for kitchen appliances in GPH = estimated hot water demand for pot sinks, pre-rinse, triple & double compartments sinks etc. x number of appliances.
 - 5. Estimated hot water demand for showers in GPH = estimated hot water demand (gpm) X 10 minutes (duration) X number of showers.
 - 6. Estimated hot water demand for JSC in GPH = estimated hot water demand for JSC x number of appliances.
 - 7. Assume one (1) peak unless an available data profile of hot water usage in schools reveals more than one peak.
- C. Determination of the total and hourly hot water demand shall be based on the estimated hot water demand of each plumbing fixture or device and kitchen appliances that utilize hot water and showers, and by summing up the estimated partial hot water load of all fixtures based on the hourly flow rate (GPH) of each fixture as follows:

<u>Fixture</u>	<u>Flow Rate</u>	<u>Delivered Water Temp.</u>
Lavatory:	5 GPH	Tempered 90°F
Classroom Sink	5 GPH	Tempered 90°F

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Design Requirements

Mechanical Services – Section 6.0

Janitors Sink Closet	15 GPH	Hot 120°F
Shower	18 GPH	Tempered 110°F
Kitchen Hand Sink	5 GPH	Tempered 90°F
Kitchen Single Compartment Sink	15 GPH	Hot 140°F
Kitchen Double Compartment Sink	30 GPH	Hot 140°F
Kitchen Three Compartment Sink	30 GPH	Hot 140°F
Kitchen Can Wash	30 GPH	Hot 140°F

For schools with a calculated domestic hot water load of 150 MBH and below and a 200 gallons storage tank or smaller, the most suitable and preferred HPWH is integrated heat pump water heaters assembled in a maximum combination of up to two separate units.

Use the following formulas to determine required energy and storage capacity:

1. Energy input @ various temperatures in BTU/H or MBH = Energy input for hand-washing @ 90°F degree + energy input for kitchen @ 140°F degree + energy input for showers @ 110°F degree + energy input for Janitor sink closet @ 120°F.
2. Assume cold water temperature @ 50°F.
3. Energy input for hand-washing in BTU/H = estimated hot water demand for hand-washing (gph_(hot at 90°F) X (90-50) X (8.33 lbm/US gallon). See step B.3 above for estimated hot demand for hand- washing
4. Energy input for kitchen in BTU/H = estimated hot water demand for kitchen (gph_(hot at 140°F) X (140-50) X (8.33 lbm/US gallon). See step B.4 above for estimated hot water demand for kitchen.
5. Energy input for showers in BTU/H = estimated hot water demand for showers (gph_(hot at 110°F) X (110-50) X (8.33lbm/US gallon). See step B.5 above for estimated hot water demand for showers
6. Energy input for JSC in BTU/H = estimated hot water demand for JSC (gph_(hot at 120°F) X (120-50) X (8.33lbm/US gallon). See step B.6 above for estimated hot water demand for JSC.
7. Energy input for storage in BTU/H = Mixing Factor X Energy input @ various temperatures.
Mixing Factor is 0.3, which means that:
Energy input for storage in BTU/H = 0.3 X energy input @ various temperatures. See Step 1 above (C.1) for energy input @ various temperatures.
8. Required Storage Tank in GPH = energy input for storage/[(140- 50) X 8.33]. See Step 7 above (C.7) for energy input for storage.
9. Remaining energy input = energy input @ various temperatures – energy input for storage

OR

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Remaining energy input (i.e. required of heater) = 0.7 X energy input @ various temperatures*

* Note

- For central heat pump units, the nominal remaining energy input (i.e. required of heater) is 70% of the energy input @ various temperatures and that energy input for storage is 30% of the energy input @ various temperatures. The Designer is to confer with the equipment manufacturer for verification that the ratios of 0.70 and 0.30 respectively between the heat pump remaining energy and the storage tank do not need to be revisited given the inherent slower recovery rate of heat pumps.
 - For integrated heat pumps, the percentage of the energy input at various temperatures that is provided by the heater and the percentage of energy input provided by storage tank is fixed, given the unique design feature of a self-contained storage tank that the integrated unit comes equipped with.
10. Where calculations reveal that the required energy input @ various temperatures is above 150 MBH and that the required storage tank capacity is above 200 gallons, utilize central air-source heat pump water heaters in conjunction with auxiliary back-up electric water heaters. For maximum system design efficiency and better energy savings, designers should size the central HWHPs in such a way that the equipment compressor alone can provide the recovery needed for storing the required amount of domestic hot water during OFF-PEAK hours for the next peak. The electric resistance heaters of the central units are for backup only in the event the heat pump compressors fail. Designers are to size the electric resistance heaters in the central unit tank to provide a capacity closest to the heat pump compressor capacity by defining the number of electric heating elements. This is to guarantee that the electric resistance heaters of the central units provide a true 100% backup.
11. All heat pump compressor heating capacity and COP for both the central units and integrated units shall be determined at 60°F ambient air temperature. HVAC space heating units will be provided to guarantee at least a 60°F ambient air temperature. Designers are to “derate” the heating capacity of the equipment compressor that is usually listed for a rating corresponding to 75°F or 80°F ambient conditions. Use a capacity and COP that are based at 60°F ambient air temperature by consulting the manufacturers’ performance curves of compressor heating capacity and COP versus ambient space temperature.
12. The integrated units experience a further reduction in COP (in addition to the loss of COP when the ambient temperature is colder than the “rated” temperature) as the unit operates in a hybrid mode and at any one time the hybrid COP is a combination of the heat pump compressor COP and the electrical resistance COP (nominally 1.0). For the integrated units, energy modelers are to establish what the hybrid COP is at various percentage loads by computing a weighted average of the heat pump compressors’ COP and the electrical resistance COP (nominally 1.0). Energy modelers are to input a blended average hybrid integrated COP based on an anticipated load cycle (i.e. an assumed given number of hours at a given percentage loading).

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- 13. The combination central air-source heat pumps, and the added back-up electric water heaters for enhancing and for ensuring the reliability of recovery, shall be installed in schools where hot lunches are served over repeated periods and the cooking is done at the premises.
- 14. It is also anticipated that the designs for schools with a large student populations and with showering facilities shall call for the combination central air-source heat pump assemblies that include electric water heaters.
- 15. The other parameter that shall be factored into HPWH selection is the First-Hour Delivery or First-Hour Rating. The amount of fully heated hot water that is available for distribution in the first hour period is known as the First-Hour Delivery or First-Hour Rating. Use the below formulas to determine the First-Hour Rating:

First- Hour Delivery or Rating = Required Storage Tank Capacity + Recovery Rate of Heater

Recovery in GPH= Remaining energy input /[(Delta T for water distributed @ 140F) X 8.33].
See step C.9 above for the remaining energy input, thus:

Recovery in GPH = Remaining energy input/[(140-50) X 8.33]

The HPWH that is ultimately selected shall closely match the calculated First-Hour Rating.

Note that the Recovery in GPH is NOT to be added to Required Storage Tank in GPH as determined above in Step C.8 for storage tank sizing. The tank storage volume shall be the numerical value of Required Storage Tank in GPH expressed in units of gallons.

- 16. HPWHs shall be located in a mechanical or boiler room where free heat to draw from the surrounding air is available for the heater’s operation. The boiler or mechanical room is a conditioned space and it is anticipated that placing the HPWH inside these rooms will put an extra heating load burden on the space heating system to maintain a space temperature of 60°F. Other possible locations for integrated units include an alcove off of the Main Telecom Room (subject to approval by DIIT) and an alcove off of the Kitchen (subject to OSFNS approval). Alcove shall be provided with a dedicated corridor door for access and an open fence between the alcove and the room that allows air to freely circulate between the alcove and the room. MTR alcove shall be provided with protective pipe shrouds that would prevent any water from entering the MTR in the event of a pressurized pipe leak. Additionally, all alcoves shall be provided with a floor drain, corridor door saddle and saddle at the threshold of the fence separating the alcove from the room to contain any possible leaks.

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6.1 Plumbing and Drainage

6.1.24 Thermal Bridges & Heated-Water Circulating Systems

Description/Design Approach:

- A. When filing and seeking approval for construction documents that list work types in drainage and domestic water heating systems, the designer shall demonstrate compliance with provisions of the 2020 NYC Energy Conservation Code (NYCECC) that relate to thermal bridging and the correct selection of features for controls that must be provided for the heated-water circulating systems that are employed. The two types of heated-water circulating systems are a circulation system and a heat trace system.

- B. Heated-water Circulating and Temperature Maintenance Systems
 - 1. A circulation-type system is the SCA's preferred method for providing a heater-water circulating and temperature maintenance system. As is prescribed in Section C404.6.1 of the 2020 NYCECC, a circulation pump shall be employed for this system type. The system return pipe shall be a dedicated return pipe. Controls for the circulation pumps shall start the pumps based on the identification of a demand for hot water within the school. Note that the SCA standard design for a heated-water circulation system features two (2) circulation pumps; one circulation pump for tempered water supplied at 90°F and another pump for hot water delivered at 140°F to the kitchen. Pump controls shall automatically turn off the pump when water in the circulation loop is at the desired temperature and when there is no demand for heated water.

 - 2. A heat trace system, the other type of heated-water circulating system, is only to be used for a remote plumbing fixture when installation of a dedicated return line is impractical and requires SCA approval, as a point of use water heater would typically be the preferred means of providing heated water to a remote fixture. As per Section C404.6.2, controls for the heat tracing system shall be able to automatically adjust the energy input to the system so as to maintain the desired water temperature in the piping based on the need for heated water in the school. Heat tracing shall be arranged to be turned off automatically when there is no demand for hot water. Instantaneous water heaters are the other option for remote fixtures.

- C. Thermal Bridging
 - 1. For drainage and vent pipes passing through roofs, floor assembly, walls etc. as required by Section C402.6.1, special attention shall be paid to "clear field thermal bridges". When the impact of clear field thermal bridges is not accounted for in U-factors, C-factors, or F-factors as outlined in Appendix A of ASHRAE 90.1-2016, a note on the drawings shall indicate the effects of clear field thermal bridges on roofs, walls and floor assemblies.

 - 2. As per Section C402.6.3, the designer shall put notes on the drawings to document linear thermal bridges situations in a tabular format for the linear thermal bridges listed in Table C402.6.1. The documentation presented in the tabular format shall highlight the following:
 - a. Linear thermal bridge

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- b. Aggregate length of each type of linear thermal bridge.
- c. Relevant detail in the drawings showing a cross-section through the thermal bridge.
- d. The ψ -values for each thermal bridge from Table C402.6.

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6.2 Heating, Ventilation & Air Conditioning

6.2.0 General Overview of Heating, Ventilation & Air Conditioning (HVAC) Systems

Description/Design Approach:

- A. Heat Pump Type Selection Criteria: Various heat pump options are covered in this Design Requirement. With ample Classroom ceiling heights, rooftop packaged DX heat pump units where Classrooms utilize VAV boxes with electric baseboard and PA spaces utilize electric terminal units (recessed electric convectors), are the preferred option based on the following:
1. Major control components are provided by the OEM with the rooftop packaged DX heat pump units, thus requiring less field coordination with the Temperature Controls Contractor's (TCC) controlled ancillary systems, such as pumps and bypass valves associated with air to water heat pump chiller/heater systems.
 2. Rooftop packaged DX heat pump systems historically have had lower construction costs as compared to air to water heat pump chiller/heater systems serving dual temperature air handling units. Designer is to consider present market conditions for the costs of the air to water heat pump chiller/heaters (and associated dual temperature water piping and air handling unit costs) when comparing the cost of packaged DX systems versus the cost of chiller/heater dual temperature systems.
 3. All heat pump systems require emergency back-up redundant heating system to provide 75% capacity of the heat pump system. This entails utilizing simple electric resistance coils in the air handling units (**and also assumes that the energy recovery wheels are still functioning but at 50% effectiveness since they are fouled due to a lack of maintenance**). When air to water heat pump chiller/heaters are utilized, electric boilers must be provided in the secondary loop of a primary/secondary system, which makes the back-up redundant heating system more complex than just having simpler electric resistance coils in the air handling units when DX units are used. Refer to Design Requirement 6.2.40 for the Air to Water Heat Pump Chiller/Heaters.
 4. Rooftop packaged DX heat pump systems with factory packaged refrigerant lines/fittings avoids the necessity of having to provide field refrigerant lines with brazed fittings for associated with split DX systems, thus minimizing the likelihood of leakage from the refrigerant lines/fittings.
 5. Roof units (DX or dual temperature water) provide as much program space as possible inside the building for educational instruction. This must be moderated with:
 - a. The aesthetics of having units on a low roof might be objectionable when viewed from higher portions of the building (e.g., on a Developer project).
 - b. Low roof located rooftop units might obstruct the views from the school to the surroundings when viewed from other sections of the building.
 - c. The need for site specific PV and green roofs.
 - d. If the rooftop unit design results in units having very high external static pressure requirements and hence very high brake horsepower requirements resulting in non-compliance with the energy codes and standards (ASHRAE 90.1-2016, the 2020

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NYCECC and LL **51/23**). The design of the roof-mounted system and duct layout must be optimized to keep the external static pressure to a minimum.

- e. For existing buildings, if indoor reusable Mechanical Equipment Rooms (MERs) already exist

The above might then justify indoor MERs for the air handling units in lieu of rooftop units.

6. Note that utilizing air to water heat pump chiller/heater systems is a possible solution but not optimal per paragraphs A1, A2 and A3 as stated above. Packaged rooftop DX systems are optimal. Note however for CIP projects, if existing chilled water piping system is in good salvageable condition, then dual temperature chiller/heaters become a more feasible option.
7. Energy modeling was performed on several new school designs with various HVAC systems to ensure school buildings would meet the energy performance requirements of Local Laws LL 31/16 and LL 32/16 (**subsequently replaced by LL51/23**), the Green Schools Guide and LL97/19 mandated carbon dioxide reductions and to see where the design is in relation to the 2030 requirements. Based on the results of that energy modeling, and where ample interstitial space exists to install VAV boxes, all school HVAC systems for non-assembly spaces for Capacity project new stand-alone buildings, additions and major modification/substantial reconstruction projects that also involve substantial work to the building envelope shall be Multi-Zone Variable Air Volume (MZVAV) systems. These systems tend to use the least amount of energy when utilizing custom MZVAV DX heat pump units or utilizing custom MZVAV air handlers served by chiller/heater plants. However, meeting the maximum energy usage requirements of LL**51/23** is highly dependent on the amount of fenestration and lighting and must be modeled for each school. Capacity projects with major modification/substantial reconstruction that do not involve substantial work to the building envelope must meet the energy cost saving requirements of LL **51/23** but are not required to meet the maximum energy usage requirements of LL 51/23. Capital Improvement Program projects not in Environmental Justice Areas involving biodiesel B100 Ready burner retrofits or replacements (\$2,000,000 or more project cost) and HVAC systems (\$2,000,000 or more project cost) must meet the energy cost savings requirements of LL**51/23**. For LL**51/23** to be applicable to burner retrofit or replacement projects, the cost of the project must equal or exceed 50 percent of the cost of replacing the heating distribution system of the building.
8. For existing building CIP projects, Designers are to present their proposed heat pump systems to replace existing equipment in a Building Electrification Project Field Report (template located on www.nycsca.org). Field Report shall describe all existing HVAC, P&D and Electrical systems with justification for Designer's preference for specific heat pump system candidates. Electrification Field Report is subject to review/approval by the Authority. Following the Authority's review of the Building Electrification Project Field Report and to narrow down the list of candidate systems, designers shall complete the CIP Carbon Reduction Electrification Equipment Selection Matrix (template located on www.nycsca.org) for which HVAC systems are optimal (rated "1"), possible but not optimal (rated "0"), and which systems are not an option for given existing building parameters (rated "T" for terminal non-feasible system selection). Subsequent to the Authority's review of the CIP Carbon Reduction Electrification Equipment Selection Matrix where the most promising candidate heat pump system will be selected, Designers are to complete the Draft, then Final Scope Report.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



B. General Building HVAC Design

1. All DX heat pump units or dual temperature air handling units served by chiller/heaters for non-assembly spaces and PA spaces may be roof mounted (preferred per above Heat Pump Type Selection Criteria) or located in a Mechanical Equipment Room (MER) for the situations noted in Section A.5 above. The Mechanical Designer shall coordinate with the Architect.
2. All DX heat pump units or dual temperature air handling units served by chiller/heaters shall have nominally 55°F air discharge (out of the unit and into the supply duct) in the cooling mode and shall be equipped with airfoil plenum type or fan array supply and exhaust fans. Return fans are not to be used even when an energy recovery wheel is not used. This is because better exhaust flow modulation can be achieved with exhaust fan VFD as compared to a return fan with a damper throttling the exhaust flow.
3. The DX heat pump units or dual temperature air handling units served by chiller/heater plants shall have pre-filters with a minimum efficiency reporting value of MERV 7 and final filters with a minimum efficiency reporting value of MERV 13. Additional filtering systems may be required if air testing in the building area during the SEQRA investigation or if the ASHRAE Outdoor Air Analysis and Computational Fluid Dynamics (CFD) modeling indicate that ambient contaminants are to be mitigated and moving the units to another location on the building (preferred option) is not possible or will not mitigate the issue. MERV filters are required on both sides of the energy recovery wheel.
4. All central supply heat pump units shall be equipped with DX coils and all central supply air handling units shall be equipped with dual temperature coils that provide both heating and cooling capacity. Capacity and CIP projects are not authorized to proceed with a design based on providing new fossil fueled boilers unless approval is granted by the Authority. Capital Improvement Projects (CIP) not located in Environmental Justice Areas may have a system based on utilizing new or retrofitted existing biodiesel "B100 Ready" burners where existing boilers can be salvaged if they have a future expected service life of at least 15 years.
5. Heat pump DX units and dual temperature air handling units served by chiller/heater plants shall be provided with OEM controls, which will simplify the field commissioning and simplify the coordination of the controls for the units. All OEM controls must be native BACnet or be provided with communication cards that allow integration of the new central units into the DOE's standard BACnet network.
6. When central DX MZVAV heat pump units are utilized, electric baseboard mounted 4" above finished floor shall be provided for the Classrooms, Offices, and other non-assembly areas for perimeter heating. When central DX DOAS heat pump units are utilized, ceiling (if less than 20,000 SF) or floor mounted VRF units shall be provided for the Classrooms, Offices, and other non-assembly areas for perimeter heating/cooling.
7. When central dual temperature MZVAV air handling units served by chiller/heater plants are utilized, hydronic hot water fin tube radiation mounted 4" above finished floor shall be provided for the Classrooms, Offices and other non-assembly areas for perimeter heating. When central dual temperature DOAS air handling units served by chiller/heater plants are utilized, hydronic dual temperature fan coil units with ECM fan motors shall be provided for the Classrooms, Offices and other non-assembly areas for perimeter heating/cooling. When

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utilizing chiller/heater plants, hydronic dual temperature vertical unit ventilators (VUVs) may also be provided. Refer to Paragraphs B, C and D below for the selection criteria.

8. When central DX heat pump units are utilized, special spaces such as Science Labs, Libraries, Music Rooms, and other spaces where shelving would interfere with the functioning of the electric baseboard, shall be equipped with fan powered VAV boxes that have electric reheat coils. When central DX heat pump units are utilized, Toilets and Stairways shall utilize electric cabinet heaters. Toilet electric cabinet heaters shall be ceiling-mounted fully recessed units. Stairway electric cabinet heaters shall be fully recessed and mounted 4" above floor, or ceiling mounted. Alternately, recessed electric convectors mounted 4" above floor may be used in the stairways. When chiller/heater heat pump plants are utilized, Toilets and Stairways shall utilize hot water cabinet heaters. Toilet hot water cabinet heaters shall be ceiling-mounted fully recessed units or recessed behind the wall, 4" above the floor. Stairway hot water cabinet heaters shall be fully recessed and mounted 4" above the floor, or ceiling mounted. Alternately, recessed hot water convectors mounted 4" above the floor may be used in the stairways.
9. New Construction (Stand-alone Buildings and Addition Projects) and Major Modification/Substantial Reconstruction Capacity Projects (in which the scope of work includes rehabilitation work in at least two of the three major systems of the building (electrical, HVAC and plumbing), and where construction work affects at least 50 percent of the building's floor area):
 - a. The baseline for comparative regulated site energy use shall comply with Local Law **51/23**. The baseline for comparative total source energy use to show compliance with **LL51/23** is 70 kBTU/SF/yr. This is 50% of the median source energy use intensity (140 kBTU/SF/yr) for buildings designed and constructed for similar uses according to the 2015 benchmarking data. Note however per Design Requirement 1.3.1.10, the source energy target is presently 60 kBTU/SF/yr or below, though may vary slightly above based on the project. Projects that modeling demonstrates the EUI is in the high 60's are to be discussed with the Design and Resiliency team to determine potential reasons, such as different assumptions made, modeled occupant density and schedules, a high window to opaque wall ratio, or a large kitchen load due to serving more than just the building. The Authority may provide direction (through the subsequent standards revisions) to meet more aggressive targets to meet the City's 2030 source energy use intensity target. The baseline for comparative energy use to show compliance with the Authority's Green Schools Guide is ASHRAE 90.1-2010 Performance Rating Method (PRM).
 - b. In general for the custom DX heat pump units and custom dual temperature air handling units served by chiller/heater plants, designers are to utilize both energy recovery wheels (the Cafeteria/Kitchen combination unit being the exception) and demand controlled ventilation. (Commercial multi-zone units may eliminate demand controlled ventilation when they are equipped with energy recovery wheels).
 - 1) Energy recovery wheels (ERW) (prescriptive in ASHRAE 90.1-2016) can only be eliminated on Capacity projects upon approval of the Authority's TSS Unit if the designer demonstrates that flow rate of the exhaust air is significantly less than the outside air intake flow rate (due to remote exhausts) and the energy loss associated with static pressure drop through the wheel exceeds the potential energy savings that the wheel could otherwise generate. To demonstrate this, designer will need to

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perform two energy modeling analyses (one with the ERW and one without the ERW) or provide equivalent analysis.

- 2) Demand controlled ventilation (mandatory in ASHRAE 90.1-2016) can only be eliminated on Capacity projects upon approval of the Authority's TSS Unit if the design meets the Exceptions of Section 6.4.3.8, and if energy modeling demonstrates that the design meets LL51/23.

10. Capital Improvement Projects (CIP) utilizing commercial units not required to comply with LL51/23 based on the estimated construction cost and which follow the requirements of the 2020 NYCECC instead of ASHRAE 90.1, may only eliminate the mandatory energy recovery wheel upon approval from the Authority's TSS Unit if the design meets the Exceptions of Section C403.7.4.
11. Capital Improvement Projects (CIP) utilizing commercial units not required to comply with LL51/23 based on the estimated construction cost and which follow the requirements of the 2020 NYCECC instead of ASHRAE 90.1 may only eliminate the mandatory demand controlled ventilation upon approval of the Authority's TSS Studio if the design meets the Exceptions of Section C403.7.1.
12. Deviation from these standards when justified by project specific modeling and approved by the Authority's TSS Unit may require alternate solutions. Note that all heat pump systems utilizing A1 refrigerants (DX or dual temperature chiller/heater systems) are to be limited to 15 HP max per refrigerant circuit when the aggregate HP of all the units adds up to more than 100 HP to avoid the need for the Department of Education to provide a Refrigerating System Operating Engineer. Refer to Table FC 606.1.1 of the 2022 NYC Fire Code. Refer to Design Requirement 6.2.36 based on ASHRAE 15-2022 for the measures to be taken on A2L systems to avoid the need for a Refrigerating System Operating Engineer that otherwise would be required per the NYC Fire Code.

C. Capacity Project New Construction (Stand-alone Buildings and Addition Projects) and Major Modification/Substantial Reconstruction Capacity Projects with Adequate Slab-to-Slab Heights in the Classrooms, Offices, Non-Assembly Areas and Corridor:

1. Non-Public Assembly Spaces (Classrooms, Office, other Non-Assembly Areas, and Corridors):
 - a. Spaces shall be served by custom multi-zone variable air volume (MZVAV) DX heat pump units (preferred) or dual temperature MZVAV air handling units served by chiller/heater plants. DX MZVAV central units shall be equipped with hot gas reheat that provides reheat to avoid overcooling (as monitored by the return duct air temperature sensor) while the discharge air off of the cooling coil remains at a maximum of 55°F for indirect dehumidification purposes. All MZVAV central air handlers shall provide tempering of ventilation air in the winter.
 - b. Classroom, Offices and other non-assembly spaces shall be served by non-fan powered VAV boxes for cooling. When DX heat pump units are utilized, perimeter heating shall be provided by electric baseboard mounted 4" above finished floor. Science Labs, Music Rooms, Libraries and other special spaces where the usage of shelving would impact the functioning of electric baseboard, shall be served by fan powered VAV boxes with electric

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reheat. When dual temperature MZVAV air handling units served by chiller/heater plants are utilized, perimeter heating shall be provided by hydronic fin tube radiation units mounted 4" above finished floor.

- c. The Corridors shall also be served by the central MZVAV unit that also serves the Classrooms. Each Corridor shall be provided with a Constant Air Volume (CAV) box or VAV box per floor. Corridor VAV boxes shall be controlled from a temperature sensor located in the most remote part of the Corridor. Refer to Design Requirement 6.2.07 for details. The minimum box setting for the Corridor boxes shall never to be less than 0.06 cfm/SF per Table MC 403.3.1.1 of the 2022 NYC Mechanical Code. In addition, the minimum setting for the Corridor boxes shall be such that any transfer air from the Corridor to the adjacent Toilets and Electrical Closets shall always be maintained.

- d. Terminal Design

See Design Requirement 6.2.3 for details.

2. Public Assembly Spaces

- a. Gymnasiums, Gymatoriums, Auditoriums and Cafeterias/Kitchens shall be served by custom Single Zone Variable Air Volume (SZVAV) DX heat pump units (preferred) or custom dual temperature SZVAV air handling units served by chiller/heater plants. PA spaces with room dividing foldable partitions shall utilize Multi-zone Variable Air Volume (MZVAV) units. Transferring otherwise wasted exhaust air from the Cafeteria/Cafetorium to the Kitchen for Kitchen hood make up air is very energy efficient. When DX SZVAV heat pump units are utilized, PA spaces shall utilize recessed electric convectors mounted 4" above the floor. When dual temperature SZVAV air handling units served by chiller/heater plants are utilized, PA spaces shall utilize recessed hydronic hot water convectors mounted 4" above the floor.

D. Capacity Project New Additions with Slab-to-Slab Height of Nominally 12' (where New Addition Floors are to Match Existing Building Floors) and Major Modification/Substantial Reconstruction of Existing Buildings with Limited Slab-to-Slab Heights for Classrooms, Offices, Non-assembly Areas and Corridors (after determining that VAV box ceiling soffits are not an option):

- 1. General Selection Criteria: Options include DX Vertical Unit Ventilators (VUVs), DX custom DOAS/VRF units and DX custom SZVAV heat pump units or dual temperature Vertical Unit Ventilators (VUVs), dual temperature custom DOAS/FCUs and dual temperature custom SZVAV units served by chiller/heater plants. (Per above Heat Pump Type Selection Criteria, DX is preferred over dual temperature units served by chiller/heaters).
 - a. When DX vertical unit ventilators (VUVs) are utilized and a maximum acoustic level of NC35, (40 dBA) must be adhered to in order to comply with the NYC Green Schools Guide based on LEED v4, compressorized VUVs may have to be further enclosed in a closet or custom enclosure.
 - b. DX VUV design is preferred over DX custom DOAS/VRF design in order to avoid field refrigerant brazed VRF joints and to take advantage of factory DX piping in the VUV. Note that per Section 7.5.1.2 of ASHRAE 15-2022, split/VRF piping is not allowed in Corridors and Corridors must be served by "unit" systems, which ASHRAE 15-2022

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defines to be the same as self-contained systems that are packaged systems. ASHRAE 15-2022 defines self-contained systems as “a complete factory assembled and factory tested system that is shipped in one or more sections and has no refrigerant containing parts that are joined in the field by other than companion flanges or block valves”. Refer to Design Requirement 6.2.36.

2. Non-Public Assembly Spaces (Classrooms, Office, other Non-Assembly Areas, and Corridors)
 - a. Spaces are to be served by VUVs (either DX packaged (preferred if acoustics are not an issue) or DX split or dual temperature VUVs served by chiller/heater plant). Other option is to utilize custom 100% dedicated outside air system (DOAS) constant volume DX heat pump units with VRF terminal units, or DOAS constant volume dual temperature units (served by chiller/heater plant) with fan coil terminal units that utilize ECM fan motors. The central DOAS units need only provide decoupled tempering of the ventilation air in both the summer and the winter. The selection of using VUV or DOAS/associated terminal units (VRF or dual temperature hydronic fan coil units) is to be discussed with the Authority. Each system has pros/cons. For DX units, the refrigerant leakage associated with VUVs having factory packaged refrigerant piping would be less of an issue as compared to multiple indoor VRF units connected to one outdoor air-cooled condensing unit. VUVs also eliminate balancing concerns associated with a central air system such as the DOAS units. Should a VUV fail, it only would affect the space that it is serving unlike a failure of the central DOAS unit. DOAS/associated terminal units (VRF or dual temperature hydronic fan coil units) however avoid the need to make multiple penetrations of the envelope otherwise required for the VUVs. Should a VUV fail, the space served by the VUV would lose both the ventilation capability and heating/cooling capability. Should the DOAS unit fail, only the ability to ventilate would be lost since the terminal units (VRF or FCU) units could continue to provide space cooling and space heating. Demand Controlled Ventilation (DCV) is more easily accomplished with the VUV units compared to DOAS units, which would otherwise require VAV boxes in the DOAS supply ductwork responding to CO₂ sensors. Acoustics are less of a concern with dual temperature VUVs as compared to packaged DX VUVs considering the compressor generated noise.
 - 1) DX DOAS central units shall be equipped with hot gas reheat that provides reheat to avoid overcooling while the discharge air off of the cooling coil remains at a maximum of 55°F for indirect dehumidification purposes.
 - 2) Both the floor mounted DX VUVs and floor-mounted multi-positional VRF units might have to be further enclosed in a sound attenuating closet or enclosure. Designer to verify. This is required to guarantee that the sound pressure levels do not exceed 40 dBA/NC 35 as required by the 2019 Green Schools Guide Acoustical prerequisite. Floor mounted VRF units are required in lieu of ceiling VRF units for buildings exceeding 20,000 SF due to the need to avoid having to use ladders for maintenance.
 - 3) For Demand Controlled Ventilation (DCV) with the VUVs, the quantity of ventilation air shall be varied to each non-assembly space by employing CO₂ sensors. VUV manufacturers offer DCV as a standard option. With DX systems, there are limitations how low the flow over the DX coils could be to avoid coil freezing. In

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addition, there are limitations for how low the flow could become considering that the fans must remain stable. Considering the added expense of having to provide VAV boxes and the fact that the flow can only be minimally lowered below the full ventilation airflow, DCV is not warranted with DOAS systems.

- 4) For acoustical benefits, the discharge air from the VUVs or floor mounted VRF units should be ducted. Return air from the space would be drawn back to the vertical unit ventilator or floor mounted VRF unit (or enclosure/closet if required) return grille without the usage of return ductwork.
- 5) The VUVs or floor mounted VRF units are to be provided with a hard-piped condensation drainage system.
- 6) In the heating mode, the VUVs or floor mounted VRF units should be sized for the skin load plus the pickup load associated with the heating up of the ventilation air.

3. Public Assembly Spaces

Gyms, Auditoriums, Gymatoriums and Cafeteria/Cafetorium/Kitchens, shall be served by SZVAV or MZVAV custom air handling heat pump units per above as described in paragraph B.2.a.

E. Capital Improvement Projects (CIP) on Existing Buildings Undergoing Electrification:

1. HVAC options are based on several parameters of the existing building including:

- a. If age of roof is more than 15 years old nominally, rooftop DX or rooftop dual temperature air handling units should be avoided as much as possible in favor of classroom/office VUVs and SZVAV indoor units located in MERs. Existing dunnage/curbs might have to be elevated to allow future re-roofing.
- b. If utilization rate exceeds 80% and hence Classroom swing space is not available to relocate the students while working in one selected area, VUVs are preferred.
- c. If MER is located in a flood plain, lower elevation MERs below the flood plain are to be avoided but higher floor MERs are an option.
- d. VAV boxes are not an option if the structural floor to ceiling height is below 9 ft. Ideally for acoustical benefits, the discharge air from the VUVs or floor mounted VRF units should be ducted. If the ceiling height in existing building precludes the usage of ducted supply, then VUVs/floor mounted VRF units may be ductless with free-delivery supply (but still maintaining NC40, 45 dBA).
- e. If building has cinder concrete slabs/clay tile arches, supplemental steel will be required. Lighter dual temperature VUVs are preferred over heavier compressorized VUVs.
- f. If building is SHPO eligible, new or enlarged envelope penetrations by VUVs are discouraged. Maintaining existing louver size is the preferred option when utilizing VUVs. Dual temperature VUVs or split VUVs are preferred over packaged compressorized VUVs due to their smaller required louver size.

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- g. If existing unit ventilators are to be removed, existing window louvers might be reusable or replaced in kind. This might require a plenum be built behind the VUV. Designer to verify VUV does not protrude too much into the Classroom. Existing envelope masonry openings for the original louvers of former horizontal unit ventilators would have to be modified to accommodate the vertical unit ventilators.
- h. If existing chilled water piping system is in good salvageable condition, dual temperature chiller/heaters are more feasible.
- i. If windows are BCAS rated at 4 or 5, single pane or more than 35 years old, VUVs are a more appealing option since exterior façade should also be altered by a window replacement. Note if otherwise acceptable condition ribbon windows are in existing building instead of punched windows and a window replacement is not planned and individual ribbon window lite removal for new louvers compromises the structural stability of the ribbon windows, design shall incorporate measures to reinforce ribbon window frames used by the new louvers or replacement should be considered.
- j. If windows have narrow width or classrooms only have a few windows, central systems are a better option since VUVs would subtract from the already limited window openings.
- k. If the roofs are pitched, roof located central units are less desirable as they can only be placed on flat roofs sections, which may be limited. Classroom/Offices VUVs and PA space SZVAV central units located in interior mechanical equipment rooms are more optimal. MER central DX units with smaller roof mounted outdoor units would be preferable over MER dual temperature central units since the associated large roof mounted chiller/heater plant would not be optimal with pitched roofs.
- l. If Auditoriums have ornate and/or historic ceilings: Lower floor MER located indoor central units are preferred in lieu of rooftop units to be able to salvage existing wall register design and avoid having to provide new overhead ductwork which would interfere with ornate and/or historic ceiling. Existing lower bottom register supply diffusers are optimal for heating, but not for cooling. Investigate the possibility of providing ceiling VRF units (for lower ceiling heights that still allow for VRF maintenance) or wall VRF units (with additional wall hung HEPA units to account for the fact that wall hung VRF units can't be used with MERV 13 filters).
- m. If Gymnasium is on the top floor: Roof top units are preferred. DX units are preferred over dual temperature hydronic units.
- n. When air to water heat pump chiller/heaters are the basis of design, to address the need for emergency back-up redundancy heating, for schools not located in Environmental Justice Areas, utilizing new secondary loop gas condensing boiler plant in lieu of new secondary loop electric boiler plant is a possibility if there is an existing gas service able to serve new gas fired condensing boilers (two, each at 37.5%, 75% total capacity) to reduce the size of the new required electrical service. Other option for schools not located in Environmental Justice Areas could be to utilize new secondary loop biodiesel hot water boiler plant if existing building was oil-fired and oil tank is salvageable to store biodiesel fuel. The idea of utilizing new gas or new biodiesel boilers to downsize the new electric service must be moderated with the preference to only use new electric boilers

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when new boilers are required as backup for the chiller/heater system. Discuss with the Authority. If an option, replace references to electric boilers with gas condensing boilers or biodiesel hot water boilers on detail 1598510e. In addition, revise the Sequence of Operation to refer to utilizing gas condensing boilers or biodiesel hot water boilers instead of electric boilers.

- o. For the rare case when a Public Assembly space only has a 12' slab to ceiling height and there is no room to run large cooling coupled ducts associated with SZVAV units, then DOAS system (with smaller ducts) driving VRF cassette terminal units is an option.
 - p. The relative cost differential between various options is to be considered when deciding upon which system should be the basis of design. The relative costs are to be highlighted in the Pre-Scope Electrification Field Report.
2. For carbon dioxide reductions, if it is determined that the existing boilers have less than 15 years of future life and hence biodiesel B100 Ready burner retrofits or replacements are not warranted, then the existing HVAC systems are to be replaced with heat pump systems. The heat pump systems are to be the same as described above in Cases B and C except CIP projects shall utilize central commercial heat pump units in lieu of the central custom heat pump units used on Capacity projects. When the slab-to-slab heights do not permit usage of VAV boxes and ceiling soffits are not an option, VUVs or DOAS/associated terminal systems (VRF or dual temperature fan coil units with ECM fan motors) may be used in accordance with above paragraph C. Note that the units could be floor mounted without being located in closets or having enclosures. The CIP projects are not bound to follow the 2019 Green Schools Guide, which has the 40 dBA/NC35 acoustical prerequisite. For the CIP projects, it is acceptable to have sound pressure levels not exceeding the prior 2009 Green Schools Guide based on LEED Version 3 prerequisites of 45 dBA/NC40.

F. Central Station Monitoring for Systems Using A2L Refrigerant

1. In addition to mechanical designer determining per ASHRAE 15-2022 if continuous ventilation is required when the Effective Dispersal Volume Charge (EDVC) for an A2L independent refrigerant coil leak is exceeded, mechanical designer is to determine if the A2L refrigerant charge in an independent HVAC coil circuit if leaked into the space(s), could equal or exceed the 25% Lower Flammability Limit (LFL) in the event of a continuous ventilation system failure. If so, since the ASHRAE 15-2022 required air handler OEM integral detectors would be rendered useless should the fans fail, HVAC controller shall close dry contacts upon fan failure that in turn are wired by Div. 16 Contractor back to the Div 16 systems for central station monitoring. Mechanical designers are to edit the HVAC Specification Sections (according to the Notes to Specifier) to delete the need for central station monitoring if an A2L refrigerant leak would always be less than the 25% LFL threshold. When required, the continuous ventilation system fans should be designed such that when working properly, the 25% LFL threshold should not be exceeded. Refrigerant dispersal volumetric flow rate may be inadequate should the VFDs not modulate the fan speed as required, or a damper should hang up, etc. In the case where the fans are working, where the required integral OEM leak detectors are functional, should the 25% LFL be equaled or exceeded, central station monitoring signal would also have to be sent by closing HVAC controller dry contacts and Div 16 Contractor would have to wire from the dry contacts to Div 16 central station monitoring systems per Section BC 918 of the 2022 NYC Building Code.

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2. Designer is to also identify any space where an A2L refrigerant leak from the A2L refrigerant piping in the space not enclosed in gas-tight fire resistive ducts could equal or exceed 25% of the Lower Flammability Limit (LFL) and which is not served by an HVAC unit with integral OEM leak detectors providing the continuous code required refrigerant dispersal volumetric flow and having lower edges of the return openings less than or equal to 12" AFF. Such identified spaces will require area refrigerant leak detectors as specified in Section 15997. Designer is to indicate such spaces on the Drawings. Upon area detectors sensing a concentration equaling or exceeding the 25% LFL level, Section 15997 refrigerant leak detector control panel shall close dry contacts that in turn are wired by Div. 16 Contractor back to the Div 16 central station monitoring systems. Note that spaces served by HVAC units providing the code required refrigerant dispersal volumetric flow, having lower edges of the return openings less than or equal to 12" AFF and equipped with OEM integral leak detectors, do not require area detectors.
3. In general, designers shall strive to design A2L systems where the refrigerant charge per circuit is less than the EDVC value and that would not exceed 25% LFL in the event of an independent circuit refrigerant leak. In so doing, central station monitoring would not be required.

G. Dampers/Detectors:

1. Fire Dampers, Smoke Dampers, Combination Fire/Smoke Dampers and Smoke Detectors shall be provided for duct and air transfer openings in accordance with the Section BC 717 of the 2022 NYC Building Code. Refer to Table 6.2.0 below. Supply duct and recirculation duct penetrations of the 2-hour rated partitions at Fire Rescue Areas shall be equipped with combination fire/smoke dampers and shall be further equipped with local duct smoke detectors for control of the fire/smoke dampers. Verify the location of all fire rated construction and smoke barriers/partitions (if any) with the Architect.
2. Note that per Section MC 102.4.2.1 of the 2022 NYC Mechanical Code, in cases where the building's passive fire-resistance protection design, including rated construction, corridors and fire separations, complies with 1968 or prior codes, the determination as to whether a fire or smoke damper is required shall be permitted to be made pursuant to the 1968 Building Code, or at the election of the applicant, the 2022 New York City Mechanical Code.
3. Ventilating systems for safe areas shall not be connected to systems serving any other spaces, unless separated from such systems by fire/smoke dampers actuated by smoke detectors per Section BC 1029.19.3.2(4).

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TABLE 6.2.0
Fire and Smoke Damper Requirements²⁴

ASSEMBLY TYPE	FIRE DAMPER	SMOKE DAMPER	NOTES
Fire Wall BC 717.5.1	Y	Y	1, 20, 31
Fire Barrier BC 717.5.2	Y	N	2, 3, 4, 5, 10a, 19, 29, 30, 34, 35, 37, 39, 42, 43 (for related combustion damper)
Shaft Enclosure BC 717.5.3	Y	Y	2, 7, 8, 9, 10a, 11, 12, 19, 23, 25, 32, 34, 35, 37, 39, 40
Fire Partitions BC 717.5.4	Y	N	2, 3, 13, 14, 19, 29, 35, 37, 39, 42
Smoke Barriers BC 717.5.5	(See Note 21)	Y	10b, 15, 21, 26, 34, 35, 39, 42
Smoke Partitions BC 717.5.7	(See Note 21)	Y	10c, 15, 21, 26, 27, 28, 33, 35
Supply Air Handling Systems MC 607.2.3	N	Y	16, 17, 18, 23, 25

NOTES:

1. Penetrations by ducts and air transfer openings are permitted only for fire walls that are not on a lot line per Section BC 706.11. The size and aggregate width of all openings shall not exceed the limitations of Section BC 706.8. Provide fire dampers and smoke dampers for allowed penetrations per Section MC 607.5.1. Exception per Sections BC 717.5.1 and MC 607.5.1: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency condition. Per Section BC 717.5.1, the air-handling system shall be continuously monitored to ensure continuous airflow at a constantly attended location and be inspected and maintained in accordance with the system manufacturer's instructions. Per Section MC 607.5.1, a standby generator would be required in case of a loss of normal power in accordance with Chapter 27 of the New York City Building Code if the smoke damper is to be eliminated. In order to avoid the necessary connection to the standby generator, provide the smoke dampers at penetrations of fire walls.
2. Fire dampers and smoke dampers are not required where ducts are used as part of an approved smoke control system in accordance with Section BC 909 (BC 717.2.1) (BC 717.5.3 Exception 1.3) (BC 717.5.3 Exception 4).
3. Per Sections BC 717.5.2 (Fire Barriers) and BC 717.5.4 (Fire Partitions): Ducts and air transfer openings that penetrate fire barriers or fire partitions shall be protected with listed fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate exit enclosures and exit passageways (ref Section MC 607.5.2) except as

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permitted by Sections BC 1023.5 and BC 1024.6, respectively. Fire dampers are not required where walls are penetrated by a ducted HVAC system, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system. Such a duct system shall be constructed of sheet steel not less than 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals (BC 717.5.2 Exception 3).

4. A smoke damper shall be provided at each point a duct or air transfer opening penetrates a horizontal exit constructed as a fire barrier per Sections BC 717.5.2.1 and MC 607.5.2.1.
5. For Group E occupancies, per the definitions in Section BC 202, corridors serving only one institution are deemed interior corridors and are not public corridors and thus the provisions of Sections BC 717.5.2.2 and MC 607.5.2.2, Public Corridors, would not apply. If there is a condition where a school shares occupancy on a floor with another entity, the provisions of those Sections requires a listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a public corridor wall constructed as a fire barrier. Exception: Smoke dampers shall not be required in ducts where the air continues to move and the air handling system is arranged to prevent recirculation of exhaust or return air under fire emergency conditions. The air-handling system would have to be continuously monitored to ensure continuous airflow at a constantly attended location and be inspected and maintained in accordance with the system manufacturer's instructions. A standby generator would be required in case of a loss of normal power in accordance with Chapter 27 of the New York City Building Code if the smoke damper is to be eliminated. In order to avoid the necessary connection to the standby generator, provide smoke dampers at penetrations of Public Corridor fire barriers. Smoke dampers are not required in public corridor penetrations where the building is equipped throughout with an approved smoke control system and smoke dampers are not necessary for the operation and control of the system (BC 717.5.2.2). Smoke dampers are not required in public corridor penetrations (BC 717.5.2.2) or horizontal exit penetrations (BC 717.5.2.1) where the duct is constructed of steel not less than 0.019-inch in thickness and there are no openings serving the corridor.
6. Not used.
7. Ducts and air transfer openings shall not penetrate a shaft serving as an exit enclosure except as permitted by Section BC 1023.5.
8. Fire dampers and smoke dampers are not required where the penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction (BC 717.5.3 Exception 1.4).
9. Fire dampers and smoke dampers shall not be required at a shaft where the shaft is acting as an extension of the mechanical equipment room that it serves and the shaft and mechanical equipment room maintain fire and smoke separation required by the greater of the two spaces from the occupied portions of the building and meet the requirements of Sections BC 713.11 and BC 713.12.
- 10a. Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions (BC 717.5.2.2 Public Corridors, & BC 717.5.3 Exception 7 Shafts). To not require smoke dampers at Public Corridors (As indicated in Note 5, would not apply to

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schools) and shaft penetrations, the fans would have to be provided with standby power in accordance with Chapter 27. In order to avoid the necessary connections to the standby generator, provide smoke dampers at penetrations of Public Corridors and shafts.

- 10b. Per BC 717.5.5, Smoke Barriers, smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.
- 10c. Per BC 717.5.7, Smoke Partitions, a listed smoke damper designed to resist the passage of smoke shall be provided at each point that an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section BC 717.3.3.2. Note that unlike Section BC 717.5.5 for smoke barriers, smoke partitions do not have the exception to be able to eliminate the smoke damper if the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

An exception for where smoke damper can be eliminated in smoke partition penetration is where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section BC 909, for which an approved alternative protection shall be utilized.

11. Smoke dampers shall not be required in exhaust ducts or shafts where the exhaust fan is maintained in operation during occupancy, such as in bathroom and toilet room exhausts (BC 717.5.3 Exception 2).
12. A duct constructed of approved materials in accordance with the 2022 New York City Mechanical Code that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided a fire damper is installed at the floor line and the penetration is fire blocked in accordance with Section BC 718.2.5 (BC 717.6.1) or the duct is protected in accordance with Section BC 713.4. For air transfer openings, see Sections BC 712.1.9 and 717.6.
13. Fire dampers are not required at interior corridor walls in other than Group H occupancy in buildings equipped throughout with an automatic sprinkler system and the duct is protected as a through penetration (BC 717.5.4 Exception.1). This does not apply to rated corridors serving as Areas of Refuge or Exit Passageways.
14. Per Sections BC 717.5.4, Exception 3, and MC 607.5.3, fire dampers are not required at fire partition wall penetrations (such as corridor walls) for duct systems meeting all of the following minimum requirements (even if not equipped throughout with an automatic sprinkler system in accordance with Sections BC 903.3.1.1 or 903.3.1.2):
 - a. The duct shall not exceed 100 sq. in.
 - b. The duct shall be constructed of steel a minimum of 0.0217 in. in thickness.
 - c. The duct shall not have openings that communicate the corridor with adjacent rooms or space.
 - d. The duct shall be installed above a ceiling.
 - e. The duct shall not terminate at a wall register in the rated wall.
 - f. A minimum 12-inch-long by 0.060-inch-thick steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the

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sleeve with minimum 1½-inch by 1½-inch by 0.060- inch steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 screws. The annular space between the steel sleeve and the wall opening shall be filled with wool batting or approved equivalent on all sides.

Per Sections BC 717.5.4, Exception 3, and MC 607.5.3, fire dampers are not required at fire partition wall penetrations (such as corridor walls) if equipped throughout with an automatic sprinkler system in accordance with Sections BC 903.3.1.1 or 903.3.1.2 and partitions are penetrated by “ducted” HVAC systems, have a required fire-resistance rating of 1 hour or less, and are in areas of other than Group H. For the purposes of this exception, a “ducted” HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure’s HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage in thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

15. Per Sections BC 717.5.5 and MC 607.5.4 (Smoke Barriers) and Sections BC 717.5.7 and MC 607.5.7 (Smoke Partitions), a listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier or smoke partition. Smoke dampers are not required where the smoke barrier openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel. (BC 717.5.5 Exception.1.). Smoke dampers are not required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions. Per Section MC 607.5.7, where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section MC 513, approved alternate protection shall be used.
16. Smoke dampers shall be installed both upstream and downstream of filters and ahead of any branch connections in supply air-handling apparatus and systems having a capacity equal to or greater than 15,000 cfm per MC 607.2.3.
17. Smoke dampers are not required where the air-handling unit is located on the floor that it serves and serves only that floor. (MC 607.2.3 Exception1)
18. Smoke dampers are not required where the air-handling unit is located on the roof and serves only the floor immediately below the roof. (MC 607.2.3 Exception.2)
19. Penetrations by hazardous exhaust systems shall be in accordance with Section MC 510.7. (BC 717.2.2)
20. Per MC 502.10.2, hazardous exhaust ducts may not penetrate building separation fire walls.
21. Smoke barriers have a one-hour fire resistance rating per Section BC 709.3 and require fire dampers (unless not required by Note 3 above). Smoke partitions are not required to have a fire resistance rating per Section BC 710.3 and do not require fire dampers.
22. Division 16 Fire Alarm Contractor shall furnish fire alarm system compliant smoke detectors to the Mechanical Contractor who shall in turn furnish them to the central rooftop unit or central air handling unit manufacturer for factory installation or to the Sheet Metal Contractor for field ductwork installation as applicable. Division 16 Contractor shall provide all signal and control power wiring. Mechanical Designer shall show location of all duct mounted smoke

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detectors on the plan and riser drawings and shall coordinate with the Electrical Designer to verify that all wiring of all detectors (both factory and field installed) is shown on the Electrical drawings.

23. Per Section MC 607.5 Exception 2, smoke dampers shall not be required to be located within a prescribed distance of a fire-rated enclosure where isolation smoke dampers are used in air-handling equipment. Shaft enclosures shall be protected with approved fire and smoke dampers but per Section MC 607.5.5 Exception 6, smoke dampers shall not be required at shaft penetrations when isolation smoke dampers are used in air-handling equipment. Note that the DOB Code Committee per Section BC 717.5.3 Exception 6 interprets this as only being applicable for supply and return duct shaft penetrations where the ductwork continues on to an air handling unit that is itself equipped with smoke dampers. This would only be applicable for fan mechanical equipment rooms. All supply duct shaft penetrations and return duct shaft penetrations with the exception of the supply and return duct shaft penetrations in fan mechanical equipment rooms as noted above shall be equipped with smoke dampers (in addition to fire dampers). Provide combination smoke-fire damper at these locations. Non-recirculating exhaust duct shaft penetrations could not be provided with smoke dampers where the air continues to move and where the exhaust fan is maintained in operation during occupancy per Sections BC 717.5.3, Exception 7. Per that Exception 7, such fans would have to be provided with standby power in accordance with Chapter 27. In order to avoid the necessary connections to the standby generator, provide the smoke dampers at shaft penetrations.
24. This table is a summary of fire damper and smoke damper requirements applicable to school construction. For complete requirements refer to Sections BC 717 and the MC 607.
25. The DOB Code Committee has determined that the “total-coverage smoke detector system” of Section MC 607.3.3.2 Method 5 is an area smoke detection system and that the smoke detectors in the central air handling or air conditioning units do not constitute a “total-coverage smoke detector system”.
26. Per Section BC 509.4.2, where BC Table 509 permits an automatic sprinkler system without a fire barrier, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The walls shall extend from the top of the foundation or floor assembly below to the underside of the ceiling that is a component of a fire-resistance-rated floor assembly or roof assembly above or to the underside of the floor or roof sheathing, deck or slab above. Doors shall be self- or automatic-closing upon detection of smoke in accordance with Section BC 716.5.98.3. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80. Walls surrounding the incidental use shall not have air transfer openings unless provided with smoke dampers in accordance with Section BC 709.7.
27. Elevator Lobbies per Section BC 3006.1.1 and BC 3006.1.2: Except as provided by Sections BC 403.6.1 and BC 403.6.2, an enclosed elevator lobby shall be provided in high rise buildings opening onto a fire-resistance-rated corridor, in all occupancy groups. The lobby enclosure shall separate the elevator shaft enclosure doors from each floor by smoke partitions. Penetrations of the elevator lobby enclosure by ducts and air transfer openings shall be protected in accordance with Section BC 710.8. Refer to Design Requirement 6.2.10 for the elevator hoistway pressurization option in lieu of providing enclosed elevator lobbies for high rise buildings.

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28. Per Section BC 710.8 Ducts and air transfer openings: The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the free passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with Section BC 717.3.2.2, Exception: See Note 33.
29. Per Sections BC 714.1.1 and MC 607.1.1, ducts and air transfer openings: Penetrations of fire-resistance-rated walls by ducts that are not protected with dampers shall comply with Sections BC 714.2 through BC 714.3.3. Penetrations of horizontal assemblies not protected with a shaft as permitted by Exception 4 of Section BC 712.1.7, and not required to be protected with fire dampers by other sections (other than BC 714.1.1) shall comply with Sections BC 714.4.1 through BC 714.4.2.2. Ducts and air transfer openings that are protected with dampers shall comply with Section BC 717.
30. Per Section BC 717.5.6 and MC 607.5.6, exterior walls, ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section BC 705.10 shall be protected with listed fire dampers installed in accordance with their listing.
31. Per Section BC 717.5.2.1 and MC 607.5.1.1 horizontal exits: A listed smoke damper designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a fire wall that serves as a horizontal exit. Exception: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions or loss of normal power by provision of standby power in accordance with Chapter 27 of the New York City Building Code. In order to avoid the necessary connections to the standby generator, provide smoke dampers at duct or air transfer opening penetrations of a fire wall that serves as a horizontal exit.
32. Per Section BC 717.5.3, fire dampers are not required at penetrations of shafts where steel exhaust sub-ducts are extended at least 22 inches vertically in exhaust shafts provided there is a continuous airflow upward to the outside.
33. Per Section BC 717.5.7 Exception 1, where the installation of a smoke damper at a smoke partition penetration will interfere with the operation of a required smoke control system in accordance with BC 909, approved alternative protection shall be utilized.
34. Per Section MC 607.5.6.1, for fire-resistance-rated exterior walls, an outdoor air intake opening with gross area of more than 144 square inches shall be provided with fire dampers and smoke dampers, or combined fire and smoke dampers when such opening is located as follows:
 - a. Less than 30 feet above grade in rated walls. Per DOB Code interpretation, unrated walls need not be provided with fire dampers or smoke dampers for penetrations less than 30 feet above grade.
 - b. Less than 30 feet in any direction from any opening in another building.
 - c. Less than 15 feet from a lot line.
 - d. Less than 50 feet above and less than 50 feet in any direction from a roof constructed of combustible material or a building in which the exterior walls are constructed wholly or partly of wood.

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- e. Where fire dampers are required by Section MC 607.5.6.
Exceptions:
 - 1) Smoke dampers shall not be required for outdoor air intake openings of systems greater than 15,000 cfm that are provided with smoke dampers in accordance with Chapter 6 and arranged so as to not introduce smoke into the building or space in which the equipment is located.
 - 2) A damper is not required where the combustion air intake duct, boiler room, and combustion air intake louver for such boiler room are enclosed with construction having a fire-resistance rating not less than the rating of the exterior wall, boiler room and any intervening space.

- 35. Per Section MC 510.7.1, fire dampers and smoke dampers are prohibited in hazardous exhaust ducts.

- 36. Per Section MC 607.1.2.1, the space around a duct penetrating a non-fire resistance-rated floor assembly shall comply with Section BC 717.6.3.

- 37. Per Section MC 607.2.1, where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with BC 909, approved alternative protection shall be used. Where mechanical systems including ducts and dampers used for normal building ventilation serve as part of the smoke control system, the expected performance of these systems in smoke control mode shall be addressed in the rational analysis required by Section BC 909.4.

- 38. Per Section MC 607.3.3.2.6, smoke dampers that are part of an engineered smoke control system shall be capable of being positioned manually from a command station. Such positioning devices shall be provided for supply and return/exhaust dampers grouped by floor and by type. Damper switch positions shall indicate whether the related dampers are commanded to be either open or closed. Smoke damper positioning switches shall be located at the Fire Command Station, or in a Mechanical Control Center in buildings without a Fire Command Station.

- 39. Per Section MC 607.5, ducts 20 square inches or less passing through fire-resistance rated assemblies (other than firewalls) shall not require fire dampers or smoke dampers.

- 40. Per Section MC 607.5.5 Exception 4, smoke dampers are not required at penetrations of shafts where ducts are used as part of an engineered mechanical smoke control system designed in accordance with Section BC 909 and where the smoke damper will interfere with the operation of the smoke control system.

- 41. Per Section MC 607.6.2, ducts and air transfer openings constructed of approved materials, in accordance with Section MC 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:
 - a. A shaft enclosure in accordance with Section BC 713.
 - b. A listed ceiling radiation damper and firestopping installed at the ceiling line where a duct penetrates the ceiling of a fire resistance-rated floor/ceiling or roof/ceiling assembly.

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- c. A listed ceiling radiation damper and firestopping installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.
- 42. Per Section MC 709.2, where the combustion air openings are provided with automatic, smoke or fire dampers, the dampers shall be electrically interlocked with the appliances served, so as to prevent operation of any appliance when any of the dampers are closed. Manually operated dampers shall not be installed in combustion air openings. The damper opening shall be proven prior to burner operation. Per Section MC 710.1, combustion air openings to the outdoors shall comply with the location and protection provisions applicable to outside air intake openings of Sections MC 401.5 and MC 401.6.
- 43. Per the DOB Boiler Division, a required combustion air intake damper for boiler combustion air intake or gas hot water heater combustion air intake must be visible for an operator standing anywhere in the mechanical room. Typically, a combustion air intake damper located in the mechanical room perimeter wall louver complies. When space is limited on the perimeter wall of the mechanical room and thus the combustion air intake louver is located in an adjacent room not within the line of sight of the operator, the combustion air intake damper shall be located in the transfer duct running from the adjacent room to the mechanical room. The location of the combustion air intake damper must be in the section of the transfer duct that is in the mechanical room, so an operator has visible verification of the damper status. Note that if the adjacent room perimeter wall is rated and requires a fire damper, that fire damper would still be located in the adjacent room perimeter wall.

F. Smoke Detector/Damper Requirements

Per Section MC 607.3.3.2, Smoke damper actuation, the smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section MC 606 and Section BC 907.3 and one of the following methods, as applicable:

- 1. Where a smoke damper is installed within a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.

Exception: Duct smoke detectors will not be required at each smoke or combination fire smoke damper provided:

- a. The supply fan shall shut down and all the smoke and combination fire smoke dampers associated with the supply system automatically close upon actuation of any automatic alarm initiating device on the floor(s).
- b. Non-ducted return air systems shall have a smoke detector located within 5 feet upstream of each return air or transfer opening in a fire barrier rated 2-hour or greater.

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- c. Ducted return air systems shall have a duct smoke detector located within 5 feet of a smoke damper; additional smoke detectors are not required at smoke and combination fire smoke dampers located downstream where there are no additional return air inlets.
2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector shall be installed on either side of the smoke barrier door opening. The detector shall be listed for releasing service if used for direct interface with the damper.
3. Where a smoke damper is installed within an un-ducted opening in a wall, a spot-type detector shall be installed within 5 feet horizontally of the damper. The detector shall be listed for releasing service if used for direct interface with the damper.
4. Where a smoke damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a smoke detection system is installed in all areas served by the duct in which the damper will be located, the smoke dampers shall be permitted to be controlled by the smoke detection system.
6. Smoke dampers that are part of an engineered smoke control system shall be capable of being positioned manually from a command station. Such positioning devices shall be provided for supply and return/exhaust dampers grouped by floor and by type. Damper switch positions shall indicate whether the related dampers are commanded to be either open or closed. Smoke damper positioning switches shall be located at the Fire Command Station, or in a Mechanical Control Center in buildings without a Fire Command Station.

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6.2 Heating, Ventilation & Air Conditioning

6.2.1 HVAC Unit Centralization and Coordination

Description/Design Approach:

- A. HVAC heat pump units **and dual temperature air handling units served by air to water heat pump chiller/heaters**, shall be centralized (i.e., combined) as much as possible to minimize the total number of units. The initial Architectural layout shall be planned so that one unit can serve multiple spaces. **Refer to Design Requirement 6.2.0 that indicates the preference for heat pump units over dual temperature air handling units served by air to water heat pump chiller/heaters.**
1. The Gymnasiums, Gymatoriums and Auditoriums shall each **be** served by their own dedicated Single Zone Variable Air Volume (SZVAV) heat pump **or dual temperature air handling** unit. Refer to DR 6.2.0. **Additionally**, the Kitchen and Cafeteria may be served by one (1) combination Single Zone Variable Air Volume (SZVAV) heat pump **or dual temperature air handling** unit. Refer to Design Requirement 6.2.22.
 2. Corridors, Classrooms, Offices and other non-assembly areas in new schools (standalone and new Additions) and Major Modifications where the existing envelope is modified shall be served by **multi-zone** variable air volume (VAV) heat pump **or dual temperature air handling** units that provide tempered ventilation air in the heating season and provide all space cooling and ventilation air in the cooling season.
 3. Provide **central VAV heat pump or dual temperature air handling** units (as above for new schools) for existing buildings where the existing envelope is not to be altered and there is ample ceiling height. **Multi-zone VAV heat pump or dual temperature air handling** units should serve the Classrooms, Offices, other non-assembly areas and Corridors.
- B. The same central heat pump **or dual temperature air handling** unit is to serve the Library and Classrooms since both spaces have the same Occupancy Class E.
- C. Mixed SZVAV heat pump **or dual temperature air handling** unit that serves the Gymnasium are desired to serve locker rooms, if feasible. If combined with Gymnasium, the air from the locker rooms may not be recirculated. In all cases, locker rooms are to be negatively pressurized.

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6.2 Heating, Ventilation & Air Conditioning

6.2.2 Ductwork and Shafts

Description/Design Approach:

- A. The distribution ductwork from any roof-mounted DX heat pump units or roof mounted air handling units served by air to water heat pump chiller/heaters shall have multiple supply and return risers in multiple two-hour rated shafts. Horizontal distribution ductwork shall be headered in the space above the top floor suspended ceiling for distribution to the risers, as providing multiple supply and return risers enables the downsizing of the horizontal ductwork of the lower floors and allows a shallower slab-to-slab height for those floors. To accomplish this intent, the top floor slab-to-slab height can vary up to two feet higher than the remainder of the floors to provide room for the ductwork distribution header. During the preliminary phase of the Project, the Engineer shall advise Architect to stack classrooms above each other as much as possible to be able to take advantage of this ductwork distribution scheme.
- B. If the above scheme results in units having very high external static pressure requirements and hence very high brake horsepower requirements resulting in non-compliance with the energy codes and standards (ASHRAE 90.1-2016, the 2020 NYCECC and LL **51/23**), the designer shall investigate providing split DX heat pump units or air handling units served by air to water heat pump chiller/heaters within mechanical equipment rooms (MER) located within the building. Air-cooled condensing units associated with the interior DX split units shall be located outdoors. Possible scenarios include providing a MER on each floor to serve that floor, or, providing MERs on every other floor to serve the floor that the MER is located on and an adjacent floor. Designer is to verify if using rooftop mounted DX heat pump units or roof mounted air handling units served by air to water heat pump chiller/heaters complies with the energy codes as this is the SCA preference since it maximizes the amount of floor space available for instruction.
- C. Refer to DR 6.2.00 for additional justification why interior located air handling units in Mechanical Equipment Rooms (MERs) might be preferred over rooftop units.



6.2 Heating, Ventilation & Air Conditioning

6.2.3 Non-Assembly Spaces (Classrooms, Offices, Corridors, etc.)

Description/Design Approach:

- A. **Capacity Projects:** New Construction (Stand-alone Buildings and Addition Projects) and Major Modification/Substantial Reconstruction Projects with Adequate Slab-to-Slab Heights

Classrooms, Offices, other non-assembly areas and Corridors shall be provided with supply air from custom Multi-zone Variable Air Volume (MZVAV) central recirculating DX heat pump or dual temperature hot water/chilled water air handling units. Refer to Design Requirement 6.2.0, which defines when air to water heat pump chiller/heater plants may be utilized. Additionally, refer to Design Requirement 6.2.40 for the considerations that must be accounted for after it has been elected to use chiller/heaters. The MZVAV units' role is to temper the heating season ventilation air and provide all space cooling capacity. Spaces shall utilize Variable Air Volume (VAV) boxes with conventional ceiling mounted air diffusers. Achieving 40 dBA (NC35) in the Classrooms, Offices and other non-assembly spaces is required and should be accomplished since there are no fans located in these spaces when non-fan powered VAV boxes are used.

1. The supply branch into each Classroom, Office and other non-assembly space shall be equipped with a conventional (non-fan powered) VAV box. VAV box shall be provided with integral sound attenuator. (Refer to HVAC Design Requirement 6.2.25, Acoustical Standards, which defines when acoustical lining downstream of the VAV box may be used.) The box shall throttle down the supply air under low load conditions.
2. Pre-K, 3K, Kindergarten, 1st and 2nd grade classrooms that have adjoining toilets may exhaust a portion of the outside air component through the toilet exhaust fan.
3. For the central MZVAV units, the Engineer of Record shall calculate the fully occupied minimum outdoor air flow and standby minimum outdoor air flow (used in Demand Controlled Ventilation (DCV) for resetting of the cumulative central unit outdoor air). Engineer of Record shall also indicate the maximum air flows required for each space and shall provide these values on the contract drawings in the form of a Ventilation schedule. The schedules shall also contain an entry for each space VAV box indicating its required fully occupied minimum flow and maximum air flow values. The maximum air flow shall be that required to satisfy the thermal loads during the occupied scheduled time periods at the adjustable space temperature setpoint. For the custom MZVAV units, DCV for each space is to be provided in addition to utilizing an energy recovery wheel (ERW) in the central air handling unit. Per DR 6.2.36, EDVC allowable refrigerant charge calculations shall comply with ASHRAE 15-2022. Further note for cases when the charge per independent A2L circuit exceeds the EDVC value as calculated per Equation 7-8 of ASHRAE 15-2022, the minimum outdoor air flow rate can never be lowered to be below that required per Equation 7-10 of ASHRAE 15-2022 to provide continuous ventilation to disperse any leaked A2L refrigerant. Designer is to reflect appropriate minimum flows considering ventilation and refrigerant leak dispersal on the Drawing schedules.
4. The following required DCV logic shall be utilized: For the non-assembly spaces, when fully or partially occupied during scheduled occupied hours as indicated by a space CO₂ sensor, the minimum outdoor air ventilation rate shall be the sum of the space ventilation rate (cfm/SF * SF) plus the occupant ventilation rate (cfm/p * instantaneous population), and when

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vacant during scheduled occupied hours as indicated by a space CO₂ sensor, the minimum outdoor air ventilation rate shall be the space ventilation rate (cfm/SF × SF) (subject to maintaining continuous ventilation to disperse any leaked A2L refrigerant). In order to avoid motor overheating at excessive turndowns, maintain fan stability, and maintain sensor functionality, the minimum flow provided to a space shall be the fully occupied rate (whether or not actually fully occupied). The space ventilation rate (cfm/SF) and occupancy ventilation rate (cfm/p) shall be determined from the 2022 NYC MC Table 403.3.1.1. Refer to Section 6.4.3.8 of ASHRAE 90.1-2016 for Demand Controlled Ventilation (DCV) for Classrooms equipped with VAV boxes. Although the minimum flow to a space is to never be reduced below the fully occupied rate, the central heat pump unit outdoor air flow ratio will be adjusted based upon the cumulative instantaneous outdoor air flows required in each space (subject to maintaining continuous ventilation to disperse any leaked A2L refrigerant). As the central heat pump unit outdoor air damper modulates, the central heat pump unit return damper shall also modulate in a reverse fashion.

5. Supply outlets shall be spaced so as to avoid air stagnation and stratification and to provide a maximum forty (40) feet per minute air impingement velocity when the air moves past occupants in order to comply with ASHRAE 55-10.
6. Classrooms, Offices, non-assembly areas and Corridor return ducts shall be hard ducted, as ceilings will not be used as return plenums. This is in keeping with the desire to have improved indoor air quality and to avoid circulating any ceiling plenum dust and debris.
 - a. For A1 refrigerant systems, since ceiling return plenums create negatively pressurized spaces for those spaces near the unit main return, ceiling return plenums for A1 refrigerant systems may only be used with the permission of the Authority if there are space constraints where hard-ducted ceiling returns cannot be utilized.
 - b. For A2L applications, note that per Section 7.6.4.c of ASHRAE 15-2022, inlets for exhaust air and inlets used to mechanically transfer air to a separate indoor space, shall be located such that the bottom of the inlet is within 12" of the lowest elevation in the space where leaked refrigerant would be expected to accumulate. Per ASHRAE 15-2022, all commonly used refrigerants except ammonia (R-717) and water (R-718) are heavier than air when at room temperature. Hence, all A2L system return/exhaust/transfer inlets shall be located at the bottom of the wall within 12" of the lowest elevation in the space.
7. In general, top floor Corridors having a summer thermal load are to be provided with a VAV box controlled by a temperature sensor located in the most remote part of the Corridor. If the roof is well insulated and there is no appreciable summer thermal load, constant volume box may be used. Intermediate floor core Corridors and bottom floor Corridors with no appreciable thermal load may use constant air volume boxes (CAV). The minimum ventilation rate for the Corridor VAV and CAV boxes must be no less than 0.06 cfm/SF as defined in the Table MC 403.3.1.1 of the 2022 NYC Mechanical Code and the minimum setting of the Corridor VAV and CAV boxes shall be such that all Toilets and Electrical Closets that draw air from the Corridor shall be provided with ample make up air.
8. For terminal heating, a perimeter electric baseboard system (when the central MZVAV unit has DX coils) or perimeter hot water baseboard system (when the central MZVAV unit has dual temperature water coils) mounted 4" above finished floor shall be provided for each Classroom, Office and other non-assembly areas. The baseboard units located in each Classroom, Office and other non-assembly areas shall provide the space heating capacity

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.2 Heating, Ventilation & Air Conditioning

6.2.4 Public Assembly Spaces

Description/Design Approach:

- A. New Schools (Stand-Alone Buildings and Addition Projects) and Major Modification/Substantial Reconstruction Capacity Projects: Public Assembly (PA) spaces (Auditoriums, Gymnasiums, Gymnatoriums, Cafeterias and Cafetoriums) shall be served by custom Single Zone Variable Air Volume (SZVAV)** rooftop heat pump units or dual temperature air handling units served by air to water chiller/heaters. Variable volume units are required per Section 6.5.3.2 of ASHRAE 90.1-2016, since the mechanical DX cooling capacity will exceed 65,000 BTU/hr and the fans of the dual temperature air handling units will exceed 1/4 hp. Constant volume units may be used for Historic Building PA spaces where ASHRAE 90.1-2016 need not apply per Section 4.2.1.3 of NYCECC Appendix CA changes to ASHRAE 90.1-2016. Additionally, compliance with ASHRAE 90.1-2016 shall not be required per Section 6.1.1.3 Exceptions of ASHRAE 90.1-2016 for repairs, where replacement or alteration of equipment requires extensive revisions to other systems, refrigerant changes of existing equipment, relocation of existing equipment or cases where there exists insufficient space. Hence, for these cases constant volume systems may be used. However, to meet New York City’s energy saving mandates more efficient systems are to be utilized if technically feasible.
- B. Refer to Design Requirement 6.2.0 that indicates the preference for heat pump units over dual temperature air handling units served by air to water chiller/heaters.
- C. Capital Improvement Projects (CIP): Public Assembly (PA) spaces (Auditoriums, Gymnasiums, Gymnatoriums, Cafeterias and Cafetoriums) shall be served by commercial Single Zone Variable Air Volume (SZVAV)** rooftop heat pump units.
- D. Assembly areas (Auditoriums, Gymnasiums, Gymnatoriums, Cafeterias and Cafetoriums) provided with a SZVAV** system shall have a decoupled heating system where the SZVAV** units provide nominally 65°F ventilation air during the heating mode and the PA spaces are equipped with terminal heating capability (recessed electric convectors for DX applications or recessed hot water convectors for dual temperature air handling unit applications mounted 4” above finished floor). Kitchen terminal heating shall be accomplished by a reheat electric coil (for DX applications) or hot water coil (for dual temperature air handling unit applications) located in the duct that serves the Kitchen. Units shall be coupled in cooling with a mixed variable air volume system (SZVAV)**.

** Public Assembly spaces utilizing partitions where each sub-divided space can be used independently shall be served by Multiple Zone VAV (MZVAV) heat pump or dual temperature air handling units instead of Single Zone VAV (SZVAV) units. Each sub-divided space shall be equipped with multiple VAV boxes and a temperature sensor.

- E. For units serving PA spaces (Gym, Auditorium, etc.), energy modeling performed as the basis for the SCA Standards indicates that both the Energy Recovery Wheel (ERW) (See Section 6.5.6 of ASHRAE 90.1-2016, prescriptive requirement and Section C403.7.4 of the 2020 NYCECC, mandatory requirement) and Demand Controlled Ventilation (DCV) (See Section 6.4.3.8 of ASHRAE 90.1-2016, mandatory requirement and Section C403.7.1 of the 2020 NYCECC, mandatory requirement) are to be employed in the design.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



1. Energy recovery wheels (prescriptive in ASHRAE 90.1-2016, mandatory in the 2020 NYCECC) can only be eliminated upon approval of the Authority's TSS Unit if the designer demonstrates that flow rate of the exhaust air is significantly less than the outside air intake flow rate (due to remote exhausts) and the energy loss associated with static pressure drop through the wheel exceeds the potential energy savings that the wheel could otherwise generate. Designer will have to verify by running two energy models: one with the energy recovery wheel and one without. Designs not required to comply with LL **51/23** based on the estimated construction cost and which follow the requirements of the 2020 NYCECC instead of ASHRAE 90.1, may only eliminate the mandatory energy recovery wheel if the design meets the Exceptions of C403.7.4.
 2. Demand controlled ventilation (mandatory in both ASHRAE 90.1-2016, and the 2020 NYCECC) can only be eliminated upon approval of the Authority's TSS Unit if the design follows the requirements of ASHRAE 90.1-2016 and meets the Exceptions of Section 6.4.3.8 and if energy modeling demonstrates that the design meets LL **51/23** Energy Use Intensity (EUI). Designs not required to comply with LL **51/23** based on the estimated construction cost and which follow the requirements of the 2020 NYCECC instead of ASHRAE 90.1, may only eliminate demand controlled ventilation upon approval of the Authority's TSS Unit if the design meets the Exceptions of C403.7.1.
- F. Energy modeling performed as the basis for the SCA Standards indicates that SZVAV** units that serve the Cafeteria/Cafetorium PA space and Kitchen and only employ Cafeteria/Cafetorium DCV without the use of an energy recovery wheel will be compliant with ASHRAE 90.1-2016 **and LL 51/23**.
- G. When DCV is employed, carbon dioxide sensors shall be located in each PA space to reduce the outdoor air intake when the spaces are not occupied.
1. For Auditoriums, Gymnasiums and Gymatoriums, the minimum total supply rate is the fully occupied ventilation requirements as defined in Table MC 403.3.1.1 of the 2022 NYC Mechanical Code, to preserve fan stability, avoid motor overheating and provide enough flow for the sensors to function properly. Outdoor air at the central unit is modulated and shall be based on instantaneous occupancy.
 2. Cafeteria/Cafetorium and Kitchen are to be served by a combination unit. The minimum outdoor air intake ventilation rate that the Cafeteria/Cafetorium carbon dioxide sensors can throttle the central unit outside air intake rate down to in the non-cooking mode is the Cafeteria/Cafetorium specific cfm per square foot requirements as defined in Table MC 403.3.1.1 times the Cafeteria/Cafetorium square footage plus the cumulative Kitchen General Exhaust, Can Wash Room and Staff Toilet exhaust make up requirements considering that ample make up air must always be provided for the Kitchen General Exhaust, Can Wash Room and Staff Toilet. The space specific cfm/SF requirements are established in order to maintain the minimum Indoor Air Quality (i.e., to account for VOC outgassing of carpets, adhesives, paints etc.) even if the space is unoccupied. Refer to Design Requirement 6.2.9 to determine the ventilation rates. Avoiding motor overheating at excessive turndowns, maintaining fan stability, and maintaining sensor functionality are addressed by limiting the minimum supply flow to the fully occupied ventilation rate.
 3. Note that for all Public Assembly spaces, when the charge per independent A2L circuit exceeds the EDVC value as calculated per Equation 7-8 of ASHRAE 15-2022, the minimum

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



outdoor air flow rate can never be lowered to be below that required per Equation 7-10 of ASHRAE 15-2022 to provide continuous ventilation to disperse any leaked A2L refrigerant. Designer is to reflect appropriate minimum flows considering ventilation and refrigerant leak dispersal on the Drawing schedules.

- H. Ceiling diffusers and wall grilles shall be spaced so as to avoid air stagnation and stratification and to provide a maximum forty (40) feet per minute air impingement velocity when the air moves past occupants in order to comply with ASHRAE 55-10.
 - 1. For A1 refrigerant applications, high ceiling spaces (i.e., Gymnasium, Auditorium, Gymnasium, etc.) shall be provided with a mixture of higher elevation and lower elevation return grilles/ductwork to achieve better air distribution.
 - 2. For A2L applications, per Section 7.6.4.c of ASHRAE 15-2022 inlets for exhaust air and inlets used to mechanically transfer air to a separate indoor space, shall be located such that the bottom of the inlet is within 12" of the lowest elevation in the space where leaked refrigerant would be expected to accumulate. Per ASHRAE 15-2022, all commonly used refrigerants except ammonia (R-717) and water (R-718) are heavier than air when at room temperature. Hence, all A2L system return/exhaust/transfer inlets shall be located at the bottom of the wall within 12" of the lowest elevation in the space. Ceiling returns are not allowed in A2L applications.
 - 3. Exposed Gymnasium ductwork shall be round, insulated double wall, and have a spiral seam.
- I. Central units shall maintain 78°F dry bulb space conditions during occupied periods when the outside air conditions are 89°F DB and 73°F WB per Chapter 12 of the 2022 NYC Building Code and no more than 85°F unoccupied setup conditions. Return duct humidity sensors shall monitor relative humidity during occupied periods. A PA space temperature sensor shall be utilized during unoccupied periods.
- J. Refer to Design Requirement 6.2.22, "Kitchen Ventilation" that defines the functionality of the combination Kitchen/Cafeteria unit(s).



6.2 Heating & Ventilation

6.2.5 Considerations for Pre- Kindergarten, Kindergarten, 1st and 2nd Grade Classrooms

Description/Design Approach:

The provisions of Design Requirement 6.2.3 apply to Pre-Kindergartens, Kindergartens, 1st and 2nd grade classrooms.

However, in facilities with crawl spaces and basements, provide heaters in the crawl spaces and basements to avoid cold slabs as those grades many times sit on the floor. In facilities with Pre-Kindergarten and Kindergarten classrooms situated on a slab on grade, **slabs are to be insulated as per DR 1.3.2.2.**



6.2 Heating, Ventilation & Air Conditioning

6.2.6 Convectors and Enclosures

Description/Design Approach:

- A. Fully recessed electric convectors mounted 4" above finished floor may be used in the corridors/stairway landings. **When dual temperature air to water heat pump chiller/heaters are utilized, fully recessed hot water convectors mounted 4" above finished floor may be used in the corridors/stairway landings.** Alternately, fully recessed electric cabinet heaters (**or fully recessed hot water cabinet heaters when dual temperature chiller/heaters are utilized**) mounted 4" above finished floor may be used in corridors/stairway landings. Ceiling hung fully recessed electric cabinet heaters (**or hot water heaters in the case chiller/heaters are utilized**) may be used in lieu of recessed wall mounted units in the corridors/stairway landings. Corridors may also be provided with electric baseboard (**or hot water baseboard when chiller/heaters are utilized**) when space is available. **When chiller/heaters are utilized, all terminal units (door air curtains, cabinet unit heaters, convectors) located in areas where doors frequently open/close shall be supplied with 30% propylene glycol water mixture from the primary dual temperature water loop.**
- B. All toilets that are located on the perimeter of the building or any toilet room (interior or perimeter located) that is located on the top floor or on a slab on grade, shall be provided with terminal heating capacity. Toilets shall be provided with fully recessed ceiling-mounted electric cabinet heaters. **For chiller/heater applications where the heat pump units generate hot water, Toilets may utilize fully recessed ceiling mounted hot water cabinet heaters. Toilets may also use fully recessed hot water convectors (mounted 4" AFF).**
- C. Recessed perimeter electric convectors (wall mounted 4" above finished floor) (**or recessed perimeter hot water convectors when chiller/heaters are provided**) shall serve Public Assembly spaces equipped with single zone variable air volume (SZVAV) units.
- D. Floor mounted units shall not be used in the Kitchen. Kitchens shall have their terminal heating provided by electric heater (**or hot water coil when chiller/heaters are provided**) located in the duct that serves the Kitchen.



6.2 Heating, Ventilation & Air Conditioning

6.2.7 Corridor HVAC Units

Description/Design Approach:

A. New Construction (Stand-alone Buildings and Addition Projects) and Major Modification/Substantial Reconstruction Capacity Projects with Adequate Slab-to-Slab Heights

1. Corridors shall be served by the custom multi-zone Classroom variable air volume MZVAV heat pump unit(s) **or, when approved, the Classroom dual temperature MZVAV air handling units served by air to water heat pump chiller heater systems. Usage of air to water heat pump chiller heater systems is subject to review and approval by the Authority, which should be during the Schematic phase or early in Design Development.**

a) The Classroom/Corridor variable volume **unit** shall provide

b) **Top floor** Corridors where a **cooling** load exists shall be provided with VAV boxes controlled by temperature sensors located in the most remote parts of the Corridors. The minimum VAV box setting for the Corridor VAV boxes shall never to be less than 0.06 cfm/SF per Table MC 403.3.1.1 of the 2022 NYC Mechanical Code. In addition, the minimum setting for the Corridor VAV boxes shall be such that any transfer air from the Corridor to the adjacent Toilets and Electrical Closets shall always be maintained. Core Corridors without significant loads can be equipped with constant air volume boxes with the flow set to the maximum of 0.06 cfm/SF versus the transfer air requirements.

2. For terminal heating, electric baseboard (**or hot water fin tube radiation for the case when chiller/heaters are provided**) may need to be provided (space permitting) **for top floor Corridors, slab-on-grade Corridors or Corridors located over unheated basements.** If the Corridor layout or location of the Corridor within the building precludes electric baseboard **or hot water fin tube radiation** being an appropriate design, alternates to be investigated include fully recessed electric **or hot water** wall mounted 4" above finished floor convectors or electric **or hot water** recessed cabinet unit heaters mounted 4" above finished floor, or ceiling-mounted recessed electric **or hot water** cabinet unit heaters. Designer is to determine the best effective design approach.

B. Major Modification/Substantial Reconstruction **Capacity Projects** of Existing Buildings with Limited Slab-to-Slab Heights:

1. Where limited ceiling height Classrooms are served by **DX** vertical unit ventilators or VRF units and decoupled custom **DX** DOAS central heat pump units, the Corridors shall be served by **dedicated DX Multiple Zone Variable Air Volume (MZVAV) system (if top floor Corridor has VAV box) or dedicated Single Zone Constant Air Volume (SZCAV) unit (if top floor does not have considerable load and hence no variable volume or constant volume boxes need to be used on any Corridor floor).** Note that **having the Corridors served by Classroom decoupled custom DX DOAS central units and utilizing Corridor A1 or A2L VRF units is disallowed by Section 7.5.1.2 of ASHRAE 15-2022, which requires that refrigeration systems in Corridors be "unit systems" which are packaged systems.**

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



- a. Per Section 7.5.1.2 of ASHRAE 15-2022, no split A1 or A2L refrigerant piping is allowed in Corridors as such systems do not meet the definition of “unit systems”, which ASHRAE defines to be equivalent to self-contained packaged systems.
 - b. Dual temperature DOAS units that serve the Classrooms (where Classrooms are served by ECM fan coil units) may also serve the Corridors (where Corridors would also be served by ECM fan coil units).
2. The flow to the Corridor should never to be less than 0.06 cfm/SF per Table MC 403.3.1.1. In addition, the flow to the Corridor should be such that any transfer air from the Corridor to the adjacent Toilets and Electrical Closets will always be maintained.

C. Capital Improvement Projects (CIP)

Corridor HVAC systems being upgraded in an existing building are to be provided with the same HVAC systems as Corridors in Capacity projects as described in paragraphs A and B above. Note that usage of air to water heat pump chiller/heaters would require Authority approval after reviewing the CIP Pre-Scope Electrification Report.

D. Corridor Exhaust

1. For all projects (Capacity or CIP), the outside air supplied to the Corridors shall be exhausted by the Toilet exhaust fans, Janitor’s Closet exhaust fans and by the combined central Classroom/Corridor Multi-zone Variable Air Volume (MZVAV) heat pump units (or dual temperature MZVAV units served by air to water heat pump chiller/heaters if approved by the Authority) for stand-alone new schools, new Additions and Major Modification projects. Note that the Toilet exhaust system and Janitor’s Closet exhaust system may be combined with each other. For mixed air MZVAV units, the component of the total air supplied to the Corridor that is not exhausted shall be recirculated back to the central mixed air MZVAV unit.
2. Stand-alone new schools, new Additions and Major Modification projects where the Classrooms are served by VAV boxes or existing building limited slab to slab height Classrooms (served by DX DOAS/VRF systems or dual temperature DOAS/ECM fan coil units) shall have all of the Classroom exhaust air returned to the central unit to be able to utilize total enthalpy energy recovery wheels that recover both sensible and latent energy.
3. For CIP project, buildings built to the 1968 code and before required mechanical locker exhaust, which may be maintained when upgrading the HVAC system.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.2 Heating, Ventilation & Air Conditioning

6.2.8 Wardrobe/Locker Ventilation

Description/Design Approach:

- A.** Mechanical exhaust ventilation is not required for wardrobe closets and/or locker areas in Classrooms and Corridors.
- B.** Wardrobe closets inside each Primary School and Intermediate School Classroom shall be provided with bottom louvers to provide natural ventilation.
- C.** Corridor lockers shall be provided with top and bottom louvers for natural ventilation.



6.2 Heating, Ventilation & Air Conditioning

6.2.9 Heating and Cooling Design Parameters (Load Calculations)

Description/Design Approach:

Heating and Cooling Systems shall be designed in accordance with Section MC 312 of the 2022 NYC Mechanical Code, Heating and Cooling Load Calculations, and shall be in accordance with ANSI/ASHRAE/ACCA 183-2007 per Section C403.1.1 of the 2020 New York City Energy Conservation Code (NYCECC) and Section 6.4.2.1 of ASHRAE 90.1-2016. Per Section C403.1.1 of the 2020 NYCECC, heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE Handbook - HVAC Systems and Equipment. Use the following criteria:

- A. Heating for New Construction, Major Modification/Substantial Reconstruction Capacity Projects **and Capital Improvement (CIP) Projects:** The fresh air requirements shall be in accordance with Section MC 403.3.1.1, Ventilation Requirements.
 - 1. Per Section MC 401.2 of the 2022 NYC Mechanical Code, relying on natural ventilation only without the usage of fans is not allowed.
 - a. Every occupiable space shall be naturally ventilated in accordance with Section MC 402 and mechanically exhausted in accordance with Table MC 403.3.1.1 of the 2022 NYC Mechanical Code; or mechanically ventilated in accordance with Section MC 403.
 - b. All occupiable spaces provided with air conditioning shall be mechanically ventilated in accordance with Section MC 403.
 - 2. Occupant load for ventilation requirements shall be calculated as follows:
 - a. **Ventilation occupancy for a given space shall be the minimum of the UFT contract maximum occupancy (*prior* to the enactment of the reduced class size law on 9/7/2023) versus Table BC 1004.1.3, Egress Occupant Density.**
 - b. **For typical size classrooms, the UFT maximum will typically govern, while for smaller half-size rooms egress will typically govern. Note the occupancy (egress or UFT contract) to calculate the required ventilation rates depends on the grade level and size of the Classroom.**

UFT contract maximum occupancies are as follows:

Pre-K and K:	27 occupants
PS/IS Grades 1 through 8:	33 occupants
HS Grades 9 through 12:	34 occupants

The UFT contract occupancies represent the maximum number of students the teachers can effectively educate.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



Ventilation calculations for any space that does not have a defined occupancy per UFT contract as defined above shall be based on the default occupant density per Table BC 1004.1.3, Egress Occupant Density.

- c. Ventilation **occupancy** for PA, Administrative and other miscellaneous spaces shall be based on the default occupant density per Table BC 1004.1.3, Egress Occupant Density, since a Program of Requirements reflecting the UFT contract maximum occupancy does not exist for those spaces.

3. The minimum central unit outdoor air intake ventilation rate that the PA space (Gymnasium, Auditorium, Gymnasium) CO₂ sensors can throttle down to for a space that is vacant during scheduled occupied hours is the space specific cfm per square foot requirements defined in Table MC 403.3.1.1 times the space square footage. The minimum central unit outdoor ventilation rate for the units serving multi-zone spaces (Classrooms, Offices, etc.) is the sum of each space's cfm per square foot per Table MC 403.3.1.1 times each space's square footage.
 - a. The minimum vacant ventilation rate is established in order to maintain the minimum Indoor Air Quality (i.e., to account for the VOC outgassing of carpets, adhesives, paints etc.) even if the space is unoccupied.
 - b. The total supply air provided by recirculating unit (multi-zone or single zone) shall never be less than the fully occupied ventilation rate. Demand Control Ventilation (DCV) shall only modulate the central unit outdoor air intake rate and the amount of central unit recirculated air shall vary to provide at least the fully occupied total ventilation supply flow as the instantaneous outdoor air intake rate varies. As DCV modulates the rate of central unit outdoor air taken in, the central outdoor air ratio shall vary.
 - c. The minimum central unit outdoor air intake ventilation rate that the Cafeteria/Cafetorium carbon dioxide sensors can throttle the outside air intake rate down to for a vacant Cafeteria/Cafetorium during non-cooking scheduled occupied hours is the Cafeteria/Cafetorium cfm per square foot requirements as defined in Table MC 403.3.1.1 times the Cafeteria/Cafetorium square footage plus the amount of air required for makeup of the General Kitchen exhaust fan, Staff Toilet exhaust fan and Can Wash Room exhaust fan. This is due to the fact that the Cafeteria/Cafetorium and Kitchen are to be served by a combination central unit.

4. The required ventilation rates for dual function spaces (such as a Gymnasium or Gymnasium) are to be calculated considering each mode of operation (example when Gymnasium is used as a Gymnasium, and when Gymnasium is used as an Auditorium). Gymnasiums have a staged area to function in the Auditorium mode. Spaces denoted as "Gymnasium" (which would not have a stage) must still consider all possible modes of operation (such as when used for Gymnasium sporting events and when used for assembly gatherings).

5. **The above central unit outdoor ventilation airflow rates might have to be further adjusted when A2L refrigerants are used in the air handling units. The continuous ventilation option of Section 7.6.1.1.b of ASHRAE 15-2022 is to be employed when A2L refrigerants are used and the refrigerant charge per circuit exceeds the EDVC value as calculated in Equation 7-8 of ASHRAE 15-2022. The central unit outdoor air intake rate shall be the maximum of the required ventilation rate as calculated in accordance with**

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



Chapter 4 of the NYC Mechanical Code as compared to the outdoor air flow rate required to disperse any leaked A2L refrigerant in accordance with Equation 7-10 of ASHRAE 15-2022. If A2L refrigerants are used but the refrigerant charge per independent circuit is less than the EDVC value as calculated in Equation 7-8 of ASHRAE 15-2022, then the central unit outdoor ventilation airflow rates are to be solely based on the required ventilation rates as calculated in accordance with Chapter 4 of the NYC Mechanical Code.

6. Note that calculations are to be based on NET floor area.
7. Inside ambient design parameters:
72°F DB (in accordance with NYC Health Code and the Department of Education)
8. Outside ambient design parameters:

The Heating Design Temperature shall be 12.8°F with 99.6% weather data (NY Kennedy Airport) per Annex 1 Table B-1 of ASHRAE 90.1-2016 with reference to ASHRAE Standard 169-2013.
9. Heating load to include:
 - a. Transmission losses through exterior envelope
 - b. Ventilation outside air intake load
 - c. Miscellaneous transmission losses through basement floor
 - d. Infiltration losses (include the effects of pressurization)
 - e. Include heat transfer through piping and ductwork walls, duct leakage and inherent system inefficiencies such as damper leakage.
- B. Cooling for New Construction and Major Modification/Substantial Reconstruction Capacity Projects and Capital Improvement Projects:**
 1. The fresh air requirements for all spaces shall be the same as defined above for heating.
 2. Note that calculations are to be based on NET floor area.
 3. VAV Case (present SCA Standard):

In accordance with Section BC 1204.2 of the 2022 NYC Building Code, the inside ambient design parameters is 78°F DB at an outside ambient design maximum dry bulb condition of 89°F DB. Cooling Tower (if used) shall be designed for 78°F WB. Note that the spaces served by VAV boxes shall utilize CO₂ sensors to reset the minimum central unit ventilation airflow as defined above in Paragraph **A.3**.
 4. Cooling load to include:
 - a. Transmission and Solar heat gain through exterior envelope.

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- b. Ventilation outside air intake load.
 - c. Sensible and latent heat gain per space based on the occupancy per NET floor area of occupied space as determined above.
 - d. Interior heat gains (i.e., lights, equipment, etc.) Watts per NET square foot
 - e. Infiltration losses (include the effects of pressurization)
 - f. Fan heat
 - g. Include heat transfer through piping and ductwork walls, duct leakage and inherent system inefficiencies such as damper leakage.
- C. General Design and Construction Submissions
- 1. Refer to Design Requirement 6.2.28, HVAC Design Requirements for Special Spaces, for temperature and other design parameters that differ from the above standards for those particular spaces.
 - 2. Refer to Design Requirement 6.2.34, Verification of HVAC System Design.



6.2 Heating & Ventilation

6.2.10 Smoke Control, Smoke Venting and Post-Fire Smoke Purge Systems

Description/Design Approach:

A. Post-Fire Smoke Purge Systems

Per Section BC 917.1 of the 2022 NYC Building Code, post-fire smoke purge systems are intended for the timely restoration of operations and overhaul activities once a fire is extinguished. Post-fire smoke purge systems are not intended or designed as life safety systems and are not required to meet the provisions of Section BC 909.

1. Designers shall refer to and comply with the requirements of Section BC 917 for rules pertaining to the function, capacity and operation of building Post-Fire Smoke Purge Systems. Post-fire smoke purge systems shall be required in:
 - a. High-rise buildings per Section BC 403.
 - b. Buildings with any story exceeding 50,000 square feet in floor area.
 - c. Buildings with spaces exceeding 100 feet from natural ventilation openings. Natural ventilation openings shall consist of operable windows and doors of at least five percent of the floor area or roof vents per Section BC 910. Note that consequently, basements will typically require post fire smoke purge systems.

Per Section BC 917.2.2, provisions shall be made for sufficient make-up air. The provisions may include operable windows, doors or mechanical systems. In buildings having occupied floors located less than 75 feet above the lowest level of fire department vehicle access, breakable windows may be utilized.

Makeup air for basement post-fire smoke purge systems shall be provided by a dedicated header duct (or multiple header ducts as required based on providing a nominal velocity of 300 FPM) that serves all basement spaces. The header duct(s) in turn shall get its (their) outside air makeup from an areaway louver or ductwork terminating in a gooseneck shaped arrangement with an outside air intake Class 1 motorized leakage rated damper interlocked with a dedicated basement post-fire smoke purge fan. In locations where there is insufficient space to allow for a gravity make-up air system, provide make-up air fan connected to duct header and louvers. As an alternate to a dedicated header duct(s), transfer grilles may be provided between the basement spaces. Fire dampers that can be overridden at the firefighter's panel shall be provided at all basement fire rated duct penetrations and/or transfer grilles. This supply arrangement will be similar for high-rise buildings if the operable windows do not provide the required five percent floor area (considering the limitations of the window stops) and can not supply the make-up air (and low-rise buildings in the unusual case the breakable window area does not provide the required five percent floor area). In this case, a wall louver equipped with an interlocked outside air intake Class 1 motorized leakage rated damper shall be provided to provide makeup air to the dedicated header duct(s) or transfer grilles between the spaces.

2. A dedicated post-fire smoke purge system (i.e. one that purges the non-assembly spaces through the corridors) is preferred to one that is integrated with the HVAC units for the non-assembly spaces. Where HVAC units serving non-assembly spaces are utilized for post-fire

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



smoke purge, return fans shall be oversized to accommodate the additional CFM. The smoke purge system shall be sized to exhaust six (6) air changes per hour (or 1 cfm per sq.ft. of floor area whichever is greater) one zone at a time. Public assembly spaces may be purged separately and independently from each other and from classroom/office spaces in order to downsize the dedicated purge ductwork and dedicated purge exhaust fan. If the Public Assembly spaces are separately purged, they may be purged by using the return fans of the Public Assembly **heat pump** or air conditioning unit or by using separate Public Assembly purge fans. Provision shall be made for sufficient make-up air per Section BC 917.2.2.

3. The fire dampers and combination fire-smoke dampers necessary for operation of the purge system shall be provided with a manual override feature, which shall be activated by the NYC Fire Department at the post-fire smoke purge panel.
4. Post-fire smoke purge fans are not required to be connected to an emergency power source.
5. Smokeproof Enclosures: Per Section BC 917.1, a post-fire smoke purge system is not required where all exits are constructed as smokeproof enclosures in accordance with Section BC 1023.11.
6. **Per Section BC 917.2.4, interior exit stairways or ramps or exit passageways shall not be used as a portion of the post-fire smoke purge system. Doors in interior exit stairways or ramps or exit passageways shall not be permitted to be used as a portion of the post-fire smoke purge system. Air transfer and duct openings associated with the post-fire smoke purge system shall not be permitted in the interior exit stairways or ramps or exit passageways.**

B. Smoke Control Systems

1. Per Section BC 909.4.6, Duration of Operation, all portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than 20 minutes or 1.5 times the calculated egress time, whichever is more.
2. Per Section BC 909.10.6, Seismic Requirements, smoke control systems covered by Section BC 909 are required to function after an earthquake. Hence, smoke control fans must be seismically rated. Such smoke control systems must be seismically designed in accordance with Section BC 1613 and ASCE 7-16. The component importance factor, I_p , must be taken as 1.5 in accordance with ASCE 7-16, section 13.1.3. The smoke control system includes all components required for its operation, including but not limited to fans, ducts, electrical power, switchboards, motor control centers, starters, and controls. In addition, emergency or standby generators, depending on what is used for the project, must be seismically rated.

Exception: Smoke control systems in structures classified in Seismic Design Category B **are exempt from seismic requirements per Section 13.1.4 of ASCE 7-16.**

3. Per BC 909.11, Power Systems, the smoke control system must be supplied with two sources of power. Primary power must be from the normal building power systems. Secondary power must be from an emergency or standby source complying with Sections BC 2702. Ensure the electrical designers account for these connections in their design.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



4. Stage Emergency Ventilation

- a. Section **BC 202** defines a stage as a space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. Section **BC 410** defines a platform as, a raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein, other than horizontal sliding curtains, there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.
- b. Verify with the Architect whether a stage or a platform is being provided prior to design. Most SCA projects utilize platforms per the definition in Section BC 410, as they typically utilize only horizontal sliding curtains unless they are a specialty performing arts platform.
- c. **Stages require** an emergency ventilation system if **greater than 1,000 sq. ft. in floor area** or **with a stage height** higher than 40 ft. Reference Section **BC 410.3.7.1** for roof vent requirements (preferred) or Section **BC 410.3.7.2** for smoke **venting** requirements. Smoke **venting** systems shall be automatically activated by heat detector, smoke detector, sprinkler flow, etc. and supplemental manual activation.
- d. **Stages under 1,000 sq. ft. in floor area** or **less than 40 ft in height** and **platforms do not require a stage emergency ventilation system.**

5. Atrium Smoke Control Systems

- a. Per **Section BC 202**, an Atrium is defined as, an **opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or any other vertical openings that are not required to be enclosed by other provisions of this code, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.**
- b. As per Section **BC 404.5**, a smoke control system designed in accordance with Section **BC 909** shall be provided for atriums, **but as per the exception for most building occupancies including Class E, smoke control is not required for atriums that connect only two stories.**

6. Smoke Venting of all Closed Shafts and all Stairways

Per Section **BC 713.12.1**, all closed shafts, including vertical exit enclosures, having a floor area exceeding 4 square feet shall be provided with a smoke vent in accordance with Sections **713.12.1.1** through **713.12.1.3**. Interior vertical exit shaft enclosures shall also comply with **BC Chapter 10**.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



a. Smoke vent construction

Smoke vents may be constructed as windows, louvers with smoke dampers, skylights, vent ducts with smoke dampers, trap door hatches, or similar devices per Code. The SCA preference is to utilize trap door hatches that provide the most access to the area smoke detectors, as the area smoke detectors are integral parts of the trap door hatches. Louvers and vent ducts, if used, shall be provided with Class 1 motorized leakage rated smoke dampers that open upon sensing of smoke by area smoke detectors located at the top of the shaft. Architect/Engineer of Record shall obtain Authority approval to use louvers/vent ducts and must demonstrate that the associated area smoke detector is accessible. Skylights and trap door hatches shall be spring-loaded and shall be automatically opened by integral area smoke detectors and the trap door hatches shall be located at the top of the shaft. Where a vent duct is installed, such vent ducts shall be enclosed by construction having the same fire-resistance rating as required for the shaft enclosure.

b. Smoke vent dimensions

The effective venting area shall not be less than 3½ percent of the maximum shaft area at any floor, but in no event less than 72 square inches.

c. Smoke vent location

1) Smoke vents located above the roof line:

Where a closed shaft or smoke vent duct penetrates through the roof of the building, the vent shall be located as follows:

- a) The vent shall be located at least 8 inches above a noncombustible roof assembly or at least 36 inches above a combustible roof assembly.
- b) The vent shall be located at least 10 feet from any window, door, exterior stairway, or interior lot line. The vent may be located no less than 5 feet from any window or door if the vent is located at a point higher than the top of such window or door.
- c) Where the vent is constructed as a window or louver, the sill of the window or louver shall be located at least 36 inches above the roof assembly.

2) Smoke vents located in an exterior wall:

Where the exterior wall serves as part of a shaft enclosure or where a smoke vent duct penetrates the exterior wall of the building, no openings shall be located in the wall within a distance of 30 feet vertically above the vent opening, nor within 5 feet on either side of the vent opening.

7. High-Rise Buildings Stairway Smoke Control System

In addition to the requirements of **Section BC 713.12.1** (See Item B.6 above), per Section BC 403.5.4 and Section BC **1023.11**, every required **interior exit stairways and ramps**



serving occupied floors more than 75 feet above the lowest level of fire department vertical access shall be provided with smoke-proof enclosures or pressurized stairway.

a. Definition

Per Section **BC 202**, a Smokeproof Enclosure is defined as, “**An exit stairway, ramp or passageway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.**”

b. **Per Section BC 909.20**, smokeproof enclosures shall be designed with one of the following:

- 1) The stairway shall be accessed through an open exterior balcony or
- 2) The stairway shall be accessed through a naturally ventilated vestibule when the vestibule enclosure is part of the building envelope i.e. when the vestibule is located on the perimeter of the building.
 - a) Per Section BC 909.20.3.3, each vestibule shall have a minimum net area of 16 square feet of opening (windows; louvers and vent ducts with Class 1 motorized leakage rated smoke dampers that open upon sensing of smoke by smoke detectors located at the floor-side entrance to each vestibule or similar devices) in a wall facing an outer court, yard or public way that is at least 20 feet in width; or top floor vestibules shall be equipped with trap door hatches/skylights that open upon sensing of smoke by smoke detectors located at the floor side entrance to each vestibule or,
- 3) The stairway shall be accessed through a mechanically ventilated vestibule when the vestibule is not located on the perimeter of the building (i.e. when the vestibule is a core space).
 - a) Per Section BC 909.20.4.2, the vestibule shall be supplied with not less than one air change per minute and the exhaust shall not be less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required at the vestibule penetrations if the vestibule enclosure is not part of the building envelope.
 - b) Per Section BC 909.20.4.2.1, where a specially engineered system is used, the system shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule in the emergency operation mode and shall be sized to handle three vestibules simultaneously.
 - c) Smoke detectors shall be located at the floor-side entrance to each vestibule and shall activate the system for the affected vestibule. Supply air and exhaust air

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



ducts penetrating the building envelope shall be equipped with interlocked Class 1 motorized leakage rated dampers that open only when the system is activated by the smoke detectors located at the floor-side entrance to each vestibule. Smoke detectors shall be installed in accordance with Section BC 907.3. The vestibule ceiling shall be at least 20 inches higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless approved and justified by design and test.

- d) Per Section BC 909.20.4.4, the stair shaft shall be provided with an interlocked Class 1 motorized leakage rated dampered relief opening if the opening vents directly to the exterior and the stair shaft shall be supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water in the shaft relative to the vestibule with all doors closed. The system shall maintain a maximum of 0.35 inch of water in the shaft relative to the building measured with all stairway doors closed under maximum anticipated stack pressures. Relief opening interlocked Class 1 motorized leakage rated damper shall open only when the system is activated by the smoke detectors located at the floor-side entrance to each vestibule. Per Section BC 909.20.4.5, the door opening force shall not exceed limits in Section BC **1010.1.3** or
- 4) A pressurized interior exit stairway shall be constructed in accordance with Section BC **1023.1**.
 - a) Per Section BC 909.20.5, where the building is equipped throughout with an automatic sprinkler system in accordance with Section BC 903.3.1.1, the vestibule is not required, provided that interior exit stairways are pressurized to a minimum of 0.10 inches of water and a maximum of 0.35 inches of water in the shaft relative to the building measured with all stairway doors closed under maximum anticipated conditions of stack effect and wind effect. The stair shaft shall be provided with an interlocked Class 1 motorized leakage rated dampered relief opening if the opening vents directly to the exterior that shall only open when the system is activated by the smoke detectors located at the entrance to the smokeproof enclosure.

Where access to the roof is required by the **2022** New York City Fire Code, such access shall be from the smoke proof enclosure where a smoke proof enclosure is required.

c. Smokeproof Enclosure Door Closers

Per Section BC 909.20.2.1, doors in a smoke proof enclosure shall be self- or automatic-closing by actuation of a smoke detector in accordance with Section BC **716.5.9.3** and shall be installed at the floor-side entrance to the smoke proof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smoke proof enclosure at all levels. Smoke detectors shall be installed in accordance with Section BC 907.3.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



d. Ventilating Equipment Activation

Per Section BC 909.20.6, the activation of ventilating/pressurization equipment shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section BC 907.3.

e. Independent Ventilation Systems

Per Section BC 909.20.6.1, ventilation systems shall be independent of other building ventilation systems.

f. Smoke Control System Power

Per Section BC 2702.2.2, standby power shall be provided for smoke control systems in accordance with Section BC 909.11.

g. Smokeproof enclosures

Per Section 2702.2.19, standby power shall be provided for smokeproof enclosures as required by Section BC 909.20.6.2.

h. Acceptance and Testing

Per Section BC 909.20.6.3, before the mechanical equipment is approved, the system shall be tested in the presence of the Department or approved agency to confirm that the system is operating in compliance with these requirements.

8. Underground Building Smoke Control System

Provide if required in accordance with Section BC 405.5 for underground buildings with spaces having a floor level used for human occupancy more than 30 feet below the finished floor of the lowest level of exit discharge.

9. Smoke Protected Assembly Seating

If aisle widths are reduced per BC Table **1029.6.2**, provide smoke control per Section BC **1029.6.2.1** by providing either a smoke control system complying with Section BC 909 or natural ventilation designed to maintain the smoke level at least 6 feet above the floor of the means of egress.

10. Elevator Hoistway Smoke Venting is no longer required per the 2022 NYC Building Code.



6.2 Heating, Ventilation & Air Conditioning

6.2.12 Unit Ventilators (Existing School Buildings Only)

Description/Design Approach:

- A. For non-Electrification projects such as window replacements, exterior masonry work, etc., existing horizontal unit ventilators may be replaced in kind (horizontal unit ventilators utilizing steam or hot water, chilled water, two pipe or four pipe).
- B. As electrification projects are concerned with CO₂ reduction and hence to minimize energy usage, vertical unit ventilators are required whereby the vertical unit ventilators exhaust the air and energy recovery wheels are utilized. For Electrification projects, horizontal unit ventilators not having energy recovery wheels and relying on the central exhaust system, are not permitted. For Electrification projects, designer is to refer to the SCA website www.nycsca.org for the Building Electrification Project Field Report and the CIP Carbon Reduction Electrification Equipment Selection Matrix.
- C. Large corridors, large lobbies, assembly areas, cafeterias, and other large interior rooms shall be provided with a central ducted ventilation system.
- D. Unit ventilator fans and coils shall be sized to satisfy the loads using a combination of fresh air and recirculated air. Fresh air ventilation requirements shall be calculated in accordance with Design Requirement 6.2.9.
- E. Architect/Engineer of Record shall secure the services of an acoustical consultant to minimize the noise experienced in the classrooms. It is intended that the maximum acceptable sound pressure level be 45 dBA/NC40 in keeping with the 2016 version of the Green Schools Guide, which was based on version of LEED V3.

Requirement Applies to: New Construction Major Modernizations ✓ Capital Improvement Projects



6.2 Heating, Ventilation & Air Conditioning

6.2.13 Arrangement and Sizing of Equipment

Description/Design Approach:

Heat pump units (**both DX and, if approved by the Authority, dual temperature units served by air to water heat pump chiller/heaters**) shall be provided for all spaces according to Design Requirement 6.2.0.

The heating loads and cooling loads shall be calculated as per Design Requirement 6.2.9.

A. Heating Capacity

1. Projects based on providing new boilers are not authorized to proceed without Authority approval. All heat pump units in the heating mode are to be sized based on being able to provide the required capacity at outdoor air design conditions (12.8°F). Designers are cautioned to not select heat pumps based on the AHRI heating rating condition of 47°F outdoor air temperature.
2. Separate detailed calculations for Capital Improvement Program (CIP) projects are to be submitted for review with the design submission at 50% (if project has such submission) and again at 100% and 60% and again at 100% for Capacity projects. Submit a separate set of detailed calculations to Building Code Compliance (BCC) unit for review when the project is filed. Detailed calculations are to include:
 - a. Heating load calculations indicating transmission, infiltration and ventilation loads as well as assumed safety factors.
3. HVAC Schedules on the filed drawing set shall include summary schedules indicating:
 - a. Total transmission load, total infiltration load, total ventilation load, safety factors and selected heat pump capacity (with required auxiliary supplemental/back-up redundancy electric heating).
4. For existing schools undergoing Capital Improvement (CIP) Projects, heat pump capacity is to be based on current envelope U-value as best as can be determined. The U-value may be better than at the time of original construction, as the original windows have probably been replaced with better windows such as dual glazed insulated windows.
5. For new buildings and existing buildings undergoing Major Modernization projects that require new HVAC systems, refer to Design Requirements 6.2.0, 6.2.3 and 6.2.4 for heat pumps.

B. Cooling Capacity

1. Cooling loads shall include the sensible loads and the latent dehumidification loads (refer to Design Requirements 6.2.3 and 6.2.4). Design shall maintain comfort levels during transition seasons (such as humid, cool days in the spring) as well as peak load days.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



2. The ventilation calculations for New Construction and Major Modernization Capacity Projects and Capital Improvement Projects shall be calculated in accordance with Design Requirement 6.2.9.
- C. Designing for the Most Restrictive Conditions

The designer shall review all of the characteristics associated with all of the approved equipment manufacturers. The design should be able to accommodate any of the approved equipment manufacturers in terms of mechanical equipment room sizing, electrical power feeds, noise characteristics, slab openings, roof access, catwalks, vibration isolation/seismic restraints, New York City Fire Code requirements regarding rooftop access and obstructions, etc.



6.2 Heating, Ventilation & Air Conditioning

6.2.14 Fuel Oil Storage Tanks: Capacity and Room/Vault Ventilation

Description/Design Approach:

Provide oil tanks on CIP projects for burner retrofit or replacement from No. 2 or No. 4 oil to biodiesel B100 Ready burners when existing above ground (not directly encased in the soil) tanks are leaking but the boiler itself is to be salvaged and has an anticipated service life of at least 15 years as follows:

A. Tank Capacity

1. For CIP Project single fuel source systems, oil storage tanks for B20/B100 heating oil shall at least be sized as follows:
 - Schools less than 110,000 SF.....Two (2) ea. 7,500-gallon tanks
 - Schools greater than or equal to 110,000 SF but less than or equal to 130,000 SF.....Two (2) ea. 10,000-gallon tanks
 - Schools greater than 130,000 SF.....Two (2) ea. 15,000-gallon tanks
2. Fuel oil tanks shall not be buried but shall be located inside the **building or in a vaulted tank chamber**.
3. Fuel oil tanks shall be designed for the maximum static head that will be imposed with the normal vent piping filled with oil in accordance with Section MC 1305.7.4 of the 2022 NYC Mechanical Code.

Note that existing tanks associated with existing dual fuel gas/No 2 oil typically are only sized for 10 hours of operation per day for 10 days and hence will not meet the above single oil fuel tank sizes and there might be space constraints against installing larger tanks to replace existing leaking tanks. **Refer to Design Requirement 6.2.16 Fuel Burning Equipment which addresses dual fuel and straight gas burner retrofits/replacement.**

Note that **Capacity Projects** (New Schools and Schools undergoing Major Modernization projects) shall be equipped with heat pump systems (**DX or dual temperature water generated from air to water heat pump chiller/heaters**). Refer to Design Requirements 6.2.0, 6.2.3, 6.2.4, 6.2.39 and 6.2.40.

B. Tank Room/Vault Ventilation

Rooms containing fuel oil tanks located above ground (not directly buried in soil) shall be ventilated to limit the concentration of vapors in the room at or below 25% of the Lower Flammability Limit (LFL) of the oil being used per Sections MC 1305.13.2.3 and MC 1305.13.3.4. Per Section MC 1305.16, the tank room exhaust fans shall run continuously at two air changes per hour to guarantee the concentration will be at or below 25% of the Lower Flammability Limit (LFL). Multiple tank rooms may be served by a shared exhaust system. Make-up air shall be

Requirement Applies to:	New Construction	Major Modernizations	✓ Capital Improvement Projects
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provided via a ducted building ventilation system. All dampers, including smoke dampers, shall be interlocked with the exhaust air system.

Per Section MC 1305.16.1, replacement of tanks in prior code buildings may utilize an existing gravity ventilation system complying with the following:

1. The total net free area of supply and exhaust openings shall be equal to at least 1 percent of the floor area of the room, equally divided between the supply and exhaust; and
2. Independent supply and exhaust openings to the outside; or
3. Independent supply and exhaust ducts to the outside.



6.2 Heating, Ventilation & Air Conditioning

6.2.15 Cleaning and Inspection Requirements for Boilers and Chimneys

Description/Design Approach:

- A. Contract specifications for B100 burner retrofit or replacement projects shall set forth cleaning and inspection requirements for boiler, boiler breeching and chimney. **Reference Section MC 801.18.2 of the 2022 NYC Mechanical Code for the requirement to clean, repair and reline flue gas passages.**
- B. No boiler/burner (or vent from a gas appliance) shall be connected to an unlined chimney or to a chimney having a damaged lining. **Reference Section MC 801.16 for the requirement to line masonry chimneys.** Contract specifications shall set forth lining installation and repair requirements, as appropriate.
- C. Contract specifications for burner retrofit or replacement projects shall include soot cleaning of boiler firetubes.
- D. Required smoke test per Section MC 810: **All** new and altered chimneys, and chimneys to which a new appliance has been connected, shall be test run under operating conditions to demonstrate fire safety and the complete exhausting of smoke and the products of combustion to the outer air. Designer is to call out required smoke test in the contract documents as required.
- E. In order to avoid the potential of change orders where a stainless steel lining is determined to be needed based on a failed field smoke test, designer is to inspect existing chimney. Previously, when converting to gas burners, a chimney liner was automatically added due to the lower flue temperatures of gas burners as compared to oil burners and the tendency for any flue condensation to react with existing sulfur deposits in the chimney. When retrofitting existing No 2 or No 4 burner to burn biodiesel B20/B100 fuel or replacing with B100 ready burners, the stack temperatures will be such that a liner is not automatically **needed**. Hence, designer is to check existing condition of the firebrick and existing mortar joints before deciding to reuse existing chimney and not install a stainless steel liner for B20/B100 retrofit/replacement burner projects.

Requirement Applies to: New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.2 Heating, Ventilation & Air Conditioning

6.2.16 Fuel Burning Equipment

Description/Design Approach:

A. New Construction/Existing Buildings Undergoing Major Modernization Capacity Projects

New construction/existing buildings undergoing Major Modernization shall utilize **DX rooftop heat pump units, DX heat pump vertical unit ventilators or VRF heat pump systems** as detailed in Design Requirements 6.2.0, 6.2.3, 6.2.4 and 6.2.39. **Other option (subject to approval by the Authority) is to utilize Dual Temperature (DT) rooftop units, DT vertical unit ventilators or DT DOAS/DT fan coil units having ECM fan motors. In general, for indoor MERs, split DX systems or indoor DT air handling units may be used instead of rooftop units. Refer to Design Requirement 6.2.40 for air to water heat pump chiller/heaters.**

B. Existing Construction (No. 2 or No 4 Fuel Oil Burner Replacement or Retrofit to B100 Burner, Possible Fuel Tank Replacement) Capital Improvement Projects (CIP)

1. Directly buried tanks shall not be reused and shall either be left in place and filled with inert foam or removed if a soil study indicates that **soil** remediation is required.
2. Burners shall be biodiesel B100 Ready burners if the boiler has an anticipated future service life of at least 15 years. If the existing tanks are not directly buried and are located in **the basement/cellar or in** a concrete vault and if they are not leaking, the tanks may be salvaged for storage of B100 fuel oil. Tanks located in **the basement/cellar or in** a concrete vault that are leaking shall be replaced if the boiler has an anticipated future service life of at least 15 years. **Refer to related Design Requirement 6.2.14.**
3. Possible chimney lining with stainless steel liner must be considered in the cost analysis. Replacement or retrofit of #2 or #4 oil burners to B100 fuel oil burners may or may not require a new stainless steel liner depending on the integrity of the existing stack as determined by Designer's investigation. On the Drawings, Designer is to call out the need for a smoke test according to Section MC 810 of the 2022 NYC Mechanical Code. See related Design Requirement 6.2.15.

C. Existing Construction (Dual Fuel Gas/No. 2 Oil or Straight Gas) Burner Replacement or Retrofit Capital Improvement Projects (CIP) Not in Environmental Justice Areas

1. **For the dual fuel case where gas is the primary fuel and No. 2 oil is the secondary fuel, retrofit or replace with burners that have gas as the primary fuel and B100 as the secondary fuel. Straight gas burners are to be retrofitted or replaced in kind.**
2. **The justification to continue to use natural gas is based on the below information of the CO₂ generation per the 2016 NYC Green House Inventory Report and NO_x and SO₂ generation based on the statewide electricity profile for NYS in 2021. The source emissions of CO₂, NO_x and SO₂ for gas as compared to electric power generation are lower as shown in the below table:**

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



POLLUTANT	NO. 2 FUEL OIL	NO. 4 FUEL OIL	NATURAL GAS	ELECTRICITY	B20	B99.9
Carbon Dioxide CO ₂ (tCO ₂ e/MMBtu)	0.07414	0.07617	0.05	0.07632	0.05799	0.01118
Nitrogen Oxides NO _x (kg/MMBtu)	0.0783 ³⁷	0.172 ³⁷	0.0445	0.0665	0.0674	0.0206 ³⁸
Sulfur Dioxide SO ₂ (kg/MMBtu)	0.000695 ³⁷	0.1408	0.0002538	0.01329	0.000563 - 0.000695	0 ³⁸ - 0.000695

Over time, the electric grid will improve and there will be a disadvantage against using gas as the primary fuel. This future grid improvement is expected to occur nominally within the next 15 years, at which point the boilers would have no remaining useful life and the future design to address the failing boilers would be based on full electrification. Until electric power generation emits less gaseous pollutants as compared to utilizing gas burners, it will be beneficial to use natural gas as the primary fuel in a dual fuel gas/B100 system and in straight gas burners. Areas declared to be Environmental Justice Areas shall not have any burners that burn fossil fuels and are most likely candidates for full electrification. Discuss with the Authority.

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



6.2 Heating, Ventilation & Air Conditioning

6.2.17 Gas Leak Detection and Alarm Systems

Description/Design Approach:

A. Applicability: This Design Requirement is applicable to the following projects:

1. Retrofit/replacement of burners for steam boilers **having at least 15 years of remaining boiler service life** that burn natural gas or that are dual fuel natural gas/No.2 oil **converted to dual fuel natural gas/B100 biodiesel oil.**
2. New steam boilers are provided with burners that burn natural gas or dual fuel natural gas/**B100 biodiesel oil.**
3. New condensing hot water boilers are provided that burn natural gas.

All the above noted work would require Authority approval, as the Authority's standard is to employ heat pumps and in particular, designs based on providing new boilers are discouraged.

4. The case when the existing gas burner/boiler are to remain but work is required on the ancillary systems (such as a Climate Control upgrade, etc.) where the existing gas leak detection and alarm system requires retrofit or replacement.
 5. Replacement of existing fire alarm systems where **existing gas** detection system is now required to be connected to the Fire Alarm System.
- B. Gas detection systems designed to detect flammable gases required by the 2022 New York City Construction Codes or the New York City Fire Code shall comply with Sections BC 918.2 through 918.10 of the 2022 NYC Building Code.

C. For Schools with Authority Approval to Proceed with Burners that Burn Gas

1. Installation in Unoccupied Spaces: Natural gas leak detection and alarm system shall be installed with detectors provided in unoccupied spaces as follows where and when applicable:
 - a. For schools not employing heat pump domestic hot water heaters: Natural gas detectors adjacent to gas fired hot water heater (18 inches below ceiling, above the vent of the gas fired water heater in the vicinity of the barometric damper).
 - b. Natural gas detectors between the boilers (18" below ceiling above the breeching of the boilers).
 - c. Natural gas detector in Gas Meter Room and Gas Booster Room, if separate room is provided (18" below ceiling).
 - d. Natural gas detectors adjacent to gas-fired equipment (unit heaters, duct furnaces, etc.) located within the building. Install detectors 18" below the above ceiling, in the vicinity of the exhaust flue).

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



2. Operation of Unoccupied Leak Detection and Alarm System: Upon detection of combustible gas at a concentration exceeding 25 percent of the lower flammability limit (LFL) per Section BC 918.8.1, the individual leak detector shall signal the alarm control panel. The alarm control panel shall then institute the following:
 - a. Close the firm gas valve on the gas service per Section BC 918.8.3.
 - b. Electrically shut down all equipment including (but not limited to) the boilers, gas-fired hot water heaters and gas-fired rooftop equipment.
 - c. Start the explosion proof exhaust fan in the Gas Meter Room (if any).
 - d. Activate the audio/visual alarms in the Boiler Room (or Gas-Fired Hot Water Heater Room for projects without boilers) and in the Custodian's Office and send a dry contact to the Fire Alarm system per Section BC 918.10. **Mechanical designer to ensure the electrical designer indicates on the Div.16 Drawings the wiring between the Gas Leak Detection and Alarm system to the Fire Alarm system.**
 3. Per Section BC 918.5, the emergency generator, in the event of a loss of utility power, shall power the natural gas leak detection and alarm system, including exhaust fan in the gas meter room.
 4. The natural gas leak detection and alarm control panel shall contain power supplies to feed the gas leak detectors and the audio/visual alarms.
 5. A digital output natural gas alarm signal shall be sent from the leak detection and alarm system to the School Operating Console (SOC) if a **Section 15970 BMS/DDC or Section 15971 Local BACnet** system is provided. **For BMS/DDC applications, a wide area network (WAN) broadband signal shall be sent to the Central Host Control Station if the alarm signal is unanswered at the School Operating Console.**
 6. The natural gas leak detection and alarm system control panel shall be located in the Boiler Room (or Gas-Fired Hot Water Heater Room for projects without boilers).
- D. General
1. When provided, Gas Meter Room shall have an explosion proof fan, explosion proof lights and sealed penetrations. It shall also be provided with an outside air intake wall louver if above grade. If new Gas Meter Room is below grade, provide an 8-inch diameter outside air intake pipe terminating in a reverse bend two feet above grade level maximum length of 15 feet as per Appendix E.4 of the 2022 NYC Fuel Gas Code.
 2. Engineer of Record must edit the Contract documents to cover the retrofit case where new gas leak detection and alarm equipment is to be provided for existing dual fuel boilers. In that case, references must be made to two gas safety shut-off valves (Maxon valves), one for the firm gas line and one for the interruptible gas line. This Design Requirement is written for the case when a single firm gas service is being provided for single fuel gas burners.
 3. Per Section BC 918.2.1, construction documents for gas detection systems shall be submitted for review and approval to the Fire Department prior to system installation. Construction documents shall include, but not be limited to, the following:

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- a. Gas detection system devices and equipment.
- b. Engineering evaluation.
- c. Items required by Section BC 907.1.1, fire alarm system construction document requirements, as applicable.



6.2 Heating & Ventilation

6.2.19 Boiler Burner Safety Considerations for Non-Condensing Boilers

Description/Design Approach:

A. General

1. Operation

- a. **Operation: Fire-tube boilers and flexible bent tube water-tube boilers shall have the Burner Management System (Flame Safeguard System) programmed to provide the number of pre-purge period air changes as required by ASME CSD-1-2011. The sequential draft damper shall be proven to be 100 % opened (with end-switch) prior to the forced draft fan operation, i.e. prior to and during the pre-purge period. For forced draft fan operation only, the sequential draft damper shall also be proven to be 100% open prior to ignition (light-off). Pointer shall be provided at indicated damper position.**
- b. **During burner idle periods (between load cycles), the sequential draft damper shall be at the “safe-closed” position (70° closed out of a possible 90° travel.)**
- c. **The post purge cycle shall have a duration as required by ASME CSD-1-2011. A safety shutdown shall have the sequential draft damper at proven 100% opened position. Smoke alarm shutdown shall be wired into the safe shutdown circuit.**

2. Clearances

Clearances from the tops of boilers to the ceiling or other overhead obstruction shall be in accordance with Table MC 1004.3.1 of the 2022 NYC Mechanical Code. Show platform/ladder details on the Drawings. Where the required clearances cannot be provided due to physical limitations, file a reconsideration request (Form CCD-1) during the filing process demonstrating the physical limitations. Edit specification references to ladders/platforms if not required.

B. Oil Burning Equipment (When existing No 2 or No 4 burners are retrofitted or replaced with biodiesel B100 Ready burners, the below shall apply)

- 1. Each boiler shall have its own oil burner pump. The oil transfer pump shall not be used as a burner pump.
- 2. **For replacement burners**, provide one (1) 2 way direct acting normally closed fuel oil safety solenoid shut-off valve, one (1) 2 way normally closed fuel oil hydramotor safety shut-off valve with one (1) FM proof of closure switch similar to ASCO/General Controls HOV1A safety shut-off valve and one (1) normally open recirculation valve in burner oil piping layout. Provide Y-type strainer in burner oil piping upstream of the two (2) safety shut-off valves. Provide in line check valve in burner oil piping downstream of both fuel oil safety shut-off valves. Recirculation valve shall open when safety valves are closed. Hydramotor safety shut-off valve shall be installed downstream of the safety solenoid shut-off valve (closest to the burner). Provide two tee fittings between the solenoid oil safety valve and hydramotor oil

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safety valve. Branch leg of the first tee fitting shall be equipped with a test port that can be used to verify that the upstream solenoid safety valve has properly closed. Branch leg of the second tee fitting shall be equipped with a relief valve that in turn connects to the oil return lines.

3. Provide a low-pressure oil recirculation loop from transfer pump to oil storage tank. Branch takeoffs from this loop shall convey oil to suction side of the burner oil pumps. Oil discharged from relief valves and from the recirculation valve(s), upstream of the safety shut-off valves, shall be returned to the loop. Transfer oil pumps shall be sized in excess of heating plant maximum fuel consumption requirements to ensure that oil return flow to tank is maintained for all operating conditions. Each burner booster pump is nominally sized by the burner manufacturer to draw 1.5 times the burner oil consumption rate. The transfer pumps are to be sized at 1.5 times the cumulative draw of all booster pumps. Overall sizing factor for the transfer oil pump is 2.25 times the cumulative burner consumption. All burner oil consumption rates are based on providing the boiler nameplate horsepower using the manufacturer's stack loss.
4. All **replacement** oil burner assemblies shall be fitted with anti-drip nozzles, or equivalent devices, to prevent oil dripping into furnace following closure of the main shut-off and safety shut-off valves.
5. Provide 100 mesh strainer baskets in strainers serving burner oil pumps, strainer serving transfer oil pumps, and strainers serving burner safety shut-off valves. Oil tank and oil piping shall be thoroughly cleaned, flushed, tested, etc., before being placed in operation.
6. Each burner oil pump shall be interlocked with fuel valve circuit to shut-off when burner shut-off valves close.
7. Fuel oil transfer pumps shall be wired to burner panel so that when boiler is operating on oil, the transfer pump shall start automatically except where a day tank is provided where the day tank float switch cycles the transfer pumps as required.
8. If ceiling height in boiler room precludes the installation of the 180-degree bend as shown in the Oil Piping Schematic, then a manufacturer approved back pressure regulator may be used. The fuel oil return piping from each burner oil pump shall connect directly back to the fuel oil return header as shown on the attached Oil Piping Schematic. The burner oil pump fuel oil return lines must connect downstream of the back pressure regulator to guard against the condition of the back pressure regulator being erroneously closed.
9. Per Section MC 1305.6.2 of the **2022** NYC Mechanical Code, the fuel oil fill lines must be located a minimum of 2 feet laterally from any building opening and 5 feet away from any subway grating. Per Section MC 1305.7.2, fuel oil vent lines shall terminate outside of buildings not less than 2 feet from any building opening and not less than two feet or more than 12 feet above the fill pipe terminal. Emergency relief venting shall comply with Section MC 1305.8. Tanks designed in accordance with Section MC 1305.14 shall not require emergency relief vent piping. Thus select tank meeting such requirements when feasible. Show the fill and vent locations on the Contract Drawings. **Per Section MC 1305.14, the use of a self-closing manway cover, a manway cover provided with long bolts that permit the cover to lift under internal pressure, or other type of emergency relief vent device inside the building, shall be prohibited.**

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10. Fuel oil piping and storage shall comply with Chapter 13 of the **2022 NYC Mechanical Code** and **NFPA 31-12**. Fuel oil tanks (day tanks) shall not be located above the lowest floor unless required by existing conditions.

11. Two-Pipe System

Per Buildings Bulletin 2018-010, UL 142 day tanks not designed in accordance with Section MC 1305.14 and installed inside of buildings above the lowest floor, where the day tank normal and emergency vents are vented to an exterior termination point above the level at which the day tank is located, shall have the day tank overflow piped into the top of tank of the lowest floor storage tank that supplies the fuel to such tank. UL 80 day tanks, ASME BPVC day tanks and NYC-approved day tanks per Section MC1305.14 installed inside of buildings above the lowest floor, where the day tank normal vent is vented to an exterior termination point above the level at which the day tank is located, shall have the day tank overflow piped into the top of tank of the lowest floor storage tank that supplies the fuel to such tank.

Per Section MC 1305.7.9, Tanks Served by Pumps: Tanks on any floor served by pumps require the normal vent to be connected to the overflow pipe and shall be piped a minimum of 8 feet above the overflow pipe and terminated directly to the outdoors. A liquid sensor shall be installed in the vent of the remotely served tank in order to shut down oil supply in the event of an overflow. Per Section MC 1305.8, for tanks also having emergency vents, the design and installation of the combined normal and emergency relief vent shall be in accordance with Section MC 1305.7.

Refer to Figures C101.1(1), C101.1(2) and C101.1(3) of Appendix C of the 2022 NYC Mechanical code for the piping diagrams. Show all vent pipes and overflow pipe routing on the Drawings.

12. Per Section MC 1305.8.4, construction documents shall include calculations demonstrating that the extension of the normal and emergency vent piping is adequately sized to provide the required emergency vent flow while limiting the backpressure to less than the maximum pressure permitted by the design of the tank. Submit all calculations with the final design according to NFPA 30-12.
13. Per Section MC 1305.9.4, **Drain pan at base of shafts with leak detection, a metal drain pan shall be installed at the base of every vertical shaft enclosing the fuel-oil piping. Where the bottom of the shaft is located outside the fuel oil storage tank room, the drain pan shall be connected to and drained into a containment enclosure at the horizontal offset of fuel-oil piping. On the lowest level in the building, the outer containment of horizontal offsets shall be terminated inside the main storage tank room or transfer pump room. A drain pipe shall be provided from the lowest point in the containment enclosure to a minimum 55-gallon container with a leak detection alarm, arranged so as to sound an alarm and stop the transfer pump. Show all details on the Drawings.**
14. Per Section MC 1305.10, a remote control shall be provided to stop the flow of oil to any oil burner wherever located and to any oil-burning **appliances** located above the lowest floor in a building **as well as the fuel oil transfer pumps. Such control shall be located outside the entrance to the room in which the burner is located and as close to such entrance as practicable, except that when an outside location is impracticable, such control**

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may be located immediately inside the room in which the burner is located, provided such location is accessible at all times. Per Section MC 1305.3.4, Safeties and heat detectors, appropriate safeties shall be provided so that detection of heat within the generator or equipment room shall prevent additional fuel oil from being pumped into the piping system within such room, including fusible link operated valves in the supply pipe at the suction side of the fuel oil transfer pump and in the supply pipe entering the generator, fuel oil burning equipment room or rooftop equipment enclosure. Per Section MC 1305.13.3.3, rooms containing fuel-oil tanks and fuel-oil-burning appliances shall be equipped with automatic smoke detection in accordance with Section 907 of the New York City Building Code, except that heat detectors may be utilized where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector. Provide multiple fusible link operated valves (in the equipment room and in the transfer pump room) to protect in case a fire develops in a remote equipment room that is not located close to the transfer pumps. **Show all remote controls, fusible links, heat detectors and smoke detectors on the Drawings.**



- C. **Gas Burning Equipment (When existing gas burners or existing dual fuel gas/oil burners are retrofitted or replaced with Authority approval, the below shall apply)**
 - 1. **Gas Meter Room, if provided, shall have explosion-proof exhaust fan, light fixtures, switches, relays and accessories.**
 - 2. **A gas leak detection and alarm system shall be provided as detailed in Design Requirement 6.2.17.**
 - 3. **Provide gas safety shut-off valve(s) on the gas main(s) and locate gas safety shut-off valve(s) in the gas meter room (if provided).**



6.2 Heating, Ventilation & Air Conditioning

6.2.20 Building Management System/Direct Digital Control BMS/DDC, BACnet DDC with Local BACnet Network and DDC Only Systems

Description/Design Approach:

A. Case A: Full BMS/DDC BACnet Network Connected to Central Station for New Construction (Stand-alone Buildings and Addition Projects**) and Major Modification/Substantial Reconstruction Projects

** DOE owned (non-leased) new 3K/Pre-K schools shall be connected to Central Host Control Station (CHCS).

1. Designer shall design a BMS/DDC system with a connection to the Central Host Control Station (CHCS) at Two Metro Tech Center, Brooklyn, NY. BMS/DDC system shall consist of terminal controllers, central unit controllers, network cabling, routers, BACnet servers, Cisco switches; BACnet control cabinet and wall enclosures; Portable Operator's Terminal and School Operating Console. All scheduling shall be accomplished with central BACnet based scheduler for full BMS/DDC Systems. All graphics shall be Tridium Niagara based and are to be provided by Temperature Controls Contractor (TCC). Refer to Section 15970. The bid documents **are to** utilize Section 15973.
2. BMS/DDC digital control systems shall utilize the native BACnet protocol (or be equipped with network communication modules) where applicable as defined in each of the Specification Sections. The network operating system shall be the BACnet Network Protocol. All controllers that are native BACnet (or equipped with network communication modules) that drive the valves, dampers, etc. shall be interchangeable.
3. For projects with VAV boxes in the Classrooms, design shall indicate usage of return duct monitoring relative humidity sensors and monitoring/discharge air temperature reset controlling temperature sensors to be used in the cooling mode. Per BC 1204.2, all spaces shall be maintained at 78°F during occupied periods when the outside air conditions are at the maximum dry bulb design temperature (89°F dry bulb, 73°F wet bulb).
4. Designer shall design control systems that utilize night setback settings. Winter temperature setpoints shall be reset to 55°F from the 72°F day setting. For projects with VAV boxes in the Classrooms, design shall provide maximum unoccupied space temperature control to 85°F when controlling from the north-most representative room. Single Zone Variable Air Volume (SZVAV) heat pump systems serving PA spaces shall also utilize an unoccupied space temperature control algorithm that maintains a maximum of 85°F.
5. Designer shall design a control system with morning start up cycles that shall close the outside air intake dampers during the winter morning warm up period. Summer morning cycles and nighttime purge cycles shall purge the building with dry cooler outside ambient air before the initiation of the air-conditioning cycle if outside conditions are favorable. Summer morning purge cycle shall be followed by a recirculation only pull-down cycle.

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6. The School Construction Authority will use the services of a Facility Management Systems Integrator (FMSI) for projects equipped with a full BMS/DDC network system. The FMSI for Case A projects will have the following responsibilities:
 - a. Evaluate the control submissions made by the HVAC Contractor's Temperature Control Contractor (TCC) and Original Equipment Manufacturer (OEM). The FMSI will prepare a report for submission to the Architect/Engineer of Record if the **control** submission is recommended for rejection by the FMSI. The FMSI only makes recommendations. Final approval or disapproval of the submittal is made by the Architect/Engineer of Record.
 - b. Attend factory inspection of central units.**
 - c. Oversee the installation of the field level controls and Supervisory Control and Data Acquisition (SCADA)/Human Machine Interface (HMI) System by the TCC.
 - d. Oversee the commissioning of the field level controls as installed and commissioned by the TCC and the Original Equipment Manufacturer (OEM) controls as installed and commissioned by the OEM (or authorized OEM service representative).
 - e. Turn over all software routines, operation manuals and access codes for the system that connects a given school to the CHCS.
 - f. Connect the project school to the Department of Education Centralized Host Control Station located at Two Metro Tech Center, Brooklyn, NY.
- B. Case B: BACnet DDC with Local BACnet Network for small Capacity Lease and Special Program Projects and larger CIP Projects (other than small scope CIP projects that may use DDC Only systems)
 1. Larger CIP projects, (e.g., air conditioning for an existing school under a Noise Abatement Project, replacement/retrofit of No 2 or No 4 burner to biodiesel B100 Ready burner and replacement of terminal unit controllers in parallel, etc.) and Capacity Lease and Special Projects (Leased 3K & Leased Pre-K Program, etc.), shall be designed with a BACnet DDC with Local BACnet Network as defined in Section 15971. The central units may be equipped with non-native BACnet controllers providing that there is a gateway (communication cards) to BACnet. The terminal unit DDC controllers must be integrated into the network and shall communicate with the central equipment.
 2. Central equipment (rooftop heat pump units, etc.) shall be designed with a Human Machine Interface (HMI) that can display diagnostic error codes and system information. The bid documents shall define a Portable Operator's Terminal which functions as the School Operating Console (POT/SOC) to permit operator interface to facilitate terminal controller management (and central unit controller management in addition to the central unit controller Human Machine Interface (HMI) interface), commissioning, diagnostics and general operator interface with the installed control system. The POT shall be able to connect directly to all controllers. All graphics shall be Tridium Niagara based and are to be provided by Temperature Controls Contractor (TCC). The bid documents **are to** utilize Section 15973A.
 3. Per LL32/16, each capital project that includes the replacement/retrofit of a burner from No 2 or No 4 to biodiesel B100 Ready burners at an estimated construction cost for such replacement/retrofit of \$2,000,000 or more, shall be designed and constructed to reduce

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energy cost by a minimum of ten percent, as determined by the methodology prescribed in LEED v4 Energy and Atmosphere Optimize Energy Performance credit for LL32/16 projects or the New York City Energy Conservation Code, whichever is more stringent; provided that compliance with this paragraph shall not be required for LL32/16 capital projects that would be subject to this paragraph solely because such project involves replacement/**retrofit of a burner**, unless the cost of such project equals or exceeds 50 percent of the cost of replacing the heating distribution system of such building.

- Per LL32/16, each capital project that involves the installation or replacement of HVAC comfort controls systems (including repair/replacement of the central ventilation units) at an estimated construction cost for such installation or replacement of \$2,000,000 or more, shall be designed and constructed to reduce energy cost by a minimum of five percent (5%) as determined by the methodology described in LEED v4 Energy and Atmospheric Optimize Energy Performance credit for LL32/16 projects or the New York City Energy Conservation Code, whichever is more stringent.
4. For BACnet DDC with local BACnet network projects, all scheduling shall be accomplished with central BACnet based scheduler.
 5. There shall be no connection to the Central Host Control Station at Two Metro Tech Center, Brooklyn, NY.
 6. The Authority's Facilities Management Systems Integrator (FMSI) shall be involved in the construction process.
 7. The School Construction Authority will use the services of a Facility Management Systems Integrator (FMSI) for projects equipped with a BACnet DDC with Local BACnet Network. The FMSI for Case B projects will have the following responsibilities:
 - a. Evaluate the control submissions made by the HVAC Contractor's Temperature Control Contractor (TCC) and the Original Equipment Manufacturer (OEM). The FMSI will prepare a report for submission to the Architect/Engineer of Record if the controls submission is recommended for rejection by the FMSI. The FMSI only makes recommendations. Final approval or disapproval of the submittal is made by the Architect/Engineer of Record.
 - b. Unlike Capacity projects, the FMSI need not attend factory inspections for CIP projects.**
 - c. Oversee the installation of the field level controls and Supervisory Control and Data Acquisition (SCADA)/Human Machine Interface (HMI) System by the TCC.
 - d. Oversee the commissioning of the field level controls as installed and commissioned by the TCC and the Original Equipment Manufacturer (OEM) controls as installed and commissioned by the OEM (or authorized OEM service representative).
 - e. Turn over all software routines, operation manuals and access codes for the system.

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C. Case C: DDC Only System without Network for Small Scope Capital Improvement Program (CIP) Projects

1. Small scope projects that will not be designed with a network shall be approved by the Authority on a project-by-project basis (e.g., replace Auditorium rooftop unit, stand-alone gym program, etc.). Refer to Section 15975.
2. Scheduling of equipment is determined by the stand-alone DDC controllers with scheduling function or through the use of time clocks as digital input into the DDC controller when the controller is an application specific controller without scheduling function.
3. Design shall not call for the installation of any Ethernet/twisted pair cables or routers, BACnet servers, Cisco switches, Cat 6 backbone risers; BACnet control cabinet or wall enclosures; or School Operating Console (SOC).
4. There shall be no graphics software installed that does trending and LAN/WAN alarming at the SOC and CHCS.
5. There shall be no connection to the Central Host Control Station at Two Metro Tech Center, Brooklyn, NY.
6. The Authority's Facilities Management Systems Integrator (FMSI) for these Case C projects will not be involved in the construction process (although they will continue to perform design reviews). The DCIM Department will assign a Commissioning Authority to oversee the commissioning of the controls. The bid documents will not utilize Section 15973 **or 15973A**.

D. General

1. Some Case B and Case C projects involve replacing essentially all of the HVAC equipment and may qualify for a full BMS/DDC system as defined above in Case A per Section 15970 under special conditions. **CIP projects involving replacement of existing BMS system are to use Section 15970.** Consult with the A&E Design Manager to verify if the specific project warrants a full BMS/DDC system.
2. Architect/Engineer of Record shall edit all associated project Specification Sections as required to be consistent with the above. Refer to Specification Sections 15970 and 15973 and Standard Detail 1598502a for full BMS/DDC Projects. Refer to Specification Section 15971 for BACnet DDC with local BACnet network and 15973A and Standard Detail 1598502e for local BACnet projects.

Notes:

1. According to Title 43 Chapter 10, Capital Projects for the replacement/retrofit of burners from No 2 or No 4 to biodiesel B100 Ready burners at an estimated construction cost of 2 million dollars or more are not required to also comply with the energy reduction requirements for the installation of HVAC comfort controls.



6.2 Heating & Ventilation

6.2.21 Emergency Generator and Fuel Tank

Description/Design Approach:

New Construction projects and designated Major Modernization projects shall be provided with base diesel oil storage tanks **not exceeding 330 gallons** that are integral with the electric generator. The new generator/base storage tank assemblies shall be located outdoors within close proximity to the Electrical Service Room, in a suitable enclosure.

Existing basement mounted No. 2 diesel oil storage tanks (**not exceeding 330 gallons**) and diesel oil transfer pumps (which pump up to higher floor level day tanks/generators) shall be repaired/replaced in kind for Capital Improvement projects.

For repairs/replacements to the above defined CIP project generator systems and for any New Construction project or Major Modernization project where limited site space exists for grade mounted generators with integral base tanks and where transfer pumps are used to pump up to higher floor level day tanks/generators, the following Code requirements shall apply:

1. For projects with basement mounted No. 2 diesel oil storage tanks **not exceeding 330 gallons**, per Section MC 1305.6.2 of the **2022 NYC Mechanical Code** the diesel fuel oil fill lines must be located a minimum of 2 feet laterally from any building opening and 5 feet away from any subway grating. Per Section MC 1305.7.2, diesel fuel oil vent lines shall terminate outside of buildings not less than 2 feet from any building opening and not less than two feet or more than 12 feet above the fill pipe terminal. UL 142 tank emergency relief venting shall comply with Section MC 1305.8. Show the fill, vent and overflow piping on the Contract Drawings.
2. Diesel fuel oil piping and storage shall comply with Chapter 13 of the **2022 NYC Mechanical Code** and NFPA 31.
3. Venting and Overflow Piping shall be a Two-Pipe System:
 - a. Per Buildings Bulletin 2018-010, UL 142 day tanks not designed in accordance with Section MC 1305.14 and installed inside of buildings above the lowest floor (or outside on the roof), where the day tank normal and emergency vents are vented to an exterior termination point above the level at which the day tank is located, shall have the day tank overflow piped into the top of tank of the lowest floor storage tank that supplies the fuel to such tank.
 - b. **Per Section MC 1305.7.9, Tanks served by pumps, for tanks on any floor served by pumps, the normal vent shall be connected to the overflow pipe, shall be piped a minimum of 8 feet above the overflow pipe and terminated directly to the outdoors. A liquid sensor shall be installed in the vent of the remotely served tank in order to shut down oil supply in the event of an overflow. Per Section MC 1305.8, for tanks also having emergency vents, the design and installation of the combined normal and emergency relief vent shall be in accordance with Section MC 1305.7.**
 - c. **Refer to Figures C101.1(1), C101.1(2) and C101.1(3) of Appendix C of the 2022 NYC Mechanical Code for the piping diagrams.**

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- a. Emergency generators are not considered appliances but rather are internal combustion engines; hence the appliance outlet termination requirements of Section MC 801.21 do not apply to emergency generators.
- b. For the exhaust from internal combustion engines (not appliances) per Section MC 811.2, the location of discharge outlets for emergency and standby internal combustion engines shall comply with the requirements of NFPA 37 so that the flue gases are not directed to jeopardize the health or safety of people, overheat combustible structures, nor enter building openings in the vicinity of the outlet, nor shall the location of such openings cause the condensate leaving the outlet to come into contact with people.
 - 1) Per Section MC 811.2.1, Interference, no discharge opening shall be located and constructed so as to interfere with the proper functioning of other openings in the same building or adjoining buildings, to interfere unreasonably with the occupants of the same building or adjoining buildings, or with the general public, or to create a fire or health hazard.
 - 2) Per Section MC 811.2.2, Chimneys, the exhaust pipe may be connected to a chimney used for other equipment, provided that the operation of the engine does not adversely affect the operation of the other equipment so that it is in violation of the New York City Air Pollution Control Code.
- c. Designer is to layout the location of the generator exhaust to be in compliance with Section MC 811.2.
- d. Refer to Electrical Design Requirement 7.1.2 for the noxious generator outlet termination requirements that must be in accordance with Section MC 501.3.1.



6.2 Heating & Ventilation

6.2.22 Kitchen Ventilation

Description/Design Approach:

A. General

- 1, Note that the term 'Kitchen' as used in this Design Requirement applies to full cooking Kitchens, Therm and Hold Kitchens and Warming Pantries and the requirements indicated generally apply to all those spaces, except where specific requirements for the Therm and Hold Kitchen and Warming Pantry are so indicated. This Design Requirement also applies to Cafetorium spaces (very rarely used) and thus references to Cafeteria throughout this document would apply to both spaces.
2. This Design Requirement addresses two different design approaches:

Case 1: A combination Cafeteria heat pump unit or combination dual temperature (DT) unit served by air to water heat pump chiller/heater where the combination unit also serves the Kitchen for general Kitchen HVAC and provides makeup air for the Kitchen hood. Designs based on air to water chiller/heater usage require Authority approval considering the costs and additional complexity of the controls.

Case 2: A dedicated separate heat pump unit or combination dual temperature (DT) unit is provided for the Cafeteria and a dedicated makeup unit is provided for the Kitchen.
3. Case 1 is the SCA's preferred design approach **at this time, as it is slightly less expensive**. Case 2 is the more suitable design approach for **when certain projects are likely to exceed 70 kBTU/SF, as there is a substantial EUI savings**, and is subject to approval by the Authority. For addition projects when the Kitchen serves the existing building population as well as that of the new Addition, **Case 2 shall be implemented, as past projects have demonstrated the 70 kBTU/SF will be exceeded**. The Case 2 separate units is **slightly** more expensive as compared to the combination Cafeteria/Kitchen units used in Case 1, as there are two units instead of one (though smaller), two required electrical feeder sets, two dunnages, etc.

B. Design Features Common to Both Case 1 and Case 2:

1. Cafeteria Single Zone Variable Air Volume (SZVAV) heat pump units or DT units are required per Section 6.5.3.2 of ASHRAE 90.1-2016 when capacity of the DX heat pump system exceeds 65,000 BTUH and when the fans of the DT air handling units exceed 1/4hp.
2. Demand Controlled Ventilation (DCV) is to be employed in both cases and is addressed in Section 6.4.3.8 of ASHRAE 90.1-2016 and Section C403.7.1 of the 2020 NYCECC.
3. The Cafeteria unit shall be provided with supply and exhaust fans; outside air intake, exhaust and recirculation dampers; heat pump DX or DT cooling coils **that also function as** heat pump DX or DT coils for tempering in the heating season. Additionally, electric resistance coils shall be provided in the DX heat pump and DT unit. Note that the Kitchen hood exhaust

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air and general Kitchen exhaust air shall not be returned to the Cafeteria DX heat pump or DT unit.

4. The Cafeteria SZVAV DX heat pump or DT unit provides Cafeteria cooling and ventilation. In the heating mode, the SZVAV unit is decoupled. The Cafeteria space heating loads are met by a recessed convector terminal heating system (recessed electric convectors for DX SZVAV applications or recessed hot water convectors for DT SZVAV air handling unit applications).
5. Air is exhausted from the Kitchen via various dedicated exhaust fans. The Can Washroom is served by a constant-speed exhaust fan that is scheduled to operate in the occupied mode and disabled during the unoccupied mode. The HVAC Designer shall size Can Washroom exhaust for 10 ACH (nominally 250 cfm). The Staff Toilet is served by a constant-speed exhaust fan that operates intermittently from a DDC schedule (ON during occupied hours and OFF during unoccupied hours). The Kitchen is served by the Kitchen General Exhaust Fan (KGEF) that operates from the same DDC schedule controlling the operation of the combined Cafeteria/Kitchen SZVAV unit or DDC schedule controlling the operation of the dedicated makeup unit. The Hood Exhaust Fan is manually operated through a local switch mounted in the Kitchen and is designated as the Dietician's Switch. Whenever the Kitchen is performing cooking-related activities, the Hood EF must be activated. When the Hood EF is activated, the KGEF is de-activated and electrically interlocked main gas valves (when electric induction cooking, the SCA standard, is not utilized) are opened to allow cooking. When the Dieticians switch in the OFF position, the main gas solenoids of the Kitchen equipment burners (when electric induction cooking is not utilized) shall be de-energized (via hard wired interlock between the solenoids and the Hood exhaust fan). A method of interlocking between an exhaust hood system and appliances equipped with standing pilot burners shall not cause the pilot burners to be extinguished. When electric induction cooking is utilized, cooking appliances shall be de-energized until the hood exhaust is proven and then cooking shall be permitted.
6. Heat from the compressors of the various Kitchen reach-in equipment is produced twenty-four hours a day, seven-days a week. In addition to functioning in the Occupied modes, the General Kitchen exhaust fan with exhaust grilles located above or in the vicinity of the heat-producing equipment shall be provided for air exhaust during the unoccupied mode of the Case 1 combined Cafeteria/Kitchen SZVAV unit and for the unoccupied mode of the Case 2 separate units should the dedicated makeup air unit fail and the Kitchen space temperature rise. This KGEF shall be equipped with a motorized back-draft damper and shall be thermostatically controlled from the DDC system as sensed by the Kitchen temperature sensor. The KGEF shall operate in the unoccupied mode when the room temperature exceeds 87°F (adjustable). Makeup air for this exhaust fan shall be drawn from the Kitchen by infiltration.
7. The Case 1 combined Cafeteria/Kitchen unit and Case 2 dedicated SZVAV unit for the Cafeteria and dedicated makeup unit for the Kitchen sequence of operation is defined in Standard Specification 15985.
8. During the unoccupied period, the Cafeteria SZVAV units will utilize 85°F temperature setup. The Cafeteria shall be provided with space monitoring relative humidity sensor(s) and a hardwired space temperature sensor. The space temperature sensor shall control the Cafeteria SZVAV unit during unoccupied time periods. The Cafeteria SZVAV unit shall be provided with a return air duct monitoring relative humidity sensor and return air duct

Requirement Applies to: ✓ New Construction ✓ Major Modernizations Capital Improvement Projects



- mounted temperature sensor. The return duct temperature sensor shall control the unit during occupied time periods.
9. In the non-cooking mode, the Kitchen general exhaust fan plus Can Washroom exhaust fan plus Staff Toilet exhaust fan shall exhaust all the air provided to the Kitchen, plus 10% more to provide negative Kitchen pressurization. In the cooking mode, the Kitchen hood exhaust fan plus Can Washroom exhaust fan plus Staff Toilet exhaust fan shall exhaust all the air provided to the Kitchen plus 10% more to provide negative Kitchen pressurization. Refer to Table MC 403.3.1.1 of the 2022 NYC Mechanical Code and provide a minimum of 0.7 cfm/sf. The Kitchen exhaust hood shall exhaust all cooking grease laden vapors/odors. At any given time, the Kitchen ventilation requirements will be the sum of the general Kitchen exhaust fan (or Kitchen hood exhaust fan) plus the Can Washroom exhaust fan plus the Staff Toilet exhaust fan.
 10. Ceiling diffusers and wall grilles shall be spaced to avoid air stagnation and stratification and to provide a maximum forty (40) feet per minute air impingement velocity when the air moves past occupants to comply with ASHRAE 55-10. A displacement ventilation air system shall be used for hood makeup in that remote supply diffusers (and for the case of the combined Cafeteria/Kitchen unit, the transfer duct from the Servery area of the Cafeteria to the Kitchen) shall provide the makeup air for the hood. Hoods that have integrated supply ducts shall not be used. Diffusers shall be selected and located to achieve a maximum terminal velocity of 50 fpm at the hood. Standard diffusers shall not be used in the immediate area of the hood to maximize the capture and containment of cooking grease laden vapors/odors and minimize effluent spillage. Refer to Section 6.5.7.2 of ASHRAE 90.1-2016.
 11. Final LL**51/23** energy code compliance and compliance with the NYC Green Schools Guide shall be demonstrated by project specific energy modeling.
 12. Temperature Set Points:
 - a. Inside Occupied Kitchen design temperatures: 72°F Winter, 82°F Summer for Case 1 combined Cafeteria/Kitchen unit case; 78°F Summer for Case 2 dedicated Kitchen makeup unit case.
 - b. Inside Occupied Cafeteria design temperatures: 72°F Winter, 78°F Summer.
 13. Floor mounted exposed cabinet heaters and fan coil units shall not be installed inside the Kitchen area.
 14. Kitchen grilles, diffusers and any other devices and apparatus used for air distribution must be flush and compatible with the panel ceiling.
 15. Commercial Kitchen hoods are subject to the Special Inspection as defined in Section BC 1705.21 of the 2022 NYC Building Code (Special Inspection for Mechanical Systems) and Section MC 507.
 16. Per Section MC 507.6, a performance test shall be conducted upon completion and witnessed by a representative of the Fire Department before final approval of the installation of a ventilation system serving commercial cooking appliances.

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17. Per Section MC 506.3.13.3, exhaust outlets serving Type I hoods (Kitchen hoods for collecting and removing grease vapors and smoke) shall be located not less than 10 feet horizontally from parts of the same or contiguous buildings, adjacent buildings and adjacent property lines and shall be located not less than 10 feet above the adjoining grade level. Exhaust outlets shall be located not less than 10 feet horizontally from and not less than 3 feet above air intake openings into any building. Exception: Exhaust outlets shall terminate not less than 5 feet horizontally from parts of the same or contiguous building, an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations. The Designer is to verify that the location of the Kitchen exhaust outlets on the bid drawings complies with the above.
18. For schools of less than 300 students (typical of 3K and Pre-K projects), a Warming Pantry that utilizes commercial mobile heated carts that hold flat aluminum food trays for food cooked off-site are used. The general HVAC system serving the Warming Pantry is to be sized to remove the heat/moisture from the mobile carts.
19. For schools of 300 or more but less than 400 students, a Kitchen that utilizes fixed commercial Therm and Hold units that hold flat aluminum food trays are used. Provide commercial Type II condensate hoods ducted to the outdoors over the Therm and Hold units.
20. Air balance per Section MC 508.1.2 requires design plans for a commercial Kitchen ventilation system that include a schedule or diagram indicating the design air balance of the Kitchen and all communicating spaces clearly indicating makeup, transfer, exhaust, and infiltration airflow rates. Negative pressurization caused by the Kitchen exhaust system shall not cause improper operation of systems in communicating spaces or cause door opening forces in the building to exceed the limits set forth in Chapter 10 of the 2022 NYC Building Code.

C. Unique Design Features for Case 1:

1. Per the energy modeling performed as the basis for the SCA Standards, the combination unit utilizes Demand Controlled Ventilation (DCV) but only in the non-cooking mode. In the cooking mode, the amount of outdoor air delivered to the Cafeteria may not be reduced even if the Cafeteria is vacant since that Cafeteria air must be transferred to the Kitchen.
2. The Kitchen hood exhaust fan shall be a constant volume unit.
3. The Cafeteria unit does not employ an energy recovery wheel since the amount of air transferred to the Kitchen and not returned to the Cafeteria unit is significant and hence usage of an energy recovery wheel is not justified.
4. The Kitchen is cooled by hard ducting supply air from the combination Cafeteria/Kitchen unit to the Kitchen and transferring air from the Cafeteria to the Kitchen.
5. The Kitchen space heating capacity is to be provided by a duct-mounted hot water heating coil in the duct serving the Kitchen for DT SZVAV air handling unit applications. For DX SZVAV applications, Kitchen space heating shall be provided by flush ceiling mounted electric cabinet unit heater.
6. During the occupied modes, air is returned to the combined Cafeteria/Kitchen SZVAV unit solely from the Cafeteria area, while air from the Kitchen is vented outside through various

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exhaust fans serving the Kitchen area. Makeup air for the exhaust fans is supplied by the combined Cafeteria/Kitchen SZVAV unit via supply air diffusers and a transfer grille in the wall between the Cafeteria Servery and Kitchen.

7. The details of the control hardware required are contained in Standard Specifications 15970/15971 and are shown on standard detail control drawings 1598512k and 159858l, which also contains the DDC point lists.
 8. Table 6.5.7.2.2 of ASHRAE 90.1-2016 (more conservative than Section MC 507.5) shall be followed if hood exhaust exceeds 5,000 cfm when determining the Kitchen hood maximum allowable net exhaust flow rate. The Exception where Table 6.5.7.2.2 does not apply is if 75% or more of the total makeup replacement air is transferred to the Kitchen from otherwise exhausted Cafeteria air. The Designer is to check the ratio of what is transferred to the Kitchen compared to the total of the air hard ducted to the Kitchen plus the air transferred to the Kitchen.
- D. Unique Design Features for Case 2:
1. The dedicated Cafeteria unit utilizes Demand Controlled Ventilation (DCV) always regardless of if cooking is being done in the Kitchen or not since makeup air need not be transferred to the Kitchen and the makeup unit provides 100% of the makeup air requirements for the various exhaust fans serving the Kitchen area.
 2. The Kitchen hood exhaust fan shall be a variable volume unit.
 3. The Cafeteria unit employs an energy recovery wheel since air need not to be transferred to the Kitchen and air is exhausted by the Cafeteria unit.
 4. The Kitchen is cooled by dedicated Kitchen makeup unit.
 5. The Kitchen is heated by an all-air system where the makeup unit provides warm air to meet the Kitchen space heating loads.
 6. During the occupied heating and cooling modes, the makeup unit provides 100% outdoor air and in the unoccupied heating and cooling modes, the makeup unit is a 100% recirculating unit. The Kitchen makeup unit is coupled both in cooling and heating and employs supply air temperature reset when at partial load conditions.
 7. The details of the control hardware required are contained in Standard Specifications 15970/15971 and are shown on the standard detail control drawing 1598512o, which also contains the DDC point lists. Refer to Section 15860 for the variable volume hood controller and Section 15943 for the dedicated makeup unit.
 8. Table 6.5.7.2.2 of ASHRAE 90.1-2016 (more conservative than the Section MC 507.5) shall be followed if hood exhaust exceeds 5,000 cfm when determining the Kitchen hood maximum allowable net exhaust flow rate.



6.2 Heating & Ventilation

6.2.23 Ventilation Requirements for the Compressor Room of the Kitchen Walk-In Units

Description/Design Approach:

The Compressor Room (if any) for the Kitchen Walk-in Refrigeration Equipment shall be provided with a ventilation system to control the room temperature. The ventilation system shall be designed to mechanically exhaust at least 1100 CFM per remote condensing unit horsepower. In Kitchens, where the Compressor Room is located in the central area of the Kitchen, the ventilation system shall include but not be limited to exhaust ductwork, exhaust louver on an exterior wall or goose neck on roof, motorized backdraft damper, exhaust fan and adjustable control thermostat. Makeup air for the Compressor Room shall not be drawn from the Kitchen. Makeup air must be available 24/7 and shall be drawn from the ambient.

The preferred alternate (other than the Compressor Room location) is to locate the air-cooled condensing units on a slab on grade or roof mounted in a secured (caged) location. A secondary preferred alternate (other than the Compressor Room location) is to locate the air-cooled condensing units for the walk-in units above the walk-in units themselves at the ceiling level. This ceiling space in turn must be ventilated.



6.2 Heating & Ventilation

6.2.24 Kitchen Storeroom HVAC Requirements

Description/Design Approach:

A temperature of between 50°F - 70°F shall be maintained inside the food storage rooms by using an electrical heat pump system with the outdoor unit located next to the walk-ins air cooled condensing units, if the walk-ins condensing units are mounted outside in a caged (secured) location. If not, the electric heat pump outdoor unit shall be in a separately secured location. **For projects equipped with BMS/DDC system, Temperature Controls Contractor (TCC) shall provide both space temperature sensor and space relative humidity sensor and TCC shall integrate sensors into the BMS/DDC network.**

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6.2 Heating, Ventilation & Air Conditioning

6.2.25 HVAC Acoustical Standards

Description/Design Approach:

- A. The following are the maximum background sound level criteria to be produced by HVAC systems, expressed in terms of A-weighted sound levels.

LOCATION	A-WEIGHTED SOUND LEVEL (dBA)	APPROXIMATE NOISE CRITERION (NC) EQUIVALENT
General Circulation/Lobby Areas	50	45
Principal's Office (Private Offices)	40	35
General Office (Open-Plan Areas)	45	40
Cafeteria	50	45
Cafetorium	35	30
Toilets	55	50
Storage/Work Rooms	55	50
Music Teaching Studios	30	25
Music Practice Rooms	40	35
Classroom Grades 3K through 12*	40	35
Gymnasium	45	40
Gymatorium	35	30
Kitchen**	55	50
Auditorium	30	25
Staff Cafeteria	45	40
Library	45	40
Conference Rooms	40	35
TV Studios	30	25
Labs	45	40

Requirement Applies to: ✓ New Construction ✓ Major Modernizations Capital Improvement Projects



* NC-35 (40 dBA) may not be achievable with ducted floor mounted VRF units and ducted vertical unit ventilators employed in buildings with limited slab-to-slab heights. Designer to investigate locating the units in acoustically lined closets/enclosures and utilizing sound attenuators or duct lining for the supply air. NC-35 (40 dBA) is required for projects required to comply with the 2019 NYC Green Schools Guide. For projects not required to comply with the NYC Green Schools Guide, (Refer to DR 1.3.1.10), the maximum acceptable sound power levels are NC-40 (45 dBA), consistent with the prior GSG version based on LEED Version 3.

** NC Level for kitchen is to be attempted but may not be achieved due to kitchen hood.

- B. In general, noise is generated by mechanical equipment that serves the space as well as intruding noise that originates from adjacent spaces due to other mechanical equipment, vehicles, rail and aircraft sources. The above noise criteria values are the standards to be met when continuous background HVAC noise is present. Transient noise generated from traffic and aircraft sources are not included in the above noise criteria.
- C. Duct and terminal velocities shall not exceed the following in feet per minute, based on rectangular ductwork⁽²⁾.

	Max Terminal Velocity At Grille ⁽¹⁾	Velocity10' Upstream ⁽²⁾	Velocity20' Upstream ⁽²⁾	Velocity30' Upstream ⁽²⁾
NC-25 Supply	350	425	550	700
NC-25 Return	425	500	650	800
NC-30 Supply	425	500	700	850
NC-30 Return	500	600	800	950
NC-35 Supply	500	600	800	1000
NC-35 Return	600	700	900	1150
NC-40 Supply	600	720	960	1200
NC-40 Return	720	840	1080	1380

(1) All grilles, registers, and diffusers shall be selected according to the manufacturer's published ratings for 10 points less than the established room background noise criteria.



- (2) Velocities are based on rectangular ductwork located within the space. Velocities for round ductwork can be increased by a factor of approximately 1.7. Ductwork velocities when above lay-in ceilings can be increased by a factor of approximately 1.2. Final velocities are to be as recommended by acoustical consultant.
- D. All noise sources and construction types shall be considered in determining the composite background noise in a space. Noise from fans, ducts, multiple diffusers/registers, VAV boxes, and duct fittings shall be considered. Structure-borne noise resulting from isolator transmissibility shall also be considered.
- E. Where possible, all volume dampers and all VAV boxes shall be provided 5 to 10 duct diameters upstream of the terminal inlets and outlets. The duct length between the supply duct and volume damper or VAV box shall be 4 duct diameters in length where possible. The minimum length of this portion of ductwork shall be 2 feet.
- F. Ceiling diffusers and ceiling return grilles shall not be provided with opposed blade dampers when a lay-in acoustical ceiling or gypsum ceiling equipped with access doors is provided. Each ceiling diffuser and ceiling return grille shall have a dedicated accessible volume damper installed in its branch. Ceiling diffusers and ceiling return grilles shall only be equipped with opposed blade dampers (in lieu of branch volume dampers) when it can be demonstrated that space constraints preclude the installation of branch volume dampers. Wall supply and return registers may be equipped with opposed blade dampers in lieu of branch volume dampers if access cannot be provided for branch volume dampers.
- G. Sound traps (duct silencers) shall be specified for all VAV boxes in order to meet the noise criteria. Sound traps shall have double wall construction with perforations on the inner wall. Tedlar lining shall be loosely applied over the perforations to guarantee that the acoustical lining in between the double walls of the sound trap does not become airborne. An alternate to the Tedlar lining is to have the acoustical insulation sealed in poly plastic bags so that it cannot become airborne. Architect/Engineer of Record's Acoustical Consultant shall determine what the maximum cfm can be for non-fan powered boxes. When VAV boxes are utilized, non-fan powered boxes (conventional) shall be utilized in lieu of fan powered boxes. If fan powered boxes are used in special cases, (e.g., HS Science Labs, HS Prep Rooms, IS Prep Rooms, Music Rooms^{***}, Libraries^{***}) the maximum cfm delivered from any one fan powered VAV box shall not exceed 1200 cfm. If fan powered boxes are used in special cases, multiple fan-powered VAV boxes shall be used for spaces requiring more than 1200 cfm.
- *** Fan powered VAV boxes with electric reheat coils shall be used in lieu of electric baseboard in spaces equipped with bookshelves/furniture that impede the functioning of electric baseboard.
- H. Heat pump central units **or, when approved by the Authority, Dual Temperature (DT) air handling units served by air to water heat pump chiller heaters**, shall be provided with integral acoustically lined plenums (only if recommended by Acoustical Consultant) on the return and supply sides. Plenums shall be double walled and lined with rigid fiberglass boards that shall not erode. Inner walls shall have perforations to absorb the sound energy.
- I. Duct acoustical lining may only be used (in addition to duct silencers) if the usage of duct silencers alone fails to provide acceptable noise levels, if space constraints preclude the sizing of the ducts to provide the low velocity levels as specified above or if the unit does not have enough static pressure capability to supply the air through the duct silencer.

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1. If any fiberglass duct lining is used, it shall be covered with a matte-faced neoprene covering and sealed with an acrylic polymer. Surface burning characteristics shall have a flame spread index less than 25 and smoke developed index less than 50 per ASTM E84. Lining shall be secured with adhesive and pins or mechanical fasteners. Lining that is secured with adhesive only is not acceptable. Fiberglass lining shall conform to the erosion test method described in UL Publication No. 181. The fiberglass lining shall not support fungi or bacterial growth as per ASTM C1338, ASTM G21, and ASTM G22.

- J. Conventional ceiling diffusers shall be employed as the standard diffusers (for projects using VAV boxes in Classrooms). If linear supply diffusers are used in special cases (**when the heating load exceeds 250 BTUH/LF but is less than or equal to 450 BTUH/LF and Vertical Unit Ventilators or split/VRF units are used that are floor mounted or ducted above the ceiling units**), their integral plenums shall be provided with factory applied internal acoustical lining.

- K. VAV boxes may be lined with fiberglass providing the fiberglass is covered with a matte facing and sealed with an acrylic coating.

- L. All equipment subject to vibration shall be mounted on vibration isolators. Architect/Engineer of Record shall determine if the factory provided isolators sufficiently attenuate the vibration considering the flexibility and nature of the floor or structural roof (beam frame spacing, deck construction, etc.). If it is determined that the factory provided isolators are insufficient, equipment shall be provided without factory vibration isolators (or shipping hold down bolts shall remain secured, thus defeating the factory isolators). Architect/Engineer of Record shall define the required field erected vibration isolators (stiffness, static deflection, etc.) and reflect the field erected isolators on the Schedule of Equipment on the Drawings. Architect/Engineer of Record's vibration analysis shall be submitted to their acoustical sub-consultant for review.

- M. Contractor's registered professional engineer shall be responsible for the seismic restraints of all equipment. Contractor's registered professional engineer may elect to provide the equivalent vibration isolators in combined vibration isolator/seismic restraint supports.

- N. If determined as needed by the Acoustical consultant, the design package shall call out for the isolation of ducts using spring and/or neoprene hangers for at least fifty feet from the vibration isolated equipment.

- O. The design package shall call out for airtight fabric necks at the inlet and at the outlet connections of all heat pump **and DT** units, supply fans and exhaust fans and where ductwork connects to vibration isolation equipment.

- P. Mechanical equipment located outside of the building in a yard, court, on a roof, or where the equipment opens to the exterior of the building, shall be subject to the noise output limitations defined in Section MC 313.2.1 of the 2022 NYC Mechanical Code. The designer shall select and design any such exterior mechanical equipment in order to achieve compliance with the applicable requirements of Sections 24-218, 24-227, 24-228 and 24-232 of the Administrative Code, also known as the New York City Noise Control Code, in accordance with generally acceptable engineering practices. Per Section MC 313.2.2, the operation of such exterior mechanical equipment shall comply with any applicable requirements of Sections 24-218, 24-227, 24-228 and 24-232 of the New York City Noise Control Code, as enforced by the Department of Environmental Protection..

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- Q. Per Section MC 313.3, minimum structure-borne noise and vibration isolation requirements, all isolators shall comply with the requirements of Sections MC 313.3.1 through 313.3.10. Where vibration isolation of equipment and appliances is employed, supplemental restraint shall be used to accomplish the support and restraint.

Exception: When specified by the registered design professional, the requirements of Sections MC 313.3.1 through 313.3.10 may be modified provided that the equipment, appliances, and supports shall be designed and installed so that continuous or intermittent vibration transmitted to structural slabs shall not exceed 5,600 micro-inches per second for frequencies between 8 Hz and 80 Hz in the affected Group E occupancy space.

For the purposes of this exception, transmitted vibration shall be in accordance with the following parameters:

1. The peak third-octave band RMS velocity measurements.
2. The method shall be in accordance with ANSI/ASA S2.71-1983.

Designer of Record's Drawings shall refer to Section BC 1705.21.3, Item 8.4, for the Vibration Isolation Installation Special Inspection requirements for exterior mechanical equipment.

- R. Architect/Engineer of Record shall engage the services of an acoustical consultant during the design of the project. The report findings of the acoustical consultant shall be submitted to the Authority. Acoustical consultant shall address the possible need for the following (including but not limited to):

- The need for sound traps or acoustical lining upstream and downstream of the heat pump **or DT** units
- The need to utilize integral elbow type sound attenuators in the supply and return air plenums of the heat pump **and DT** units
- The need to utilize elbow type sound attenuators connected to the return grilles
- Locating the units over non-critical spaces where possible (e.g., corridors, storage spaces)
- Usage of 16-gauge steel ductwork both upstream and downstream of the heat pump and air conditioning units
- Usage of 2-inch thick acoustical lining in lieu of 1-inch thick lining
- The need to run unit ductwork externally on the roof
- The need to enclose the ducts within gypsum construction
- The need to provide acoustic noise barrier walls around the rooftop units in special circumstances
- The need to provide floating slabs
- The need to lower the nominal maximum flow of 1200 cfm per fan-powered VAV box based on the box location
- The possible acceptability of exceeding the nominal maximum flow of 1200 cfm per fan-powered VAV box.
- The need to use gypsum suspended ceilings with adhesively applied acoustical ceiling tiles in lieu of lay-in suspended ceilings
- The need to use double layer gypsum suspended ceilings in lieu of lay-in suspended ceilings

The Architect/Engineer of Record (through Acoustical Sub-Consultant) shall also define the maximum permissible sound power levels for the outdoor units by specifying the radiated, supply discharge, and return inlet noise levels and reflecting those values in the unit specifications for the project. The maximum permissible sound power levels shall be based on specific project

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conditions (nature of unit mounting, deck construction, presence of suspended ceiling, ceiling attenuation class of suspended ceiling, ductwork routing, possible ductwork acoustical lining, sound trap attenuation characteristics, etc.).

- S. Heat pump units shall be provided with the following (if required as determined by the Architect's/Engineer's Acoustical Consultant):
- Condenser fans with variable frequency drives and/or fan staging
 - Internal isolation of all rotating components if acceptable considering the floor or roof flexibility
 - Insulation of void spaces within roof curbs (where curbs are used in lieu of dunnage)
 - Condenser fan casings
 - Acoustically lined double walled outdoor air intake, condenser air intake, and exhaust air hoods
 - Individual acoustical jackets for each compressor



6.2 Heating & Ventilation

6.2.26 HVAC Seismic Design Criteria

Description/Design Approach:

- A.** As per Section BC 1613.1 of the **2022** NYC Building Code, every new school building structure, and portions thereof, including nonstructural components (architectural, MEP, fire protection) that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with **ASCE 7-2016**, excluding Chapter 14 and Appendix 11A. The Seismic Design Category will be determined by the structural Engineer of Record and indicated on the structural drawings.

- B.** Per Section BC 1601.2.3, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 NYC Building Code and interpretations by the Department of Buildings relating to such determinations. Refer to Local Law 17/1995 and TPPN 4/99. Any applicable seismic loads and requirements, including for the bracing of mechanical systems and equipment, shall be permitted to be determined in accordance with Chapter 16 of the **2022** NYC Building Code or reference standard RS 9-6 of the 1968 NYC Building Code.
 - 1.** If an existing building is required to meet seismic requirements as per the criteria described in DR 3.1.3 and a waiver from the Department of Buildings (DOB) cannot be obtained, the HVAC retrofit work must then meet such requirements.

- C.** For new addition projects, any items in the existing building shall also meet the seismic requirements of the addition if they are integrated with systems in the new addition that are required to function after an earthquake. All equipment in the existing building utilizing gas shall be seismically braced. This includes boilers, rooftop units etc. Existing bolting of equipment to its pad and doweling of pad to floor slab shall be analyzed. Coordinate with Plumbing and Drainage Design Requirement 6.1.13. Note that Kitchen equipment and Science Lab gas equipment are not mandated to be braced.

- D.** New School Buildings and Additions constructed after LL17/1995 went into effect are subject to the seismic requirements of the New York City Construction Codes and are considered Risk Category III, "Buildings and other structures that represent a substantial hazard to human life in the event of failure" for seismic design as per BC Table 1604.5.
 - 1.** Seismic Design Category shall be determined by the project structural engineer. The Seismic Design Category for a structure is determined in accordance with Section BC 1613. The Seismic Design Category is to be indicated on the Structural Drawings (Refer to Detail 0100054a) and Component Importance Factors related to HVAC shall be indicated on the Mechanical drawings. (Refer to Standard Detail 1550301a).

 - 2.** Component Importance Factors (I_p) are prescribed in **Chapter 13 of ASCE 7-16**. The default value for typical components in normal service is $I_p=1.0$. The following components have $I_p=1.5$ (Refer to Standard Details 1550301a for a specific listing of common items):

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- a. Life safety components required to function after an earthquake. Per Section BC 909.10.6, this includes emergency generator/standby generator systems connected to a smoke control system, smoke control fans, **ducts, motor control centers, starters, controls**, etc. Functioning after an earthquake means just long enough to evacuate the building as opposed to functioning as a disaster relief center. **Per Section 13.2.2 of ASCE 7-16**, active mechanical and electrical equipment that must remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5, analysis or experience data in accordance with Section 13.2.6, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval to the Authority after review and acceptance by the Contractor's registered design professional.
- b. Components with hazardous content. This includes materials that are highly toxic or potentially explosive and in sufficient quantity to pose a significant life safety threat to the general public if uncontrolled release were to occur. Schools typically do not contain these materials, but for seismic purposes (calculation of the seismic design force, restraint and anchorage design) fuel oil, steam piping and connected appliances such as boilers and rooftop units are to be designed as such. Note that equipment such as boilers and rooftop units need not function after an earthquake. Laboratory exhaust systems need not function after an earthquake since the Labs are rated as Occupancy E (Occupancy B if exceed 10% of the story area) and not Occupancy H spaces (unless the maximum allowed storage quantities as defined in Section **BC 427.7** are exceeded). Acid Storage Room exhaust fans need not function after an earthquake since the Acid Storage Rooms are rated as Occupancy S-1 if all of the conditions of Section **BC 427.9** are met. Per Section **BC 427.8**, Acid Storage Rooms not in compliance with the provisions of Section **BC 427.9** for the laboratory chemical quantity limitations shall be classified as Group H (hazardous) occupancy and would then be assigned an Importance Factor of $I_p=1.5$.
- c. Components containing hazardous or flammable materials in excess of the maximum allowable quantities for open systems listed in Section BC 307.
- d. Components with $I_p=1.0$ located above or in proximity to components with $I_p=1.5$ which could damage the $I_p=1.5$ equipment shall be braced.
3. For Seismic Design Category B, all mechanical components are exempt from seismic requirements.
4. For Seismic Design Category C, all mechanical components with $I_p=1.0$ are exempt from seismic requirements.
5. For Seismic Design Category C, all mechanical components with $I_p=1.5$ shall be designed and constructed to seismic requirements.
6. As per paragraph **13.6.6** of ASCE 7-16, all ductwork in Seismic Design Category C with $I_p=1.5$ shall be seismically braced.

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Per Section 13.4.6, C-type beam and large flange clamps are permitted for hangers provided they are equipped with restraining straps equivalent to those specified in NFPA 13, Section 9.3.7.

7. Appropriate seismic coefficients to be utilized in the design of seismic resistance for the mechanical system shall be those listed in Table 13.6-1 of ASCE 7-16.
 8. When seismic design is required, generic seismic bracing details shall be shown on the Contract Drawing bid set. A note shall be added stating, "Details are shown to illustrate the scope of work. Contractor's registered professional engineer shall provide calculations and be responsible for providing signed/sealed coordinated shop drawings indicating locations of seismic braces and the required connection details to file with the DOB/BCC".
 9. All bracing devices shall be qualified either through analysis **or** be tested and certified in accordance with ICC-ES AC 156. Local NYC accelerations are to be used when computing seismic inertia forces. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to seismic bracing designs must be stamped by the Contractor's Registered Professional Engineer with at least five years of seismic design experience in non-structural building components in New York State.
 10. All attachments of hangers and bracing shall be positive attachments that shall be cast in place anchors, drill in wedge anchors, or a welded or bolted connection to structure. Drill in wedge anchors shall be epoxy adhesive based and shall have an evaluation report number from ICC-ES verifying their allowable loads. Anchors must be certified for use in cracked concrete.
- E. The following note is to be included on the HVAC drawings in relation to HVAC items:
- "For all items that are required to have seismic supports or restraints, seismic plans and seismic restraint calculations shall be prepared, sealed, and submitted by a Professional Engineer licensed in the State of New York engaged by the Contractor. The Engineer shall provide installation supervision of all seismic supports and restraints. The Contractor's Registered Professional Engineer shall submit signed and sealed affidavit stating that the installation is in full compliance with the signed/sealed shop drawings."



6.2 Heating & Ventilation

6.2.28 HVAC Design Requirements for Special Spaces

Description/Design Approach:

A. Main Telecom Room and Intermediate Telecommunications Closets

1. Provide a dedicated ductless VRF heat pump system that shall maintain a 75°F space temperature, and a maximum of 55% relative humidity, 24 hours a day, 7 days a week in accordance with ANSI/TIA/EIA – 569 - A.
 - a. When a full BMS/DDC system is provided per Section 15970 or when a local BACnet/DDC system is provided per Section 15971, space temperature sensors and space relative humidity sensors (which only monitor) shall be located in the Main Telecom Room, and in all Intermediate Telecom Closets. Space temperature sensors and space relative humidity sensors shall be integrated into the BMS/DDC system and BACnet DDC with Local BACnet Network. In those cases where the allowable elevation difference between the air-cooled condenser unit and most remote DX fan coil unit exceeds the manufacturer's limitations, a rooftop packaged unit or indoor water-cooled packaged air conditioning units (with dry cooler, one packaged unit per space) may be considered as acceptable alternate designs. Refer to Specification Sections 15781 and 15783.
 - b. The Engineer of Record (EOR) shall submit cost analysis during the schematic phase of the design to justify their choice of the HVAC system when a dedicated ductless VRF system is not the basis of the design.
2. Per NYC DOE DIIT School Standards dated 10/11/23, large schools with more than 1500 students shall have the air conditioning equipment capacity for the Main Telecom Room sized to handle a load of 34,000 BTUH. For medium-sized schools with 40 to 1500 students, the air conditioning equipment capacity for the Main Telecom Room shall be sized to handle a load of 24,000 BTUH. These capacities shall account for the following loads:
 - a. Equipment located in the Project Connect Rack
 - b. Content Delivery Network
 - c. Internet Protocol Digital Video Surveillance (IPDVS)
 - d. BACnet Building Management System
 - e. IP TV (IP Broadcast Server, Program Manager, and switches)
 - f. IP Telephony
 - g. Clock system
3. EOR shall also include the loads associated with the Sound System Cabinet (designed by the EOR).
4. Consider any transmission loads, infiltration loads, loads from the lighting system and solar loads when sizing the capacity of the air conditioning equipment for the Main Telecom Room.

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5. The air conditioning equipment capacity for the Intermediate Telecom Closets shall be able to handle a load of 7,000 BTUH per closet per NYC DOE DIIT School Standards dated 10/11/23. The equipment shall account for the following loads:
 - a. Core Network (Wireless Switch and Layer Switch)
 - b. IPDVS Equipment
 - c. BACnet Building Management System
 6. Include the loads associated with the Fire Alarm Multi-Function Cabinet (designed by AEOR), transmission loads, infiltration loads, loads from the lighting system, and solar loads when sizing the capacity of the air conditioning equipment for the Intermediate Telecommunications Closets.
- B. Automatic Transfer Switch (ATS) Room, UPS Room and Elevator Machine Rooms (EMR)**
1. Per Section BC 3005.4 of the 2022 NYC Building Code and Section 15783, provide a dedicated independent ductless split heat pump system for each space that shall maintain the space temperatures (24 hours a day, 7 days a week) in accordance with the equipment manufacturer's recommendations. Elevator controllers typically require an air-conditioned environment. Refer to DR 6.4.1 for temperature and humidity requirements for the elevator machine room (ambient temperature between 50°F and 90°F and relative humidity of no greater than 95%). If a full BMS/DDC network system is provided per Section 15970 or if a local BACnet/DDC system is provided per Section 15971, provide space temperature sensor and space relative humidity sensor for the Elevator Machine Room EMR, ATS Room, and UPS Room and integrate the sensors into the network.
 2. Hydraulic Elevator Machine Rooms and machinery spaces shall be designed to be vented to the outside air mechanically as the Authority's preference in order to minimize odors associated with hydraulic oil. Refer to Section 3.7 of Appendix K of the 2022 NYC Building Code. Makeup air shall be provided and ventilation loads shall be considered when sizing the dedicated split system for the Hydraulic Elevator Machine Room. Mechanical ventilation system shall provide a minimum of six air changes per hour.
- C. Electrical Distribution Room (EDR) that Encloses the Main Switchboard per Section 16425 and Rooms/Closets Enclosing Panelboards per Section 16470**
- Provide a system that maintains the space temperatures (24 hours a day, 7 days a week) in accordance with the equipment manufacturer's recommendations. Designer shall evaluate if a split system is required or if thermostatically controlled exhaust fans will provide the conditions in accordance with the equipment manufacturer's recommendations. If a full BMS/DDC network system is provided per Section 15970 or if a local BACnet/DDC system is provided per Section 15971, provide space temperature sensor and space relative humidity sensor for the EDR and for rooms/closets enclosing panelboards and integrate the sensors into the network.
- D. Kitchen Food Storage Rooms**
- Per DR 1.3.6.2, the acceptable temperature range for Kitchen Food Storage rooms is 50°F - 70°F. Provide a dedicated split system for the Kitchen Food Storage rooms.

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E. Other Spaces

1. Provide electric unit heater in the Water Meter Room and Crawl Spaces to maintain a minimum 50°F space temperature.
2. Sloping top convectors shall be used in Janitor's Closets that are located at the perimeter of the building or mounted on the top floor or building slab. Provide electric convectors. Provide exhaust airflow of 5 minutes per change in Janitors' Closets.
3. Entrance Vestibules and Main Entrances shall be provided with floor mounted (4" above finished floor) recessed cabinet heaters. Flush ceiling hung cabinet heaters may be used in Entrance Vestibules and Main Entrances if floor space is limited. Cabinet heaters shall be provided with electric heat or hot water fortified with 30% propylene glycol from the primary loop of an air to water heat pump chiller/heater system (when approved by the Authority). Entrance Vestibules and Main Entrances shall also be equipped with electric door air curtains to provide a pressurized curtain to keep out warm humid outdoor air during the cooling season and cold outdoor air during the heating season as doors are typically left open during arrival and departure times. An alternate is to provide 30% propylene glycol hot water door air curtains when air to water heat pump chiller/heaters are used. Door air curtains shall be equipped with heating capacity used during the heating season to temper any outdoor air that infiltrates through the pressurized curtain. The open door heating setpoint to be used with door air curtains that are not to be on the full BMS/DDC network or BACnet DDC with local BACnet network shall be 45°F in accordance with Section 6.4.3.9 of ASHRAE 90.1-2016. Networks are not required for historic buildings and buildings undergoing repairs, where changes would cause extensive revisions to other systems, and where space is limited. Refer to Section 4.2.1.3 of ASHRAE 90.1-2016 as modified by Appendix CA of the 2020 NYCECC and Exceptions to Section 6.1.1.3 of ASHRAE 90.1-2016.
4. HS and IS Science Labs and Prep Rooms; Science Demonstration and Science Lecture Rooms
 - a. HVAC for Science Rooms with fixed fume hoods (HS Science Labs/HS Prep Rooms and IS Prep Rooms)

1) Existing Building Major Modernization and New School projects

Science Rooms shall have terminal units that are fan powered VAV boxes with electric reheat coils. The minimum supply flow allowed to be provided to the HS Science Labs/HS Prep Rooms and IS Prep Rooms shall be nominally 100 cfm less than the fixed fume hood exhaust cfm requirements in order to guarantee negative pressurization. The electric reheat coil of the fan powered VAV supply box shall reheat the supply air in order to avoid overcooling in those cases where the loads are minimal and the VAV supply box is not permitted to supply less than the hood exhaust requirements (minus 100 cfm for infiltration). In the cooling mode, electric reheat shall only be allowed after the fan powered VAV box has throttled down to its minimum allowable primary air capacity. In the heating mode, the electric reheat in the fan-powered box shall provide all terminal heating capacity.

- 2) The same multi-zone VAV heat pump or Dual Temperature (DT) central units that serve the classrooms may also serve the Science Labs/Prep rooms that have fixed

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fume hoods provided that air delivered to the HS Science Labs/HS Prep Rooms and IS Prep Rooms is not recirculated.

- b. Fume Hoods: HS Science Labs, HS Prep Rooms and IS Prep Rooms shall be equipped with fixed fume hoods only. IS Labs shall be equipped with ductless portable fume hoods only. IS Prep Rooms shall be equipped with a combination unit (fixed fume hood on top, acid storage cabinet on the bottom). IS Acid Storage cabinet section shall be ventilated 24 hours a day, 7 days a week. All Science Demonstration and Science Lecture Rooms shall be equipped with only ductless portable fume hoods. Fixed fume hoods shall have ducted exhausts and shall use either rooftop exhaust or sidewall exhaust. Rooftop exhaust shall be terminated a minimum of 10 feet above the roof. All sidewall exhausts shall be located 10 feet from entrances/exits, windows, intake ducts, and high traffic areas.

5. HS Acid Storage Rooms

HS Acid Storage Rooms shall be exhausted 24 hours a day, 7 days a week. Makeup air for the HS Acid Storage Room exhaust fan shall be provided. Provide a minimum of six air changes per hour in accordance with Section BC 427.9, Paragraph 4.

- 6. District 75 Special Education spaces shall be designed to be maintained at 75°F (compliant with the Section C302.1 of the 2020 NYCECC) during the cooling season during occupied periods (in lieu of the standard 78°F provided in other spaces).
- 7. Rooms used for high volume duplicating/copying shall be negatively pressurized and shall be provided with dedicated exhaust fans sized at minimum 0.50 cfm per square foot. This requirement is not applicable for small convenience copiers and printers.
- 8. Usage of domestic cooking appliances in other than Group R occupancies (example home economics room and other spaces)

Per Section MC 505.4 of the 2022 NYC Mechanical Code, all domestic cooking appliances in occupancies other than R occupancies, shall be provided with hoods and exhaust systems as required for the type of appliances and processes in accordance with Sections MC 506 and 507. Domestic appliances may be provided with domestic kitchen exhaust systems ducted to outdoors provided that the installation complies with all of the following:

- a. Each appliance shall have electric or gas connections and nameplate ratings not to exceed 10kW for electric appliances or 75,000 Btu/h for gas appliances. Branch gas connections shall not be larger than 3/4" pipe.
- b. The appliances shall not include open top broilers or fryers; and
- c. The appliances may be used for periodic, non-commercial, non-revenue generating purposes.

9. Athletic Fieldhouse and Grandstand Spaces

Administrative spaces serving special functions supporting school physical education and team sport programs can include one or more of the following 'Special Spaces':

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- a. The Medical Office, located in the fieldhouse, shall follow the same requirements as the medical office of the school, though will have less spaces than the 'suite'.
- b. The Ticket Booth area is open to the outdoors when in use and relies on natural ventilation. Cooling is not required, and minimal heating shall be provided by thermostatically controlled, fully recessed wall mounted electric fan coil heaters, or ceiling-mounted units when a finished ceiling is provided. Air recirculation within the interior shall be provided by ceiling/wall fans arranged to cool occupants.
- c. The Concession Stand does not require appliance hood exhaust since there is no food cooking. The Concession Stand area is open to the outdoors when in use and relies on natural ventilation. The removal of excess appliance heat, vapor and odors from the interior of this space shall be provided by a general exhaust fan. The arrangement of Concession Stand exhaust fan discharge shall minimize the transport of food odor, vapor and heat to the interior of the rest of the fieldhouse/school buildings and outdoor public areas. The air balance between the interior of the Concession Stand and adjacent accessible building spaces and/or outdoors shall achieve a neutral or slightly negative pressure relationship (airflow into Concession Stand interior). Cooling is not required. Minimal heating shall be provided by thermostatically controlled, fully recessed electric wall mounted fan coil units, or ceiling-mounted units when a finished ceiling is provided. Air recirculation within the interior shall be provided by ceiling/wall fans arranged to cool occupants.
- d. The Press Box is provided with operable openings for natural ventilation and does not require any permanent means of heating or cooling.



6.2 Heating, Ventilation & Air Conditioning

6.2.30 A2L Area Refrigeration Leak Detection and Ventilation System

Description/Design Approach:

- A. Applicability:** Provide an A2L area refrigeration leak detection system per Section 15597 when leakage of the A2L refrigerant would exceed the EDVC values of ASHRAE 15-2022 and would exceed 25% Lower Flammability Level (LFL) as follows:
1. For occupied spaces with A2L utilizing refrigeration systems whereby the air handling unit's A2L integral refrigerant leak detector would not sense a space refrigerant leak since the returns are not 12" AFF. (Air handling unit's A2L integral refrigerant leak detector would only sense leak of DX coil itself).
 2. For unoccupied indoor mechanical equipment room (MER) with A2L DX central air handling unit split heat pumps to address MER accumulated leaked refrigerant (in addition to central unit leak detector that monitors the spaces served by the central unit).
 3. For unoccupied indoor MER with A2L heat pump domestic water heaters.
 4. For unoccupied indoor MER with A2L refrigeration systems (chillers, air to water heat pump chiller/heaters).
 5. For spaces with refrigerant piping utilizing A2L type refrigerants that are not enclosed in gas-tight fire resistive enclosures in the event of a leak.
- B. Operation of A2L Area Refrigerant Leak Detection and Alarm System:** Upon detection of a refrigerant leak, each individual area leak detector shall signal the MER located multi-channel refrigerant controller alarm panel. The alarm control panel shall then institute the following:
1. Shutdown the compressors located in the machinery room through relay output dry contact as required by Section 8.11.6.2 of ASHRAE 15-2022 (Note the air handling unit compressors would be shut down by the air handling unit controller).
 2. Activate the audio/visual alarms of the multi-channel refrigerant controller in the mechanical rooms and in the Custodian's Office.
 3. Close the dry contacts of the multi-channel refrigerant controller. Per Section BC 918 of the 2022 NYC Building Code, central station monitoring is required upon closure of the dry contacts of the multi-channel refrigerant controller. The Division 16 Contractor shall wire the dry contacts to the Fire Alarm system per Section 16720, or Refrigerant Detection and Alarm System with Central Office Connection per Section 16731 as applicable. Mechanical designer to ensure the electrical designer indicates on the Div. 16 Drawings the wiring between the refrigerant leak detection and alarm system dry contacts to the fire alarm system.

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4. Increase the ventilation rate from Level 1 normal ventilation rate to Level 2 emergency ventilation rate to disperse leaked refrigerants in Mechanical Equipment Rooms (MERs).
5. A digital signal alarm output from the refrigerant leak detection multi-channel controller shall also be sent to the School Operating Console (SOC) if a Section 15970 BMS/DDC or Section 15971 Local BACnet system is provided. For BMS/DDC applications, a wide area network (WAN) broadband signal shall be sent to the Central Host Control Station if the alarm signal is unanswered at the School Operating Console.
6. Refrigeration Machinery Rooms shall comply with Sections 8.9, 8.10 and 8.11 of ASHRAE 15-2022 and shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. **Per Section 8.11.6.2, the alarm shall be actuated at a measured concentration level exceeding 25% of the Lower Flammability Limit (LFL) as defined in ASHRAE 34-2022.** The mechanical ventilation system shall exhaust air from the refrigeration machinery room at a volumetric rate as defined in **Section 8.11.11 of ASHRAE 15-2022** upon activation of the required refrigerant detector. Exhaust registers or outlets capable of exhausting the amount required shall be located near the floor unless a lighter than air refrigerant is used. When a lighter than air refrigerant is used, the exhaust registers or outlets shall be located near the ceiling.
 - a. The discharge of air shall be to the outdoors and shall be discharged not less than 20 feet from an outdoor intake or opening into buildings and 10 feet from an exterior fire escape or stair (Per Section MC 1105.6.1 **of the 2022 NYC Mechanical Code**).
 - b. Relief device from refrigeration machines shall terminate outside of the structure at a location not less than 15 feet above adjoining grade level and not less than 20 feet from any window, ventilation opening or exit. (Per Section MC 1105.7)
 - c. Provide separate break-glass switches for off-only control of compressors and on-only control of machinery room ventilation fans outside each entrance to the machinery room (Per Section MC 1105.10 **and Sections 8.10.g and 8.11.7 of ASHRAE 15-2022**).
 - d. Refer to related Design Requirement DR 6.2.36, Construction Document Requirements for Refrigeration Systems, for design document requirements.



6.2 Heating & Ventilation

6.2.31 Capital Improvement Program (CIP) Climate Control/Ventilation Upgrades to Steam Heating and Ventilation (H&V) Units *

* Repairs/Replacements/Retrofit work shall not proceed on the steam heating system if it has been determined that there is less than 15 years of anticipated future service life for the boilers and those projects shall be designed with heat pump units as defined in Design Requirements 6.2.0, 6.2.3, 6.2.4 and 6.2.39.

Description/Design Approach:

- A. New York City Local Law 32/16 requires that each capital project involving the installation or replacement of HVAC comfort controls systems (thermostats, control valves) and involving the repair/replacement of the central ventilation units at an estimated construction cost for such installation or replacement of two million (\$2,000,000) dollars or more shall be designed and constructed to reduce energy cost by a minimum of five percent (5%). The baseline datum is the annual energy consumption before the replacement of the comfort controls and before repair/replacement of the central ventilation units. The case considered here are schools that have a steam perimeter heating system controlled by pneumatic controls without Classroom central ventilation units and which rely on open windows and exhaust fans to provide ventilation. Those schools do however have central H&V Public Assembly (PA) space air handling units. In order to comply with the NYC Local Law 32/16, the dedicated PA space heating and ventilation units shall be replaced or retrofitted and may have to operate with additional energy conservation measures. If it is not cost effective to salvage the existing PA space H&V air handling units; they shall be replaced in lieu of being retrofitted. Single Zone Variable Air Volume (SZVAV) units are not applicable for these cases **(unless replaced with new heat pump units) since existing units** are only H&V units without provisions for air conditioning.
- B. Provide Demand Controlled Ventilation (DCV) per Section 6.4.3.8 of ASHRAE 90.1-2016 and Section C403.7.1 of the 2020 NYCECC based on occupant density or provide an Energy Recovery Wheel (ERW) to minimize heating requirements per Section 6.5.6.1 of ASHRAE 90.1-2016 and Section C403.7.4 of the 2020 NYCECC based on total airflow and the percentage of total airflow that is outside air flow. DCV is not required for systems with ERW.
- C. Constant volume units may be used for Historic Building PA spaces where ASHRAE 90.1-2016 need not apply per Section 4.2.1.3 of ASHRAE 90.1-2016 as modified by Appendix CA of the 2020 NYCECC. Additionally, compliance with ASHRAE shall not be required per the Exceptions to Section 6.1.1.3 of ASHRAE 90.1-2016 for repairs, where replacement or alteration of equipment requires extensive revisions to other systems, relocation of existing equipment or cases where there exists insufficient space. Hence, for these cases constant volume systems may be used. Designer is to present their case to A&E if they determine that Demand Controlled Ventilation (DCV) and Energy Recovery Wheels (ERW) otherwise required will not be included in the design package based on the code sections above.
- D. Even though DCV and ERW might not be required either by not meeting the requirement thresholds or in consideration of the above Exceptions, they may be elected to be employed as energy conservation measures to meet the 5% required annual energy cost savings required by LL32/16.

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- E. Designer is to submit annual energy cost savings calculations to the Authority to demonstrate that the cumulative energy savings of the steam perimeter digital comfort control upgrades, repair/replacement/upgrade of PA space units achieves the requisite 5% annual energy cost savings.
- F. If the PA space air handling units are retrofitted, the existing controls (typically pneumatic) will be replaced¹ with stand-alone “DDC-Only” direct digital (DDC) controllers with integral operator display device. The specifications shall require the Temperature Controls Contractor (TCC) to furnish and field-install the controls. The operator will be able to locally change setpoints, set schedules of operation (occupied on/occupied off), and make other such adjustments. Possible PA space H&V air handling unit upgrades include the following:
1. New Direct Digital Controller (DDC) with I/O for the control described herein
 2. Integral operator display device (Human Machine Interface)
 3. New room temperature sensor with setpoint and occupancy override
 4. Room and outside air CO₂ sensors if DCV is to be employed
 5. Tamper proof thermostat guard for room temperature and CO₂ sensor
 6. Heating coil averaging discharge air temperature sensor completely covering the area of the active coil
 7. For recirculation units, possibly replace the outside air, recirculation and spill/exhaust pneumatic damper actuators with modulating spring return electric actuators if DCV is to be employed. For 100% outside air units possibly replace existing electric or existing electric/pneumatic actuators with new spring return two-position normally closed electric actuators to guarantee full closure when system is not being used in the unoccupied and morning modes.
 8. Investigate replacing the steam heating coil valve actuator(s) with modulating, spring return, normally-open electric actuator(s). Typically there are two or more steam control valves on each unit.
- G. Controls
1. It is preferable to provide native BACnet controls for retrofitted units and replaced units. If provided controls are not native BACnet, a gateway/communication card to BACnet must be available for integration into a possible future local BMS/DDC BACnet network. Gateway/communication card will not be provided at the time of project construction. A network free DDC Only system should be provided as it is not required to provide the BACnet DDC with local BACnet network due to the limited scope of work.
 2. Refer to Specification Section 15985, Sequence of Operations, for details of the control sequence. Also refer to Standard Details 1598508c and 1598508d and Planning Design Requirement 1.3.1.10.

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H. Recirculating Heating and Ventilating Units for PA Spaces

Carbon dioxide (CO₂) sensors for demand controlled ventilation¹ shall be provided as described above for H&V units that recirculate air. CO₂ sensors shall control the normally closed modulating outside air dampers, normally closed modulating spill exhaust dampers and normally open modulating recirculating dampers. Replace existing manual start/stop switch of each motor starter with new variable frequency drive with manual bypass and circuit breaker for each fan. VFDs will be used for air balancing.

I. 100% Outside Air Heating and Ventilating Units for PA Spaces

1. In addition to possible CO₂ controls for demand controlled ventilation¹, investigate providing variable frequency drives (VFDs) ¹ for H&V units that are 100% outside air. Provide variable frequency drives (VFDs) for supply and remote exhaust fans. Synchronize operation of the H&V unit with the supply and remote exhaust fan and operation of the dampers.
2. For the coupled case where there is no perimeter heating system in the PA space, the CO₂ sensors shall control the supply fan VFD and remote exhaust fan VFD and the space temperature sensor shall control the steam throttling valve. The system will be a variable volume, variable temperature system. The CO₂ signals will be overridden if the minimum flow can not maintain the thermal setpoint.
3. For the decoupled case where the PA space has a perimeter heating system, discharge duct temperature sensors shall control the steam heating valve to provide a “neutral” space discharge air temperature (nominally 60 to 65°F). CO₂ sensors shall control the supply fan and remote exhaust fan VFDs.
4. If replacing an existing 100% outside air H&V unit, investigate if a recirculating unit can be provided while maintaining the budget limitations of the project. If not, replace with new 100% outside air H&V unit with CO₂ and VFDs as defined above.

Notes:

1. According to Title 43 Chapter 10, Capital Projects for the **replacement/retrofit of No. 2 or No. 4 burners to biodiesel B100 Ready burners** at an estimated construction cost of 2 million dollars or more are not required to also comply with the energy reduction requirements for the installation of HVAC comfort controls.



6.2 Heating & Ventilation

6.2.32 Condensing Boiler Burner Safety and Operating Considerations

Description/Design Approach:

A. Applicability: This Design Requirement is only for existing heating systems utilizing condensing hot water boilers that require gas burner retrofit/replacement. Design Requirement is also applicable when the condensing hot water boilers are to be replaced in kind. Such work requires Authority approval as the HVAC standard is to employ air source heat pumps.

B. Requirements

1. Each boiler shall be arranged for single fuel operation with firm gas. All boilers shall utilize linkage-less burners.
2. Gas Meter Room, if provided, shall have explosion-proof exhaust fan, light fixtures, switches, relays and accessories.
3. Provide gas safety shut-off valve on the firm gas main and locate gas safety shut-off valve in the gas meter room (if provided).
4. A gas leak detection and alarm system shall be provided as detailed in Design Requirement 6.2.17.
5. The condensing boiler shall have a thermal efficiency of 88% at full rated input with 130°F return water temperature.
6. Each condensing boiler shall be provided with an integral gas valve train. Gas valve train shall be ASME CSD-1-2011 compliant.
7. A balanced-flow hot water distribution piping design must be used. Reverse return piping shall be used as much as possible in multiple condensing boiler systems.
8. Fin-tube radiation perimeter hot water heating system shall be designed for approximately 140°F boiler supply water temperature and approximately 120°F return water temperature to allow the boilers to function in the condensing mode. Fin-tube radiation shall have two rows or extended length to account for the loss of equivalent direct radiation (EDR) experienced with 140°F hot water supply temperature. Tube diameter shall be sized to maintain adequate minimum velocity to promote turbulent heat transfer. If any terminal units with coils are utilized, (ex. unit heaters, cabinet heaters, unit ventilators, etc.) they shall be designed with multiple row coils to account for the loss of EDR. The hot water heating system for terminal units shall be provided with secondary hot water supply temperature that is reset as the primary loop hot water temperature is reset based on outside air temperature. Designer is to insert a reheat schedule into Section 15985, Sequence of Operation, to define how both the primary and secondary hot water temperatures are reset based on changes to the outside air temperature. Lead/lag system shall also be designed to take advantage of the higher efficiencies attainable with greater turn down ratios.

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9. Each boiler shall have separate, indirect condensate drains piped from each condensate drain pan, stack, and stack y-connection to a neutralization tank and then to a floor drain. (Refer to Design Requirement 6.1.2 – Acid Waste System).
10. Provide prefabricated double-wall metal vents suitable for use with natural gas fired hot water condensing boilers. Refer to Specification Section 15575 for wall thicknesses.
11. **Per Section MC 1004.3.1 of the 2022 NYC Mechanical Code, clearances from the tops of boilers to the ceiling or other overhead obstruction shall be in accordance with Table MC 1004.3.1.** Access Platforms over boilers are required where the distance from the floor to the top of the boiler or boiler setting exceeds eight (8) feet per the New York State Industrial Code Rules. Show platform/ladder details on the Drawings. Where the required clearances cannot be provided due to physical limitations, file a reconsideration request (form **CCD-1**) during the filing process demonstrating the physical limitations. Edit specification references to ladders/platforms if not required.



6.2 Heating & Ventilation

6.2.33 General Freeze Protection

Description/Design Approach:

- A. Avoidance of Freezing Hydronic Lines on Capital Improvement Program (CIP) Projects with Retrofit Work in Existing Buildings **and Capacity Projects Utilizing Air to Water Heat Pump Chiller Heaters (if Approved by the Authority).**
1. Hydronic hot water and chilled water lines that are not located on the exterior of the building and that do not serve units that take in outside air shall be pure water without glycol in order to minimize the energy efficiency losses experienced with the usage of glycol/water mixtures. Hydronic hot water and chilled water lines that are located on the exterior of the building or that serve units that take in outside air shall be a mixture of 30% propylene glycol and water.
 2. Any existing building project whereby the interior air handlers or interior unit ventilators take in outside air or any project where the piping runs external to the building envelope, shall be equipped with 30% propylene glycol/water mixture.
 3. In facilities with crawl spaces and basements, provide heaters in the crawl spaces and basements to minimize the potential freezing of the water lines. If the boilers are turned off at night, such as in older existing schools with older burners not equipped with a remote annunciation system for after-hours safe-shutdown notification, the heaters must be electrical. For schools equipped with a remote annunciation system for after-hours safe-shutdown notification where the boilers are not planned to be shut down in the evening, the heaters may be steam or hydronic.



6.2 Heating & Ventilation

6.2.34 Verification of HVAC System Design

Description/Design Approach:

- A. The Architect/Engineer of Record shall submit separate detailed calculations for review with the design submission at 50% (if project has such submission; otherwise at 100%) for CIP and 60% for Capacity projects. Additional Capacity project submissions required at the 100% design stage are noted below. All calculations noted below are to be submitted to the Design and Construction Innovation Management (DCIM) Department. Submit a separate set of detailed calculations to Building Code Compliance (BCC) group for review when the project is filed. BCC required submissions (which are also to be submitted to DCIM) are highlighted below by the *Italics* font and underlined. Detailed calculations to be submitted include:
1. Heating load calculations indicating transmission, infiltration and ventilation loads and, for retrofit work on existing buildings, assumed piping and pickup safety factors. Calculations shall indicate outside and inside design dry bulb temperature conditions (°F).
 2. Cooling block load calculations indicating outdoor design dry bulb and wet bulb temperatures (°F) and inside design dry bulb temperature (°F), and inside design relative humidity (%).
 3. Fan static pressure requirement calculations at 100% design stage for the design duct routes based on using loss coefficients for all fittings (in accordance with ASHRAE and SMACNA standards). Engineer of Record to provide marked-up design drawings indicating the specific routes which have the highest pressure drops that were used to compute the static pressure losses. The reduction of the central unit fan static pressure capacities due to the effects of wet cooling coils, turbulence at potential congested duct drops below the unit and dirty filters shall be included in the calculations.
 4. Diversity utilized for variable volume applications with justification for having a diversity other than nominally 85% based on block load calculations.
 5. Verification that the airflow velocity through the cooling coils does not exceed 450 fpm at maximum design flow (to minimize condensate carryover)
 6. The HVAC Standard system for non-assembly spaces (Classrooms, Offices, etc.) is a Variable Air Volume (VAV) system where each non-assembly space is provided with a VAV box and electric baseboard **when central DX units are used or hot water baseboard when central Dual Temperature (DT) units are used. The DT units would be served by air to water heat pump chiller heaters (with Authority approval).** Submit calculations showing that each VAV box can provide all required cooling capacity and that each baseboard can provide all required heating capacity.
 7. For special case projects with limited slab-to-slab heights utilizing Dedicated Outside Air System (DOAS) heat pump units **or DOAS DT units** serving VRF **terminal units or fan coil terminal units with ECC fan motors respectively**, the Architect/Engineer of Record shall provide calculations showing space latent loads and shall show that the DOAS air handling units together with the **terminal units** will provide all of the required latent capacity to meet the space latent loads based on the DOAS primary air flow (cfm) and DOAS primary air

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absolute humidity supplied. The other option for special case projects with limited slab-to-slab heights is to utilize Vertical Unit Ventilators (VUV). For that case also submit calculations indicating the cfm selected and required tonnage will meet the space latent loads.

8. For special case projects with limited slab-to-slab heights utilizing **DOAS** heat pump and VRF units **or DOAS DT and fan coil units with ECC fan motors, or** Vertical Unit Ventilators (VUV), the Architect/Engineer of Record shall provide calculations showing space sensible loads and shall show that the Classroom terminal units will provide all of the required sensible capacity to meet the space sensible loads.
9. For DOAS **heat pump/VRF, DOAS DT/fan coil unit** and VUV designs, submit calculations verifying that **the DOAS together with the terminal units** and VUV units will provide the required heating capacity.
10. Draft calculations for No 2 or No 4 retrofit or replacement biodiesel B100 Ready burners justifying any possible need for induced draft fans**.
11. Calculations for the sizing of the air intake louvers for the No 2 or No 4 retrofit or replacement biodiesel B100 Ready burners**
12. HVAC Schedules on the filed drawing set shall include summary schedules indicating:
 - a. Calculated heating total transmission load, total infiltration load, total ventilation load, and for No 2 or No 4 retrofit or replacement biodiesel B100 Ready burners pickup and piping safety factors**.
 - b. Air intake sizing for No 2 or No 4 retrofit or replacement biodiesel B100 Ready burners indicating each units' fuel input, required louver minimum free area and each units' provided louver size considering the net louver free area.**
 - c. Stack effect for No 2 or No 4 retrofit or replacement biodiesel B100 Ready burners indicating average chimney temperature, maximum chimney exhaust mass flow rate and volumetric flow rate, chimney cross sectional dimensions and usable height, flue gas velocity, actual pressure loss (in. wc), theoretical draft (in. wc) and excess theoretical draft (in. wc) equaling theoretical draft minus actual pressure loss.**
13. CIP project design is to be based on the actual envelope U-value as best as can be determined. The U-value may be better than at the time of original construction, as the original windows have probably been replaced with better windows such as dual glazed insulated windows. The designer is not to just use existing burner nameplate to size replacement burners.**
14. Ventilation calculations are to be submitted showing:
 - a. Occupant density utilized in the calculations (minimum of the 2022 NYC Building Code Chapter 10 Egress Occupancy vs UFT Contract Maximum as defined in DR 6.2.9)
 - b. Required Outdoor air flow cfm/person and cfm/ft²
 - c. Required Exhaust air flow cfm/ft²
 - d. Required Volume of Air to the Breathing Zone V_{bz}
 - e. Zone Air Distribution Effectiveness E_z
 - f. Required Zone Outdoor Airflow V_{oz}
 - g. Maximum Primary Outdoor Air Fraction Z_p
 - h. System Ventilation Efficiency E_v

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- i. Assumed Occupant Diversity D
 - j. Required Uncorrected Outdoor Air Intake Rate V_{ou} and Required Total Outdoor Air Intake Flow Rate V_{ot}
 - k. Actual Design Outdoor and Exhaust Flow Rates
15. Provide documentation that the ventilation rates shown in the ventilation calculations are used in the project specific energy modeling and shown on the Mechanical Drawing Schedules.
16. Provide calculations that show the **EDVC** refrigerant **charge limit per independent circuit per ASHRAE 15-2022** for any refrigerating system that contains more than 6.6 pounds of refrigerant. Designer to submit the refrigerant calculations and show on the plans. Refer to DR 6.2.36.
17. Air balance per Section MC 508.1.2 of the 2022 NYC Mechanical Code: Design plans for a commercial kitchen ventilation system shall include a schedule or diagram indicating the design air balance of the kitchen and all communicating spaces clearly indicating makeup, transfer, exhaust and infiltration airflow rates. Negative pressurization caused by the kitchen exhaust system shall not cause improper operation of systems in communicating spaces or cause door opening forces in the building to exceed the limits set forth in Chapter 10 of the 2022 New York City Building Code. Designer to show information on the Construction Documents.
18. Per Section MC 401.2, relying on natural ventilation only without the usage of fans is not allowed.
- a. Every occupiable space shall be naturally ventilated in accordance with Section MC 402 and mechanically exhausted in accordance with Table MC 403.3.1.1; or mechanically ventilated in accordance with Section MC 403.
 - b. All occupiable spaces provided with air conditioning shall be mechanically ventilated in accordance with Section MC 403.
19. Per Section MC 1305.8.4, construction documents shall include calculations demonstrating that the extension of the normal and emergency vent piping is adequately sized to provide the required emergency vent flow while limiting the backpressure to less than the maximum pressure permitted by the design of the tank. Per Table MC 1305.7(2), calculations also must be included in construction documents for the normal venting of UL 142 tanks. Submit all calculations with the final design according to NFPA 30-12.
- B. During the construction phase, the Architect/Engineer of Record shall provide verification that the as-designed central unit fan static pressure capacities are adequate considering the approved shop drawing routes and fitting losses based on using loss coefficients for all fittings (in accordance with ASHRAE and SMACNA standards). The Engineer of Record **is** to provide calculations based on shop drawing routes and copies of marked-up shop drawings indicating the specific routes that have the highest pressure drops that were used to verify the static pressure capacities of the central unit fans.
- C. Verify that intake openings are compliant with Section MC 401.4. Ventilation air intake openings shall comply with all of the following:

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1. Intake openings shall be located not less than 10 feet from lot lines or buildings on the same lot. For buildings on lots measuring less than 20 feet in width, intake openings shall be located at the centerline between lot lines. Where openings front on a street or public way, the distance shall be measured to the centerline of the street or public way.
 2. Mechanical and gravity outdoor air intake openings shall be located not less than 10 feet horizontally from any hazardous or noxious contaminant source, such as vents, exhausts (including but not limited to exhaust from dry cleaning establishments, spray booths, and cooling towers), streets, alleys, parking lots and loading docks, except as specified in Item 3 of Section MC 501.3.1. Outdoor air intake openings shall be permitted to be located less than 10 feet horizontally from streets, alleys, parking lots and loading docks provided that the openings are located not less than 25 feet vertically above such locations. Where openings front on a street or public way, the distance shall be measured from the closest edge of the street or public way.
 3. Where the requirements of Item 2 above cannot be achieved, intake openings shall be located not less than 3 feet below contaminant sources where such sources are located within 10 feet of the opening.
 4. Intake openings on structures in flood hazard areas shall comply with the additional requirements of Appendix G of the 2022 New York City Building Code.
- D. Verify that exhaust openings are compliant with Section MC 501.3
1. Section MC 501.3, Exhaust Discharge, states that the air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a public nuisance and the air shaft will be located not less than the distances specified in Section MC 501.3.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic or crawl space.

Exceptions:
 - a. Commercial cooking recirculating systems.
 - b. Where installed in accordance with the manufacturer's instructions and where mechanical or natural ventilation is otherwise provided in accordance with Chapter 4 of the 2022 NYC Mechanical Code, listed and labeled domestic ductless range hoods shall not be required to discharge to the outdoors.
 2. Section MC 501.3.1, Location of exhaust outlets, requires the termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the minimum distances of separation specified below. Separation shall not be required between an air intake and the discharge air from non-evaporative heat rejection or heat absorption appliances such as air-cooled condensers, dry coolers, or heat pump evaporators; such air is not exhaust. The inlet and discharge of the appliance shall not reduce the effective separation of other exhausts from ventilation intakes to less than the required minimums.
 - a. For ducts conveying noxious, toxic, explosive or flammable vapors, fumes or dusts (including but not limited to exhaust from Science Labs, Gas Meter Room Exhausts (if any), shops): 30 feet from property lines; 10 feet from operable openings into buildings; 6 feet from exterior walls and roofs; 30 feet from combustible walls and operable openings

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into buildings which are in the direction of the exhaust discharge; 10 feet above adjoining grade. Additional requirements may apply to Hazardous Exhaust Systems; see Section 510.

- b. For other product-conveying outlets: 10 feet from the property lines; 3 feet from exterior walls and roofs; 10 feet from operable openings into buildings; 10 feet above adjoining grade; 10 feet from any exterior fire escape, stair, or balcony.
- c. For all environmental air exhaust outlets: 3 feet from property lines separating lots; 3 feet from operable openings into buildings, and 10 feet from mechanical air intakes. Such exhaust outlets shall not be considered hazardous or noxious.

Exception: A 10-foot separation is not required between a mechanical air intake and an exhaust outlet for a single room with less than 750 cfm Class 1 exhaust air.

For this exception, the sum of any energy recovery device cross contamination and any re-entrainment of exhaust through the intake shall be less than 10% of the intake airflow as established by the manufacturer. The distance requirements from property lines and operable openings shall be maintained. Air Class shall be determined in accordance with ASHRAE Standard 62.1.

- d. Exhaust outlets and openings serving structures in flood hazard areas shall comply with the additional requirements of Appendix G of the 2022 New York City Building Code.
- e. For specific systems, see the following code sections:

- Kitchen hoods and other kitchen exhaust equipment, Sections MC 506.3.13, 506.4 and 506.5.
- Dust stock and refuse conveying systems, Section MC 511 (Shop exhaust, Can Wash Room exhaust)
- Subslab soil exhaust systems, Section MC 512.4.
- Smoke control systems, Section BC 909.10.3 of the 2022 NYC Building Code.
- Refrigerant discharge, Section MC 1105.7.
- Machinery room discharge, Section MC 1105.6.1.

E. The Authority standard is to utilize hard-ducted returns since plenum returns result in negatively pressurized spaces that are close to the main return stub. In addition, the 2022 NYC Mechanical Code requires special and periodic inspections as noted below. Designer is to justify any proposed design that utilizes plenum returns (possibly due to limited interstitial space above the suspended ceiling). If return plenums are authorized, they must be checked for a possible contamination condition. Per Section MC 601.4, Contamination Prevention, verify that exhaust ducts under positive pressure (exhaust fan upstream of exhaust ductwork), chimneys and vents do not extend into or pass through ducts or plenums unless the following Exceptions are met:

- 1. Exhaust systems conveying Class 1 or Class 2 air in accordance with ASHRAE 62.1-2016, located in return air plenums and that have exhaust duct joints, seams and connections that comply with Section MC 603.9 without taking any exceptions. Such exhaust system and plenum shall be subject to special inspection in accordance with Section BC 1705.39 and shall be subject to periodic inspection in accordance with MC Section 602.6.

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- G. Per Section MC 801.16.1, existing firebrick chimneys may be used to vent appliances if the firebrick is acid resistant and lab tested. Designer is to inspect the existing chimney before deciding to reuse and to not install a liner. Note that after the completion of the construction, the brick and mortar must be inspected in accordance with Section BC 1705.32.1, Reuse of existing chimneys. Section BC 1705.32.1 states when a new heating system appliance is installed, the special inspector shall verify the condition of the existing chimney lining and breeching. Deficiencies shall be reported as required by Section BC 1704.1.1.2.

During the design phase of a No. 2 or No. 4 burner retrofit/replacement to biodiesel B100 Ready burner**, Designer shall determine the condition of the existing breeching/chimney lining and design documents shall call for the required smoke test per Section MC 810.1.

- H. Per Section MC 802.9, appliance and equipment vent terminals shall be located such that doors cannot swing within 12 inches horizontally of the vent terminals. Doorstops or closers shall not be installed to obtain this clearance. Designer to consider when defining the location of the vent terminals.
- I. Per Section MC 1305.13 regarding installation of tanks, tanks shall be installed in accordance with the provisions of Sections MC 1305.13.1 through 1305.13.4. Fuel oil stored on roofs shall be deemed inside of buildings. At least 15 inches clearance shall be provided over tanks and on all sides between the tanks and the enclosure, embankment or dike or greater clearance as required by the manufacturer's instructions. Designer shall account for the for code required clearances on the Drawings.
- J. Per Section MC 1305.13.3 regarding above ground tanks and appliances above the lowest floor inside a building, regardless of capacity, fuel-oil tanks and fuel-oil-burning appliances shall comply with the following requirements:

1. Enclosure of room: Fuel-oil tanks and fuel-oil-burning appliances shall be located in a dedicated room or enclosure, having a fire-resistance rating of at least 2 hours. Designer shall indicate the required fire resistance rating on the Drawings.

Rooftop tanks need not be enclosed provided that all exterior walls and roofs within 10 feet horizontally and 20 feet vertically have a fire-resistance rating of at least 2 hours or are otherwise separated by a constructed assembly with a fire-resistance rating of at least 2 hours. Designer shall account for the above when locating any rooftop tanks.

2. Transfer pumps: Fuel-oil tanks that are filled by means of a transfer pump supplied from a primary storage tank where the transfer pump is located on the lowest floor, shall have the transfer pump located above the tank secondary containment level or outside the tank containment area. Designer shall ensure that the transfer pump is located compliant with the above.
- K. Per Section BC 913.2.1, verify that refrigerants, gas piping, gas consumption devices, gas meters or any other gas equipment and fuel storage or fuel consuming appliances are not installed in any space housing a fire pump.
- L. For cases where slab-to-slab heights are limited and Vertical Unit Ventilators (VUVs) or floor mounted VRF units are elected to be used, designer is to determine the possible need for the units to be located in closets or have enclosures and if so, closets/enclosures are indicated on the

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Drawings. Projects requiring compliance with the Green Schools Guide shall have maximum noise levels of NC 35, 40 dBA.

** Note that this Design Requirement is based on the retrofit or replacement of No. 2 or No. 4 burners to biodiesel B100 Ready burners. In special cases, with Authority approval, gas burners or dual fuel gas/oil burners may be retrofitted or replaced and boiler vessels may be retrofitted/replaced.



6.2 Heating & Ventilation

6.2.35 Ducts Requiring Dedicated Shafts

Description/Design Approach:

A. Per Section MC 607.5.5.2 of the 2022 NYC Mechanical Code and RS 13-1A Section 3-3.4.3 of the 1968 Building Code, shafts that constitute air ducts or that enclose air ducts used for the movement of environmental air shall not enclose:

1. Exhaust ducts used for the removal of smoke and grease-laden vapors from cooking equipment (also refer to Section MC **506.3.11**);
2. Ducts used for removal of flammable vapors (also refer to Section MC 510.4);
3. Ducts used for moving, conveying, or transporting stock, vapor or dust;
4. Ducts used for the removal of nonflammable corrosive fumes and vapors;
5. Refuse and linen chutes (also refer to Section BC **713.13.1** of the **2022 NYC Building Code**);
or
6. Piping.

Exception: Shafts that constitute air ducts or that enclose air ducts used for the movement of environmental air may enclose noncombustible piping conveying water or other non-hazardous or nontoxic materials.

B. Per paragraph A above, the following (including but not limited to) ducts shall be run in dedicated shafts:

Kitchen exhaust ducts, Gas Meter Room exhaust ducts, Science Lab or Prep Room fixed fume hood exhausts, sub-slab soil exhaust systems and Oil Tank Room/Vault ventilation ducts (Refer to DR 6.2.14).

Note that per Section MC **506.3.11**, Grease Duct Enclosures, **a commercial kitchen grease duct serving a Type I hood that penetrates a ceiling, wall, floor or any concealed space shall be enclosed from the first point of penetration to the outlet terminal. In-line exhaust fans not located outdoors shall be enclosed as required for grease ducts. Per Section MC 506.5.1.2 where enclosed duct systems are connected to in-line fans not located outdoors, the fan shall be located in a room or enclosure having the same fire-resistance rating as the duct enclosure. Access shall be provided for servicing and cleaning of fan components. Such rooms or enclosures shall be ventilated in accordance with the fan manufacturer's instructions. A duct shall penetrate exterior walls only at locations where unprotected openings are permitted by the New York City Building Code. The duct enclosure shall serve a single grease duct and shall not contain other ducts, piping or wiring systems. Duct enclosures shall be a shaft enclosure in accordance with Section MC 506.3.11.1, a field-applied enclosure assembly in accordance with Section MC 506.3.11.2 or a factory-built enclosure assembly in accordance with Section MC 506.3.11.3. Duct enclosures shall have a fire-resistance rating of not less than that of the fire-resistance-**

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rated assembly penetrated and not less than 1 hour. Fire dampers and smoke dampers shall not be installed in grease ducts.

Exception: A duct enclosure shall not be required for a grease duct that penetrates only a nonfire-resistance-rated roof/ceiling assembly.

- C. If the Designer elects the shaft enclosure option, a dedicated shaft enclosure is to be shown on the Drawings. This is the preferred option as it removes any workmanship issues when using the magnesium or calcium silicate insulation or duct wrap or factory-built systems. Designer to note that if non-shaft options are to be the basis of design, they are to be clearly indicated on the Drawings and the specifications shall be edited to remove the systems not used.



6.2 Heating, Ventilation & Air Conditioning

6.2.36 Construction Document Requirements and Design Criteria for Refrigeration Systems

Description/Design Approach:

A. General: ASHRAE 15-2022 defines the term EDVC, which is the effective dispersal volume charge (lb.) that ideally is the maximum pounds of refrigerant in an independent circuit such that if a leak were to occur and all the independent circuit refrigerant were to leak into the space(s), an unsafe condition would not occur. Should the pounds of refrigerant in an independent circuit for A2L refrigerants exceed the EDVC charge, then actions need to be taken. For simplicity, the standard is to employ continuous ventilation in lieu of energizing the ventilation system in response to a leak detector signal. Note that the EDVC calculations for A1 refrigerants are based on the Refrigerant Concentration Limit (RCL), but the EDVC calculations for A2L refrigerants are based on Lower Flammability Limit (LFL) due to the mildly flammable nature of A2L refrigerants.

For completeness, this Design Requirement addresses A1 refrigerants to clarify the ASHRAE 15-2022 A1 requirements. However, all refrigeration systems are to be designed with A2L refrigerants due to the phase down of A1 refrigerants by EPA and NYS DEC.

B. Construction Documents: Per Section MC 107.9 of the 2022 NYC Mechanical Code, construction documents for refrigerating systems shall contain plans that include the following data and information:

1. The location of all machinery; the horsepower of compressors; the type and number of pounds of refrigerant to be used; and the air quantities for, and means of, ventilating the machinery space.
2. The location of refrigerant detectors and emergency switches for compressors and for ventilation in the machinery rooms.
3. The location of pressure relief piping and any city water connections and water-saving devices.
4. The tonnage capacity of the machine and the suction and discharge pressures at which the machine is rated.
5. The operating weight of the equipment.
6. The safety group classification of refrigerant utilized.
7. The refrigerant concentration limit calculations and routing of all refrigerant piping for any refrigerating system that contains more than 6.6 pounds of refrigerant. Refer to Chapter 11 of the 2022 NYC Mechanical Code for refrigerant piping requirements. Additionally, refer to ASHRAE 15-2022 for refrigerant piping requirements and refrigerant charge limit calculations.

C. Protection of Refrigerant Piping Inside Building: Per Section MC 1107.1.1 and Sections 9.12.1.1, 9.12.1.2 and 9.12.1.3 of ASHRAE 15-2022, all refrigerant piping and fittings installed at a height less than 7'-3" above the floor shall be concealed or otherwise protected from mechanical damage except at the point of connection to terminal equipment. Show routing of refrigerant

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piping as concealed or show refrigerant pipe protection on the Drawings. Per Section MC 1107.2, place a note on the Drawings that states, "Refrigerant piping that crosses an open space that affords passageway in any building shall be not less than 7 feet 3 inches above the floor unless the piping is located against the ceiling of such space". Designer to note that refrigerant piping shall not be placed in any elevator, dumbwaiter or other shaft containing a moving object or in any shaft that has openings to means of egress. Refrigerant piping shall not be installed in an enclosed public stairway, stairway landing or an exit.

D. Piping in Corridors/Lobbies:

1. While public corridors as defined by the NYC Building Code do not typically apply to schools as they are considered one occupancy and have interior corridors, refrigerant piping in school interior corridors are to be treated the same as public corridors. (Note that public corridors may occur on an unusual school project with multiple tenants).

2. Refrigeration for Corridors/Lobbies per Section 7.5.1.2 of ASHRAE 15-2022:

a. Refrigeration systems shall be limited to "unit systems". Note that ASHRAE 15-2022 defines a "unit system" to be the same as a "self-contained system" that ASHRAE 15-2022 defines as "a complete factory-assembled and factory tested system that is shipped in one or more sections and has no refrigerant containing parts that are joined in the field by other than companion flanges or block valves." This means that A1 or A2L split central unit piping or split terminal unit piping or VRF unit piping is not allowed to be located in Corridors/Lobbies.

b. Per Section 7.5.1.2.b, the A1 refrigerant charge of an independent circuit shall be less than or equal to the refrigerant charge quantity as specified in Section 7.3, which defines EDVC in Equation 7-3a as follows:

$$EDVC = RCL * V_{eff} * F_{occ}$$

where EDVC is the effective dispersal volume charge (lb.), RCL is the refrigeration concentration limit as listed in Table MC 1103.1 of the 2022 NYC Mechanical Code, V_{eff} is effective dispersal volume (ft³) established using Sections 7.2.1 through 7.2.3, and F_{occ} is the occupancy adjustment factor that equals 1 for schools. Should the initial design refrigerant charge in an independent circuit exceed the EDVC value, the design shall be revised to employ more circuits in the central air handling unit with a lower refrigerant charge per circuit less than or equal to the EDVC value.

c. Usage of A2L refrigerants in Corridors/Lobbies is governed by Section 7.5.1.2.c. Refrigerant systems containing Class 2L refrigerants shall be listed and the refrigerant charge per circuit in the "unit system" shall be less than or equal to the following:

$$M_s = 0.106 * LFL \text{ where } M_s \text{ is the system refrigerant charge per circuit (lb.) and LFL is the Lower Flammability Limit per ASHRAE 34-2022 (lb./1000 ft}^3\text{).}$$

E. A1 Refrigerant Piping in Occupied/Unoccupied Spaces: In general, piping containing Group A1 refrigerant may be located in occupied/unoccupied spaces provided that the complete discharge of the circuit refrigerant system into the space will not result in a refrigerant charge greater than the EDVC effective dispersal volume charge (lb.) as calculated in accordance with Equation 7-3a of ASHRAE 15-2022 (defined above) and the refrigerant piping and fittings are concealed or

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otherwise protected from mechanical damage and either are installed with brazed joints or in refrigerant equipment manufacturer provided pre-charged tubing systems installed in accordance with the refrigerant equipment manufacturer's instructions.

F. A2L Refrigerant Piping in Occupied/Unoccupied Spaces:

1. Piping containing Group A2L refrigerant may be located in the occupied/unoccupied spaces if the refrigerant charge of a circuit that could leak is less than or equal to the EDVC value as calculated for A2L refrigerants per Equation 7-8 of ASHRAE 15-2022. Should the refrigerant charge of a circuit that could leak exceed the EDVC value, piping containing Group A2L refrigerant may be located in occupied/unoccupied spaces if they have continuous air circulation that will disperse the leaked refrigerant. Note that for simplicity, the continuous ventilation option of Section 7.6.1.1.b is preferable to the Section 7.6.1.1.a option where air circulation is initiated by a refrigerant detector.

Equation 7-8 is as follows:

$$EDVC = V_{eff} * LFL * CF * F_{occ}$$

where EDVC, V_{eff} , and F_{occ} are as defined above and LFL is the Lower Flammability Limit (lb./ft³) determined from ASHRAE 34-2022, and CF is the concentration factor with a value of 0.5.

2. For A2L systems, the continuous ventilation option defines a ventilation level required to disperse any leaked refrigerant and it depends on how much the amount of refrigerant charge in an independent circuit exceeds the A2L EDVC level.

The level of the required ventilation is defined in Equation 7-10 of ASHRAE 15-2022 as follows:

$$Q_{min} = Q_{req}/C_{LFL}$$

where Q_{min} is the minimum mechanical ventilation airflow rate, ft³/min; Q_{req} is the required ventilation as determined from Table 7-4 of ASHRAE 15-2022 and C_{LFL} is the Lower Flammability Limit conversion factor as determined from Table 7-5.

3. Similar to A1 refrigerant piping, the A2L refrigerant piping and fittings shall be concealed or otherwise protected from mechanical damage and either are installed with brazed joints or in refrigerant equipment manufacturer, provided pre-charged tubing systems installed in accordance with the refrigerant equipment manufacturer's instructions.
4. Occupied/unoccupied spaces served by A2L systems not having air circulation that will disperse any leaked refrigerant shall have an EDVC value as calculated in accordance with Equation 7-9.

- G. Refrigerant Piping Installed in Concrete Floors: Per Section MC 1107.2.2 and Section 9.12.1.4 of ASHRAE 15-2022, A1 and A2L refrigerant piping installed in concrete floors shall be encased in pipe ducts. The piping shall be isolated and supported to prevent damaging vibration, stress and corrosion. If routing is such that refrigerant piping must be routed in concrete floors, designer shall show encasing pipe ducts.

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- H. Refrigerant Piping Penetrations: Per Section MC 1107.2.3, Refrigerant Piping Penetrations, and ASHRAE 15-2022, A1 and A2L, refrigerant piping shall not penetrate floors, ceilings or roofs. Designer shall note Exceptions below. Refrigerant piping penetrations shall be protected as required, consistent with the stipulations noted below:

Exceptions:

1. A1 and A2L penetrations connecting the basement and the first floor.
 2. A1 and A2L penetrations connecting the top floor and a machinery penthouse or roof installation.
 3. A1 and A2L penetrations connecting adjacent floors served by the refrigeration system.
 4. A1 and A2L penetrations by piping in a direct system where the refrigerant quantity does not exceed the EDVC value for the smallest occupied space through which the piping passes.
- I. A1 and A2L Refrigeration Concentration Exceedance Remedial Options: Per Section MC 1107.2.3.1 and ASHRAE 15-2022 for direct systems, piping containing a quantity of refrigerant in excess of the EDVC value for the smallest occupied space through which the piping passes may comply with Section MC 1107.9 and ASHRAE 15-2022, which defines the alternative refrigerant piping safety requirements. Refer to ASHRAE 15-2022 sections as follows:
1. Section 7.2.3.2, Connected Spaces via Natural Ventilation: Connected spaces shall be on the same floor and be provided with permanent natural ventilation openings. The lower edge of the natural ventilation opening between rooms shall be located a maximum of 12" above the finished floor. The area of any openings above 12" from the floor shall not be considered. For spaces served by A1 refrigerants, the required size of the openings shall be in accordance with Equation 7-1a. For spaces served by A2L refrigerants, the required size of the openings shall be in accordance with Equation 7-2a. Note however that adjacent classrooms should not have connected natural ventilation openings to avoid noise transmission between the classrooms.
 2. Section 7.2.3.3.2, Plenums: The volume of an air ceiling plenum shall be included when calculating the effective dispersal volume where the plenum space is part of the refrigeration system air distribution system. Note that since the Authority requires hard ducted returns, the space above the suspended ceiling should not be included in the effective dispersal volume calculations.
 3. Section 7.2.3.4, Connected Spaces via Mechanical Ventilation: Where two or more spaces are connected by a mechanical ventilation system complying with the requirements of Section 7.6.4, the volume of all such connected spaces shall be included in the effective dispersal volume used to calculate EDVC. This will be beneficial for spaces served by Multizone VAV (MZVAV) systems and Dedicated Outdoor Air Systems (DOAS) systems.
 4. Section 7.3.4.4 Release Mitigation Controls: Mitigation controls are provided to limit a release by automatically isolating leaking piping or equipment by the usage of solenoid valves driven by refrigerant leak detectors in each space. The releasable refrigerant charge shall be determined based on a release of the volume of refrigerant that will occur prior to operation of the release mitigation control (solenoid valve) plus the volume of refrigerant contained

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downstream of a release mitigation control (solenoid valve). The calculations for the releasable refrigerant charge when mitigation is used are to be per Equation 7-4a. Mitigation control is an ASHRAE 15-2022 option; however, based on the required detailed calculations, other options as noted herein are preferred.

- a. Employ more circuits in the central air handling unit with a lower refrigerant charge per circuit less than the EDVC value.
- b. In the case of A2L refrigerants, employ continuous refrigerant dispersing ventilation as defined in Paragraph F above.
5. Per Section MC 1107.2. and Section 9.12.1.5 of ASHRAE 15-2022, in other than industrial occupancies (applicable to Group E Educational Occupancy Classification) where the A1 and A2L refrigerant quantity exceeds the EDVC value for the smallest space, A1 and A2L penetrations for piping that connects separate pieces of equipment shall be either enclosed by an approved gas-tight, fire-resistive duct or shaft with openings to those floors served by the refrigeration system or located on the exterior of the building where vented to the outdoors or to the space served by the system and not used as an air shaft, closed court or similar space.
6. Per Section 9.12.2.2 of ASHRAE 15-2022, Shaft Ventilation, refrigerant pipe shafts with systems using Group A2L refrigerants shall be naturally or mechanically ventilated.
 - a. Below are the ASHRAE 15-2022 options:

Option a: Naturally ventilated shafts shall have a minimum of a 4.0 in. diameter pipe, duct, or conduit that connects at the lowest point of the shaft and connects to the outdoors. The pipe, duct, or conduit shall be level or pitched down to the outdoors. A makeup air opening shall be provided at the top of the shaft. (See the below for the preferred natural ventilation amendments to Option a of Section 9.12.2.2 of ASHRAE 15-2022).

Option b: When activated, mechanically ventilated shafts shall have a minimum air velocity in accordance with Table 9-12 of ASHRAE 15-2022. Makeup air shall be provided at the inlet to the shaft for mechanically ventilated shafts. Per ASHRAE 15-2022, the mechanical ventilation shall either be continuously operated or, for pipe shafts containing systems using Group A2L, activated by a refrigerant detector. Should this Option b be selected, in consideration of the 2020 NYC Energy Conservation Code, a refrigerant detector is to be utilized instead of continuous operation. Refrigerant pipe shafts utilizing a refrigerant detector shall have a set point not exceeding the occupational exposure limit (OEL) of the refrigerant. The detector shall be located in an area where refrigerant from a leak will concentrate.

Option c: The shaft shall not be required to be ventilated for double-wall refrigerant pipe where the interstitial space of the double-wall pipe is vented to the outdoors in accordance with the discharge location requirements specified in Section 9.7.8.2.

- b. In consideration of the ASHRAE 15-2022 and the 2020 NYC Energy Conservation Code requirements, Option a, naturally ventilated shafts, is the preferred option.

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However, designers are to determine if a different option is more appropriate for their particular design.

- c. For Option a, natural ventilation, provide a refrigerant leak detector in the lower part of the shaft for the heavier than air A2L refrigerant and hard-wire the refrigerant leak detector back to the Fire Alarm system.
 - d. When the Fire Alarm system is energized, the Fire Alarm programming shall release the roof hatch latches, thus opening the roof hatches to provide fresh air makeup air paths. For shafts located in the interior of the building, provide interconnecting ducts running from the lowest point of the shafts to exterior façade louvers equipped with Class 1 dampers (leakage rate 4 cfm/SF at 1" w.c.). Each interconnecting duct shall be rectangular and pitched down to the outdoors with a minimum area equal to what would be provided with a 4" diameter pipe (i.e., 12.6 square inches). For shafts located at the exterior of the building, interconnecting ducts are not required and only louver/Class 1 damper combinations are required at the exterior façades. Each louver/damper combination shall provide a minimum free area equal to 12.6 square inches. When the fire alarm system is activated, in addition to opening up the roof hatches, the fire alarm system shall also open the dampers in the façade louvers to provide paths for the leaked refrigerant to escape from the shaft interiors.
7. For VRF systems, connect less indoor units to a given outdoor unit.
- J. Disabling of Compressors/BMS Notification for A2L Applications
- 1. Per Section 7.6.4.b.3 and Informative Appendix A Section 7.6.1.1 of ASHRAE 15-2022, when the allowable EDVC pounds of an A2L refrigerant is exceeded per circuit on a MZVAV or SZVAV A2L air handling unit, upon detection of a ventilation system failure (within 10 seconds of failure) or detection of leaked refrigerant equal to or exceeding 25% LFL, air handling unit compressor operation shall be stopped by OEM controls and a notification shall be provided to the BMS system.
 - 2. On detection of an A2L DOAS ventilation system failure (within 10 seconds of failure) or detection of leaked refrigerant equal to or exceeding 25% LFL, DOAS air handling unit compressor operation shall be stopped by OEM controls and a notification shall be provided to the BMS system and compressor operation in each associated split or VRF outdoor unit shall be stopped by TCC and a notification shall be provided to the BMS system.
- K. Central Station Monitoring to Avoid the Need for Refrigerating System Operating Engineer (reference Table FC 606.1 of the 2022 NYC Fire Code and Section BC 918 of the 2022 NYC Building Code)
- 1. If the A2L air handling unit manufacturer's integral refrigerant leak detection system or VRF indoor unit manufacturer's integral refrigerant leak detection system required by Sections 7.6.2.3 and 7.6.2.4 of ASHRAE 15-2022 or if any area refrigerant leak detection system (as determined by the Mechanical designer for the spaces associated with the field refrigerant piping not enclosed in gas-tight fire resistive enclosures or run outdoors) is triggered by equaling or exceeding a refrigerant concentration of 25% LFL, all electric resistance heaters shall be de-energized as required by Section 7.6.2.5.d. The air handling unit controllers shall close dry contacts, VRF system master controller shall close dry contacts, and additionally

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the refrigerant leak detection equipment for any area detectors per Section 15997 shall close dry contacts. The Division 16 contractor shall in turn wire all dry contacts to the Fire Alarm system per Section 16720 for central station monitoring if the Fire Alarm system is new or expandable and has unused input/output capability or to the Refrigerant Detection and Alarm System with Central Office Connection, Section 16731, for central station monitoring if the existing Fire Alarm system is not expandable.

2. In addition to central station monitoring being required should the 25% LFL be exceeded as measured by OEM integral refrigerant leak detectors or area detectors, fan failure of the units, **which would disable the ability of the fans to disperse any leaked refrigerant**, also requires closure of unit controller dry contacts and wiring by Div 16 Contractor to the Division 16 system equipment.
 3. In general, designers shall strive to design A2L systems where refrigerant piping leaks or coil leaks would be less than the EDVC value and that would not exceed 25% LFL in the event of a refrigerant leak. Designers are to calculate if a circuit refrigerant leak or refrigerant pipe leak could equal or exceed 25% of the refrigerant LFL level. If so, central station monitoring (as defined in the specification sections) is to be provided. If not, designer is to delete references to the need for central station monitoring in the specification sections. Refer to each specification section Notes to Specifier.
- L. Exhaust Air and Transfer Air Inlets: For A2L applications, note that per Section 7.6.4.c of ASHRAE 15-2022, inlets for exhaust air and inlets used to mechanically transfer air to a separate indoor space, shall be located such that the bottom of the inlet is within 12" of the lowest elevation in the space where leaked refrigerant would be expected to accumulate. Per ASHRAE 15-2022, all commonly used refrigerants except ammonia (R-717) and water (R-718) are heavier than air when at room temperature. Hence, all A2L system return/exhaust/transfer inlets shall be located at the bottom of the wall within 12" of the lowest elevation in the space.
- M. Machinery Rooms: Per Section 7.4 of ASHRAE 15-2022, machinery rooms are required for indoor chillers, indoor chiller/heaters and indoor split central air handling units if the charge per independent circuit exceeds the EDVC values (not required if the pounds of refrigerant per independent circuit is less than the EDVC value). Equipment using A1 refrigerants must be compliant with Section 8.9 of ASHRAE 15-2022. Equipment using A2L refrigerants must be compliant with Sections 8.9.1 through 8.9.4 and Section 8.11. Exception: listed self-contained (packaged) systems are permitted outside of a machinery room, provided that such systems are not located in corridors or lobbies and are limited to 22 lbs. of refrigerant where located in commercial occupancies. This exception applies to packaged vertical unit ventilators.
- N. Outdoor Located Refrigeration Equipment: Per Section 8.12 of ASHRAE 15-2022, when a refrigerating system is located outdoors more than 20 ft. from building openings and is enclosed by a penthouse, lean-to or other open structure, natural or mechanical ventilation shall be provided. The free-aperture cross section for the ventilation of the machinery room shall be in accordance with Equation 8-2a.
- O. Continuous Ventilation: For A2L applications where the charge per independent circuit (lbs. of refrigerant) exceeds the EDVC value as calculated by Equation 7-8 of ASHRAE 15-2022 and hence continuous ventilation is required, the outdoor air intake rate at all central units shall be the maximum of the ventilation rate required for the instantaneous occupancy per Chapter 4 of the 2022 NYC Mechanical Code versus the Q_{min} value for leaked refrigerant dispersal as calculated

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by Equation 7-10 of ASHRAE 15-2022. Designer shall indicate the required minimum outdoor air intake rates on the Drawing Schedules.

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6.2 Heating, Ventilation & Air Conditioning

6.2.38 Miscellaneous HVAC Drawing Requirements

Description/Design Approach:

- A. The following items shall be shown or taken into account on the HVAC Drawings:
1. For Capital Improvement Program (CIP) projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind, the Designer is to show on the Drawing Details the required strainers for all devices as defined in Section 15510 HVAC Piping (upstream of control valves/coils for cabinet unit heaters, unit ventilators, fan coil units, etc.; pumps; reducing/regulating valves; steam traps serving steam main drips; etc.) as well as other pieces of equipment that require such strainers. Terminal strainers are to be provided even if the central combination air and dirt coalescing separators are provided according to Section 15515, Hydronic Specialties.
 2. Specification Section 15514, Ductwork Insulation, calls for insulation to be applied to the ductwork and assumes that the temperature difference between the air inside the duct and the air outside of the duct is greater than 15°F (which mandates that insulation be applied per Section C40311.1 of the 2020 NYCECC). This will typically not be the case for return ducts on most projects within the building, except for shafts where it may be more likely to exceed the temperature gradient since they are not conditioned spaces. Per Table 6.8.2 of ASHRAE 90.1-2016 as modified by Appendix CA of the 2020 NYCECC, return ducts in indirectly conditioned spaces (i.e., space above suspended ceiling) do not require insulation. Note that even if the temperature difference is equal to or less than 15°F, there still may be a need for insulation on the ducts to prevent condensation problems. Section MC 603.12 of the 2022 NYC Mechanical Code states that, "Provisions shall be made to prevent the formation of condensation on the exterior of any duct". The Designer is to verify that the dewpoint of the air exterior to the duct is lower than the temperature of the air inside the duct. The Designer is to note on the Drawings any ductwork that need not be insulated if the temperature difference between the air inside the duct and the air outside of the duct is less than or equal to 15°F and if the temperature of the air inside the duct is greater than the dew point of the air outside of the duct. It is the SCA's intent not to insulate ducts if not required.
 3. All pipe diameters, duct dimensions and associated operating temperatures are to be shown on the Drawings and in the Schedules so that the Contractor can select the appropriate piping insulation thickness and ductwork vapor retardant coating (Refer to Table C403.11.3 of the 2020 NYCECC, Tables 6.8.3-1 and 6.8.3-2 of ASHRAE 90.1-2016, Specification Section 15512 Piping Insulation (HVAC) and Specification Section 15514 Ductwork Insulation).
 4. Designer is to show the diameter of all pipes on both the plan Drawings and the riser Drawings.
 5. DR 6.2.25 states all volume dampers and all VAV boxes shall be provided 5 to 10 duct diameters upstream of the terminal inlets and outlets. The upstream duct length of the supply duct serving the VAV boxes and volume dampers shall be 4 duct diameters in length where possible. The minimum length of this portion of ductwork shall be 2 feet. Designer is to show all volume dampers such as those required for constant volume units and downstream of

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VAV boxes on the Drawings. For constant volume systems (allowed for historical buildings and for those existing schools meeting the Exceptions to Section 6.1.1.3 of ASHRAE 90.1-2016 as modified by Appendix CA of the 2020 NYCECC, provide main duct volume dampers on every floor off the risers and sub-main volume dampers on each branch in addition to providing volume dampers upstream of the terminal inlets and outlets.

6. Construction documents for HVAC systems shall include the temperature to be maintained in every room and the total required output capacity in Btu/h required by the spaces served by the HVAC system. For cooling systems, the total required output capacity shall be differentiated between the sensible and latent capacities.
7. Construction documents shall indicate the procedure used to calculate the loads in accordance with Section MC 312 per ANSI/ASHRAE/ACCA 183 and Section C403.1.1 of the 2020 NYCECC. Construction documents shall show the results of peak load calculations and total design output of the HVAC system. Refer to Design Requirement 6.2.9 regarding the possible need to increase the ventilation outdoor air flow to disperse any leaked A2L refrigerant.
8. Sizing of air-cooled condensing units for walk-in refrigerators/freezers will be provided by the Kitchen Consultant and shown on the Kitchen Drawings, as are the piping runs. Coordinate location of units and piping to avoid interference with HVAC units and piping and the required shaft size with Architect. Verify that the Kitchen Consultant has not exceeded the pipe run distance recommended by the condensing unit manufacturer.
9. Designer is to show on the Schedule not only the total external static pressure (summation of the external static pressure on the suction side of supply fan plus external static pressure on the discharge side of supply fan) that the supply fan must provide, but also must show what the individual external static pressure is on the discharge side of the supply fan. Additionally, the designer shall indicate what the suction pressure is on the suction side of the exhaust fan when in the economizer mode. This is required so the Contractor can determine what Duct Pressure Class the supply and return ductwork should be constructed to and what the Duct Leakage Class should be. Designer is to note that Pressure Class 3-inch WC or higher equipment external static pressure and Leakage Class 4 is required for outdoor ductwork and shall indicate same on the Drawings.
10. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind, the Designer shall indicate isolation valves on Drawings for all waterlines (hot and chilled water, if any) at each floor and at each riser, which will facilitate testing and leak repairs.
11. For CIP Projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind and when project entails retrofitting/ replacing No 2 or No 4 oil burners with biodiesel B100 Ready burners, ensure the architect provides 2 means of egress for boiler rooms greater than 300 SF per Rule §4-6.8 of the NYS Industrial Code (NYC Mechanical Code requires such at 500 SF).
12. Ensure that condensate lines are coordinated with the layout of other equipment and the length of runs at 1/8" per foot are not excessive to affect ceiling heights or cause other coordination issues. Coordinate with Plumbing designer to ensure plumbing risers are located to receive the condensate lines. Note that the outdoor units for some heat pumps

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require condensate lines and condensate pans that must be heated to avoid freezing if the outdoor unit heat pump operates at a coil temperature below the outdoor air dew point. Show the outdoor condensate pans and drain lines on the Drawings.

13. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind and when project entails retrofitting/ replacing No 2 or No 4 oil burners with biodiesel B100 Ready burners, ensure that fuel oil pipe shafts are of sufficient size to accommodate piping and required code clearances and not interfere with building structure.
14. Ensure that shafts in general are not designed to such exact clearances that construction deviations can't be accommodated. Coordinate with the Architect to ensure space is adequate.
15. Ensure drawings do not show ductwork running directly on top of and in same direction as partitions, as the partition cannot be framed.
16. If a gravity vent is being replaced and thus requires a damper to meet the energy code, ensure the power to the damper is indicated on the electrical drawings.
17. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind and when project entails retrofitting/ replacing No 2 or No 4 oil burners with biodiesel B100 Ready burners, Designer is to show blade-indicating whisker switches on the Drawings for all appliances that require outside air dampers to be proven open before combustion. End switches are not acceptable for this per the DOB Boiler Division preference.
18. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind and when project entails retrofitting/ replacing No 2 or No 4 oil burners with biodiesel B100 Ready burners, per the DOB Boiler division preference, combustion air dampers shall be visible at all times to the boiler operator. A visible outside air intake damper located in an exterior wall is acceptable but a remote exterior wall mounted combustion air intake damper that is not in the line of sight of the boiler operator is not acceptable and for such cases, the combustion air damper is to be located in outside intake ductwork within the boiler room. For compliance with the energy codes, provide duct insulation consistent with the 2020 NYCECC and ASHRAE 90.1-2016 that can be applied to the ductwork upstream of where the combustion air damper is located. Such insulation shall extend up to the envelope penetration, thus effectively bringing the envelope boundary to the combustion air damper and shall be R-10 minimum for CIP projects (meeting the envelope requirements for mass building envelope – modify as required if other type of wall). Note that if the exterior wall is fire-rated and thus requires a fire or fire/smoke damper, the additional fire and smoke damper is still required to be located at the exterior wall.
19. As per the Note to Specifier in Section 15891, aluminum ductwork is to be provided at locations subject to moisture such as for shower exhausts, locker rooms associated with shower exhausts, can washing room exhausts, steam service room exhausts and swimming pool area exhausts. Aluminum ductwork runs shall be specifically indicated on the risers and plans. If the majority of the multiple spaces are wet areas, then the horizontal exhausts and risers shall be fabricated from aluminum. If the majority of multiple spaces connected to the riser are dry areas, the riser may be fabricated from galvanized steel with the local space

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exhausts from the dry areas fabricated from galvanized steel and local space exhausts from the wet areas fabricated from aluminum.

20. Per Section MC 107.9, Construction Documents for refrigerating systems shall contain plans that show the refrigerant concentration limit calculations (EDVC calculations of ASHRAE 15-2022) and routing of all refrigerant piping for any refrigerating system that contains more than 6.6 pounds of refrigerant. Refer to DR 6.2.36.
21. For filing purposes and as required to facilitate plan review, Drawings shall clearly document the appropriate items of the 2020 NYCECC as per the Department of Buildings Document "2020 NYECC – How-to Guide – Mechanical Systems".
22. As per Section 110.26(E) of the NYC Electrical Code, ensure that no HVAC ductwork, piping or equipment is run in the dedicated electrical space above switchboards, panelboards and motor control centers, as a structural ceiling above those items would then be required or a means to collect water from the condensate or leaks that may be produced from the system. In general, avoid running any items other than what is required to service the room.
23. Designers must be aware that many older schools have cinder concrete framed slabs and this is to be investigated with the structural engineer. It is not permitted to use post-installed anchors in cinder concrete, and thus drawings should clearly take into account that support of piping, ductwork, etc. is to be from the structural beams either by direct connection to the beams or from installation of 'unistrut' type supports running between beams. Indicate removal and repair of the beam encasement to facilitate the attachment.
24. Science labs in high schools with an AP program have a drying oven that as per Section 11600 requires ventilation to the exterior. Ensure that the drawings show the ductwork, and fan if required. Note that the drying ovens for IS schools are non-venting and thus do not require a ventilation system.
25. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind, during replacement of existing rooftop mounted HVAC units, the dunnage is to be replaced to meet the height requirements, as well as any other requirement of DR 4.4.2.5 to permit reroofing in the future without requiring the removal of equipment, unless the dunnage is already of adequate height.
26. If heating for transmission skin loads is required in the Cafeteria Servery and floor-mounted convectors are proposed, the location of the convectors and the outlets for the plug-in Servery equipment must be coordinated with the Architect and Electrical Designer to avoid cords for the servery equipment potentially draping over the convectors.
27. For CIP projects when existing systems are to be salvaged but require repair/retrofit/replacement in-kind and when chilled water systems are utilized, per Section 6.5.4 of ASHRAE 90.1-2016 as modified by Appendix CA, chilled water coils shall be selected to provide a 15°F or higher temperature difference between leaving and entering water temperatures and a minimum of 57°F leaving water temperature at design conditions.

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Exceptions are as follows:

1. Chilled-water cooling coils that have an air-side pressure drop exceeding 0.70 in. of water when rated at 500 fpm face velocity and dry conditions (no condensation).
 2. Individual fan-cooling units with a design supply airflow rate 5000 cfm and less.
 3. Constant air-volume systems.
 4. Coils selected at the maximum temperature difference allowed by the chiller.
 5. Passive coils (no mechanically supplied airflow).
 6. Coils with design entering chilled-water temperatures of 50°F and higher.
 7. Coils with design entering air dry-bulb temperatures of 65°F and lower
28. Mechanical Designer to coordinate with the Architect to avoid fire smoke damper (FSD) access issues when the branch duct serving a floor connects to the riser above a closet. If access through the closet is not possible, Architect is to determine options such as not providing a closet next to the shaft or providing a shaft extension above the closet ceiling with the shaft rating to be in line with the closet wall, moving the FSD to be in line with the closet wall and providing an access door in the soffit.
29. When a branch duct serving a floor is connected to a riser duct in the shaft to allow for smooth airflow, the connection needs to be made using a 45 degrees angle fitting. However, the shaft construction must allow sufficient space to allow for the 45 degrees fitting while maintaining the FSD sleeve inside the rated shaft wall, so if the shaft wall is too close to the riser to allow this, the Mechanical Designer shall coordinate with the Architect for the Architect to provide a detail showing the extension of the shaft above the ceiling.
30. Shafts usually do not go below the lowest framed slab, so that opening must be firestopped to close off the shaft. When a shaft encloses more than one duct, there are many times issues of firestopping since two ducts with a space between them cannot be fire-separated. The Mechanical Designer is to discuss with the Architect as they will either need to make sure there is space to provide slab between the ducts, frame the opening using studs and sheet rock around the slab penetration, or call for shaft extension with the ceiling of the lowest floor. If a shaft extension is provided, the FSD needs to be installed on the horizontal penetration to the shaft extension and not at the slab.
31. At HVAC equipment and louver flashing, the Mechanical Designer shall provide a note on the Mechanical detail to refer to the Architectural Drawings for flashing details and discuss with Architect for them to provide the details on their documents.
32. The Mechanical Designer to coordinate with the Architect to ensure that the distance between the shaft opening and the shaft wall is a minimum of 3" to allow the Contractor to support the ductwork with angles or determine a cost-effective method to determine the duct support.
33. Ensure that height of dunnage for roof top equipment in new or replacement installation follows DR 4.4.2.5 to allow for roof to be replaced in the future. Height shall take into account for a future insulation thickness of 8". For curbs, top of curb, should be set 18" above the roof, accounting for an 8" future insulation thickness.
- 34. The Mechanical Designer shall coordinate to ensure there is a means of shut-off and isolation of the radiator steam traps and control valves without having to shut down**

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the entire steam distribution system or boilers. The Mechanical Designer, when doing a climate control project with steam radiators, shall show shut off valves as per Standard Detail 1551002a. The preferred means is to provide valves for each trap and radiator. If space does not permit installation at each trap and radiator, the Mechanical Designer shall show shut-off valves for each of the risers.

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6.2 Heating, Ventilation & Air Conditioning

6.2.39 Split Heat Pumps, Packaged Heat Pump Vertical Unit Ventilators and Variable Refrigerant Flow (VRF) Systems for Occupied Spaces

Description/Design Approach:

A. Definitions

1. For terminal heat pump systems, Auxiliary Supplemental Heating is defined as the additional terminal heating capacity provided by electrical resistance heating when the outside air-cooled condensing unit(s) are functioning but cannot meet the heating load due to cold ambient temperatures.
 - a. For split heat pumps (one indoor unit and one outdoor unit) and VRF heat pump systems (multiple indoor units and one outdoor unit) serving spaces with less than or equal to 450 BTUH/LF heating load, Auxiliary Supplemental Heating is to be provided by:
 - 1) electric baseboard for ceiling cassette units
 - 2) integral electric resistance coils for above the ceiling ducted units
 - 3) integral electric resistance coils for floor mounted VRF units.

For the above cases 2) and 3), if the heating load is less than or equal to 250 BTUH/LF, then standard ceiling diffusers may be employed. If the heating load is greater than 250 BTUH/LF but less than or equal to 450 BTUH/LF, then fully adjustable ceiling linear diffusers must be employed to be able to direct the discharge air against the perimeter fenestration during the heating season to counter cold downdrafts.

- b. For all above split heat pump and VRF heat pump system types (cassette units, above the ceiling ducted units and floor mounted VRF units) serving spaces exceeding 450 BTUH/LF heating load, provide electric baseboard in each of the spaces for Auxiliary Supplemental Heating.
 - c. For vertical unit ventilators serving spaces with less than or equal to 450 BTUH/LF heating load, Auxiliary Supplemental Heating is to be provided by integral electric heaters located inside the vertical unit ventilators. **If the heating load is less than or equal to 250 BTUH/LF, then standard ceiling diffusers may be employed. If the heating load is greater than 250 BTUH/LF but less than or equal to 450 BTUH/LF, then fully adjustable ceiling linear diffusers must be employed to be able to direct the discharge air against the perimeter fenestration during the heating season to counter cold downdrafts.**
 - d. For vertical unit ventilators serving spaces exceeding 450 BTUH/LF heating load, provide electric baseboard in each of the spaces for Auxiliary Supplemental Heating.
2. For terminal heat pump systems, Back-up Redundancy Heating is defined as the electrical heating capacity required that is energized upon a failure of the outdoor air-cooled condensing

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unit (due to refrigerant leak, compressor failure, etc.) and thus the terminal heat pumps cannot deliver any heating capacity.

- a. Back-up redundancy electric heating is required for DOAS units to guarantee at least 65°F tempered ventilation air can be provided in the event of a failure of the DOAS heat pumps.
- b. For split heat pumps, VRF heat pump systems and vertical unit ventilators, provide back-up redundancy heating the same as defined above for auxiliary supplemental heating. Note that the back-up redundancy heating capability will envelope the case of auxiliary supplemental heating and will be the determining factor in sizing the electrical resistance heaters.

B. General HVAC Design

1. Split heat pumps, packaged heat pump vertical unit ventilators and Variable Refrigerant Flow (VRF) systems may be used in certain projects as addressed in Design Requirements 6.2.0, 6.2.3 and 6.2.4.
2. For occupied spaces, the following heating/cooling systems may be used (subject to meeting the space acoustical requirements):
 - a. One to one (one indoor unit to one outdoor unit) split heat pumps
 - b. VRF systems (several indoor units to one outdoor unit)
 - c. Packaged vertical unit ventilator heat pumps that draw in outdoor ventilation air and exhaust relief air from occupied spaces by utilizing a perimeter wall louver equipped with splitter plate.

Refer to Design Requirements 6.2.0, 6.2.3 and 6.2.4 for further clarification of when each type of system may be used.

The constant volume heat pump Dedicated Outside Air System (DOAS) units providing ventilation air to non-assembly spaces may be packaged roof mounted units or be split type units located in a Mechanical Equipment Room (MER) depending on available roof space, height of the building, aesthetics (if developer is involved) and available space inside the building. The Mechanical Designer shall coordinate with the Architect. Roof mounted units are preferred to provide as much space as possible inside the building for educational purposes. **This must be tempered with the need for site specific PV and green roofs, which might then require interior Mechanical Equipment Rooms (MERs) to be utilized for the air handling units.**

3. Where a central DOAS unit may not be appropriate due to ceiling heights, a local Energy Recovery Ventilator (ERV) may be considered. Local ERV has its own outside air intake and exhaust louvers. **Since the ERV does not have any cooling coil, the terminal systems must provide latent cooling as well as sensible cooling. Designer is to verify that the terminal systems have enough latent heat removal capacity.**

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4. Allowable refrigerant concentration levels:

Systems shall be designed with the intent that the maximum developed refrigeration concentration will not exceed **the EDVC values calculated in accordance with ASHRAE 15-2022**. Refer to Design Requirement 6.2.36.

5. All A1 and A2L refrigerant tubing joints are to be brazed. Flared compression fittings may be used only at the terminal equipment connections. Manufacturer provided flexible annealed pre-insulated tubing systems may be utilized. Mechanical press fittings for refrigerant lines are not allowed.
6. Provide local condensate pumps and condensate drain piping for all inside split heat pumps or inside VRF units and vertical unit ventilators.
7. If a VRF system is selected for the project for buildings less than or equal to 20,000 SF, the preference is to provide closet mounted MERV 13 equipped floor mounted multi-position ducted VRF units in each space if closets can be utilized (**for ease of maintenance**). If utilization of closets is not an option, provide MERV 13 equipped ceiling hung cassette or above the ceiling ducted VRF heat pump system indoor air handling units (2-4 tons) in each space and VRF condensing unit located on the roof. The 20,000 SF limitation for ceiling units is enforced because filter maintenance must be performed using a ladder to access the 10' high ceiling hung units. For buildings not exceeding 20,000SF, where the interstitial space between the suspended ceiling and above floor structural members precludes the use of ceiling hung units, provide closet located floor mounted ducted units. Closet located floor mounted ducted VRF units are to be provided for buildings with more than 20,000 SF to avoid an excessive number of spaces requiring filter maintenance utilizing ladders.
8. Designer shall reject any split heat pump or VRF submittals made by non-OEM Certified Installers. Submittals for refrigerant tubing, fittings, and equipment must be by OEM Certified Installers.
9. The terminal heating capacity of the split heat pump units, VRF units and packaged heat pump vertical unit ventilators must be determined without taking credit for intermittent capacity (passive solar heating, heat from lights, heat from equipment and body heat from occupants). The unit terminal heating capacity must be able to maintain an occupied space setpoint of 72°F and heat up the 65°F decoupled ventilation air to 72°F. Terminal units must also have extra reserve capacity to heat up the space from an unoccupied 55°F setback temperature to an occupied 72°F setpoint (while at the ASHRAE design winter outside air temperature of 13°F).
10. All auxiliary supplemental/back-up redundant electric resistance heating is to be controlled by the heat pump controller such that the resistance heating is last on, first off and DX heat pump heating is the primary heating mode.
11. Consideration should be given to the limited space latent load removal capacity of the **split/VRF** terminal units due to their limited coil sizing. Therefore, the **DOAS** ventilation units should be designed to provide the latent load removal capacity to supplement the latent removal capacity of the **split/VRF** terminal units so that a maximum 50% relative humidity (at 78°F) can be maintained in the occupied spaces.

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Capital Improvement Projects



12. The design of all heat pump units (DOAS, VRF, split units, vertical unit ventilators) must take into account the reduced heating capacity of the heat pumps during the heating season when the outside air temperature is 13°F (not 47°F which is the standard AHRI rating temperature of heat pump units) by providing auxiliary supplemental electric heating capacity **as required**.
- C. Special Capacity Projects (3K, Pre-K) Classrooms and Offices, Exercise Rooms (Playrooms), Regardless of Ceiling Height: Refer to 3K/Pre-K HVAC System Selection Matrix.
1. Where standard SCA systems are not feasible, more costly to install, or project duration is **short**, provide Classrooms, Offices and Exercise Playrooms with either split heat pumps, Variable Refrigerant Flow (VRF) systems or packaged vertical unit ventilator heat pumps.
 2. Provide stair towers, toilets, and janitors closets with electric heaters if perimeter located.
 3. If a DOAS unit is not appropriate due to ceiling heights, a local Energy Recovery Ventilator (ERV) may be considered. **Refer to paragraph B.3 above.**
 4. For packaged heat pump vertical unit ventilators, utilize local outside air intakes/exhausts for each unit to provide ventilation air.
- D. For special CIP projects similar to library upgrades, health clinics, etc. where standard SCA systems are not feasible, more costly to install, project duration is **short**, or the Authority has chosen the project for a Deep Energy retrofit, use of the above systems may be considered and is to be discussed with the Authority.

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capacity provided by the heat pump plant should the chiller/heaters fail (to achieve the same redundancy that the former fossil fuel boiler plants provided). For backup redundancy heating, provide two electric boilers each at 37.5% capacity for a total of 75% backup capacity.

- E. Air to water heat pump chiller/heaters shall have a capacity that is the maximum of the heating load as compared to the cooling load. Chiller/heaters are not to be sized based on just the cooling load whereby the boilers would then be expected to make up any shortfall of chiller/heater heating capacity. This requirement is to be able to use the chiller/heaters as much as possible to meet the heating load and rely less on usage of the electric boilers.
- F. For the chiller/heater design, the electric boilers shall be provided in the secondary loop of a primary glycol water/secondary water (no glycol) loop system. Secondary loop boilers are to be utilized when the secondary loop utilizes hot water fin tube radiation units (or convectors or cabinet unit heaters), or dual temperature fan coil units with ECM fan motors. Refer to Standard Detail 1598510e.
- G. When fin tube radiation (or convectors or cabinet unit heaters) are provided in the secondary loop, the temperature of the secondary loop hot water supply discharging from the primary/secondary loop heat exchanger is increased to nominally 135°F (when the outdoor temperature is nominally 13°F) by the secondary loop hot water boiler acting in an auxiliary supplemental heating mode. The discharge water temperature being supplied by the electric boilers is reset to be cooler than 135°F based on current outdoor air temperature if warmer than 13°F. In this arrangement, the secondary loop electric boilers also provide emergency back-up redundant heating at 75% of the secondary loop heating needs should the primary loop air to water heat pump chiller/heater plant fail.
- H. When dual temperature fan coil units with ECM fan motors are provided in the secondary loop, it is anticipated that the water temperature being discharged from the primary/secondary loop heat exchanger will be nominally 120°F at 13°F outdoor air temp which represents a 5°F approach relative to the nominal 125°F chiller/heater plant discharge temperature (at 13°F outdoor air temperature). It is not anticipated that the heat exchanger discharge water temperature will need to be further boosted. This is because the dual temperature fan coil units are sized based on the cooling load and the fan coil units have active fans to assist in the heat transfer process (unlike the fin tube radiation/convectors without fans where the heating surface area is just sized for only the heating load).
- I. **Note that the air handlers and vertical unit ventilators in the primary loop require electrical resistance heaters for auxiliary supplemental/back-up redundancy heating since the secondary loop electric boilers do not provide any auxiliary supplemental/back-up redundancy heating capacity for the primary loop.**
- J. All approved chiller/heater plant manufacturers listed in Section 15661 can provide 125°F hot water at 13°F outdoor air temperature and this performance should be assumed in the basis of design. Some chiller/heater manufacturers provide even better performance and hence would rely less on the electric boiler plant to boost the heat exchanger discharge water temperature; however, the designs shall be based on common ground that all approved manufacturers can meet. Designer is to select the air handling unit coils and primary/secondary heat exchanger design (and hence secondary loop hot water supply temperature) considering the minimum performance requirements of 125°F supply water from the chiller/heaters at 13°F outdoor air temperature.

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- K. When the electric boilers are in the secondary loop and the secondary loop utilizes hot water fin tube radiation, hot water convectors, or dual temperature fan coil units with ECM fan motors, the primary loop supply water temperature to the primary loop air handling units and heat exchanger must be greater than the secondary supply water temperature to the secondary loop terminal units (determined by the approach of the heat exchanger). The primary loop return water temperature from the heat exchanger must be greater than the secondary loop return water temperature to the heat exchanger. Designer shall verify that the heat exchanger has the proper primary and secondary supply and return water temperatures.
- L. For chiller/heater plant primary loop design, Designer is to consult the air to water heat pump chiller/heater manufacturer to verify that the primary loop has the required minimum water volume from the piping and air handling unit coils/heat exchanger. If necessary, provide a thermal storage tank to supplement the piping and air handling unit coils/heat exchanger water volume to provide the manufacturer required minimum volume of water.
- M. Per Section 6.5.4.7 of ASHRAE 90.1-16 (Appendix CA of the 2020 NYC ECC), dual temperature coils (when utilizing chilled water) shall be selected to provide a 15°F or higher temperature difference between leaving and entering water temperatures across the air handling unit coils and a minimum of 57°F leaving water temperature from the air handling unit coils at design conditions.

Energy Code Exceptions are as follows:

1. Chilled-water cooling coils that have an air-side pressure drop exceeding 0.70 in. of water when rated at 500 fpm face velocity and dry conditions (no condensation).
 2. Individual fan-cooling units with a design supply airflow rate 5,000 cfm and less.
 3. Constant-air-volume systems.
 4. Coils selected at the maximum temperature difference allowed by the chiller.
 5. Passive coils (no mechanically supplied airflow).
 6. Coils with design entering chilled-water temperatures of 50°F and higher.
 7. Coils with design entering air dry-bulb temperatures of 65°F and lower.
- N. For the Basis of Design, Designer may select a manufacturer that uses a step/stage control system where each module has its own isolation valve or select a manufacturer that modulates all modules in unison without the need to have each module have its own isolation valve. Schedule of Equipment and Drawings will show either control scheme, but Designer need not edit specification to only show their basis of design control scheme. Should the contractor submit an alternate manufacturer other than the basis of design that uses a different control scheme, designer shall evaluate that as a possible alternative to the basis of design.
- O. Refrigeration equipment such as air to water heat pumps shall be listed and labeled to UL 1995-2011 for A1 refrigerants. As per ASHRAE 15-2022, air to water heat pumps shall be listed and labeled to UL 60335-2-40 for A2L refrigerants (or ETL equivalent listed/labeled). During design, chiller heaters are to be selected utilizing A2L refrigerants such as R32 and R454B, for as of January 1, 2024, such units are not permitted to be manufactured for use in NY State utilizing A1 refrigerants. Designer must verify that the appropriate listing is indicated on the Shop Drawings. If during construction a proposed unit was manufactured prior to the cut-off date, the unit may utilize A1 refrigerants (R410A, R134a or R407C).

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6.3 Fire Protection

6.3.1 Sprinkler System Design

Description/Design Approach:

A. Sprinkler System Requirements for New Buildings, Additions & Major Modernizations

1. **Provide** a wet pipe automatic sprinkler system throughout the building, except in those areas exempted by the **2022 NYC Building Code per the exceptions to Section BC 903.2 of the 2022 NYC Building Code**, such as electrical equipment rooms, elevator machine rooms, main telecom room and intermediate telecom closets (**the exception taken for omitting sprinklers in telecom rooms and closets is based on a code interpretation that the NYC DOB issued to the SCA via an e-mail dated June 23, 2014**).
2. As per Section BC 903.2.3, an automatic sprinkler system shall be included in the design of new school buildings with the following conditions:
 - Throughout all school facilities with a fire area greater than **12,000 sq. ft.** **When the fire area in a building area is below the 12,000 SF fire area limit threshold**, the Authority must be involved in any decision **to omit the automatic sprinkler system**, as **other agreements with the FDNY** may compel **the installation of sprinklers**.
 - Throughout every portion of the school below the level of exit discharge
Exception: the automatic sprinkler is not required in any fire area or area below the level of exit discharge if every classroom in the school has at least one exterior door at ground level without intervening corridors, passageways or exit enclosures.
 - a. As per Section BC 903.2.11.2, an automatic sprinkler system shall be installed throughout every above-grade level story of buildings/schools below a height of 100 ft., other than the first story or ground floor, on which access is not provided directly from the outdoors by at least one window or readily identifiable access panel within each 50 ft. or fraction thereof of horizontal length of every wall that fronts on a street or a frontage space required pursuant to Section **BC 501.3.1**.
 - b. As per Section BC 903.2.11.3, an automatic sprinkler system shall be installed throughout every first basement or cellar story below grade of buildings on which access is not provided directly from the outdoors within 100 ft. or fraction thereof of horizontal length of every wall that fronts on a street or frontage space required pursuant to Section **BC 501.3.1**.
 - c. As per Section BC 903.2.11.7, an automatic sprinkler system shall also be provided throughout schools with a floor level having an occupant load of 30 or more that is located 55 ft. or more above the lowest level of Fire Dept. vehicle access.
 - d. Per Section FC **503.3.2 of the 2022 NYC Fire Code**, an automatic sprinkler system shall be provided in building **designs irrespective of the** limitations indicated above where the building lies on a public street that has an **unobstructed width of less than 34 feet**. In **existing buildings undergoing an alteration or a change in occupancy that front a**

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street with substandard width (i.e. 34 feet), a sprinkler system must be added if one did not exist.

3. The design of an automatic sprinkler system shall be in accordance with Section BC 903, NFPA 13-16, as amended in Appendix Q, **Section Q102, of the 2022 NYC Building Code**, and the **2022 NYC Fire Code**
4. In accordance with **Section 8.15.5.1** of NFPA 13-16, sidewall spray sprinklers shall be installed at the bottom of each elevator hoistway, not more than 2 feet above the floor of the pit. The sprinklers at the bottom of the hoistway required by the above shall not be installed for enclosed non-combustible elevator shafts that do not contain combustible hydraulic fluids (i.e. geared traction elevators).
5. As per **Section 8.15.5.4** of NFPA 13-16, ordinary or intermediate temperature rated, upright or pendant spray, sprinklers shall also be provided at the top of elevator hoistways unless the hoistway for the passenger elevators is non-combustible and the car enclosure materials meet the requirements of ASME A17.1-2013, Safety Code for Elevators and Escalators. A policy of no use of combustible materials in the car enclosure is a feature among others required by the Authority in Division 14, Conveying Systems.
6. Sprinklers shall be provided in all Classroom/Office Wardrobes and Material Supply Closets.
7. Per Section 8.15.2.3 of NFPA 13-16, where accessible vertical shafts have noncombustible surfaces, one sprinkler shall be installed near the bottom. Per Section 8.15.2.2.1 of NFPA 13-16, where vertical shafts have combustible surfaces, one sprinkler shall be installed at each alternate floor level. If the shaft having the combustible surfaces is trapped, an additional sprinkler shall be installed at the top of each trapped section.
8. Per **Section 8.15.3.2** of NFPA 13-16, in noncombustible stair shafts with noncombustible stairs, sprinklers shall be installed at the top of the shaft and under the first landing above the bottom of the shaft. Where noncombustible stair shafts are divided by walls or doors, sprinklers shall be provided on each side of the separation. Sprinklers shall also be installed beneath landings or stairways where the area beneath is used for storage.
9. Refer to Design Requirement DR 6.3.5 for seismic requirements for sprinkler and standpipe systems. In addition, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 **NYC Building Code** and interpretations by the DOB relating to such determination. Any applicable seismic loads and requirements shall be permitted to be determined in accordance with Chapter 16 of the **2022 NYC Building Code** or the 1968 Building Code and Reference Standard RS-9-6 of such code.
10. Additions/Major Modernizations
 - a. As per Section BC 901.9.3, fire protection systems, **including sprinkler systems**, shall be provided in enlarged portions of schools and where the fire protection provisions of Section BC 901 would require a sprinkler system in new construction for a space or building.
 - b. As per Section BC 901.9.4.1, if the value of alterations to a school equals or exceeds 60% of the value of the existing school, the entire school shall be made to comply with

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the fire protection requirements of the Section BC 901 as if the school were hereafter erected.

- c. As per Section BC 901.9.4.2, if the value of alterations of a space is between 30% and 60% of the value of the existing school those portions of the school being altered shall be made to comply with the fire protection requirements of Section BC 901.
- d. As per Section BC 901.9.2, where a change is made in the main use or dominant occupancy in a building, the entire building shall be provided with a sprinkler system as if the building were hereafter erected. A change in the occupancy group classification, or usage of a space/ room, shall also trigger sprinkler requirement for the space.
- e. Sprinklers required due to a change in use of a space(s) or room(s) may not be needed if the space(s) or room(s) were built and classified as “G Occupancy” per the 1968 Building Code and can now be classified as “E Occupancy”, the equivalent of the retired “G Occupancy”. Refer to DR 1.3.2.1 – Occupancy Classifications for Rooms and Spaces in School Buildings.

B. Sprinkler Requirements for Capital Improvement Projects (CIP)

- 1. As per Section BC 901.9.1, additions, alterations, renovations or repairs to an existing sprinkler system shall conform to that required for a new sprinkler system without requiring the existing system to comply with all of the requirements of the **2022 NYC Building Code**, except as otherwise required in Sections BC 901.9.2 through BC 901.9.6. Additions, alterations or repairs shall not cause an existing installation to become unsafe, hazardous or overloaded.
- 2. Minor additions, alterations, renovations and repairs to existing sprinkler system shall meet the provisions for new construction unless such work is done in the same manner and arrangement as was in the existing system, is not hazardous and is approved. Refer to Section BC 901.9.1.1.
- 3. Sprinkler requirements listed in this section for CIP projects also apply to Section A for New Buildings, Additions and Major Modernization projects.
- 4. As per Section BC 901.9.2, a change in the occupancy group classification, or in the usage of a space or rooms, shall trigger sprinkler requirement for the entire space if required by the code (refer to paragraphs below, which apply when changing the space or occupancy). However, the sprinkler requirement due to a change in the use of a space or rooms does not apply to spaces or rooms built and classified as “G Occupancy” per the **1968 NYC Building Code** and which may now be classified as “E Occupancy”, the equivalent of the retired “G Occupancy”. Refer to DR 1.3.2.1 – Occupancy Classifications for Rooms and Spaces in School Buildings.
- 5. An automatic sprinkler shall be installed in the following areas:
 - a. As per Sections BC 903.2.9 and BC 903.2.9.1, in Storage Group S-1 occupancies and subject to the following conditions:
 - The fire area of the S-1 occupancy exceeds 500 sq. ft.

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11. The Designer shall identify all concealed spaces requiring sprinkler protection per Section 8.15.1 of NFPA 13-16 (concealed spaces enclosed wholly or partly by exposed combustible construction or used for the storage of combustible materials or contain combustibles associated with building system features such as large bundles of computer wiring, large quantities of non-metallic piping, etc.). Sprinklers need not be provided in concealed spaces if the conditions defined in Sections 8.15.1.2.1 through 8.15.1.2.16 and 8.15.6 are met.

C. General Design

1. Sprinkler layout drawings shall be dimensioned, including pipe sizes, distance between heads, and distances to walls, and shall include standard sprinkler notes as required by the NYC Building Code.
2. **Devices for valve supervision** shall be installed on water **valve** services supplying water to the sprinkler system. Flow switches, **typically part of a floor control valve assembly that includes the flow switch, a shut-off valve, and an inspector's test tee etc.**, shall be installed **throughout**. System shall produce a water flow alarm and shall be capable of indicating the floor where the sprinkler head was activated. Sprinkler alarm bell and sign associated with flow switches shall be provided under Electrical.
3. The system shall be hydraulically designed utilizing the most cost effective of the "tree" type or "loop" type configuration. **Hydraulically designed systems** shall comply with the requirements of NFPA 13-16, as modified by the **Section Q102**. A sprinkler booster pump or a fire pump shall be provided if the hydraulic calculations indicate that the street **water** pressure is inadequate to **provide the proper water pressure at the highest/most remote** floor sprinkler heads. The engineer shall submit hydraulic calculations **for the proposed sprinkler design** complete with **hydrant flow test results from the DEP**. **Use a ten (10) psi** safety factor in the hydraulic calculations **for the proposed sprinkler design**.
4. During reviews of the design and shop drawings submitted by the Contractor's engineer during the construction phase, the Engineer of Record (EOR) shall not approve reduction in size of risers, mains, and sub-mains. Only branch piping **and its size** may be revised by the **Contractor for** accommodation of any need for additional sprinkler heads or the rerouting of piping due to interferences. The EOR shall ensure that hydraulic calculations required to be submitted by the Contractor's engineer provide for the minimum ten (10) psi safety factor as per the original design. As per a decision made by the Authority and as included in the specifications for the project, the Contractor's engineer shall supersede the original applicant and shall become the Engineer of Record for the Fire Protection system and will be responsible for all subsequent filings with BCC.
5. Per Section BC 903.1.2.4, in buildings where a new separate fire sprinkler system is required, the available water pressure at the top and bottom floors of each zone shall be shown on the riser diagram.
6. Installation of automatic sprinkler systems shall comply with the Special Inspection requirements of the Building Code, Chapter 17
7. **Where a fire standpipe system is required, the preferred fire protection system is a combination standpipe and sprinkler system.**

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6.3 Fire Protection

6.3.2 Fire Standpipe and Hose System Design

Description/Design Approach:

A. Standpipe System Requirements for New Buildings, Additions and Major Modernizations

1. Standpipe and hose systems, where required by the **2022 NYC Building Code**, shall be installed in accordance with NFPA 14-2016, Standard for the Installation of Standpipe and Hose Systems, as modified in Appendix Q, **Section Q105**, of the **2022 NYC Building Code**. **Where both a standpipe and an automatic sprinkler system must be provided, the designer shall design a combination manual wet standpipe and automatic sprinkler system for low-rise school buildings and a combination automatic wet standpipe and automatic sprinkler system for high-rise school facilities.**
2. Standpipe systems shall be installed where required by Section BC 905.3.1 (Applicability) and Section BC 905.3.5 (Underground Buildings) **of the 2022 NYC Building Code** and in the locations indicated in Section BC 905.4. Standpipe systems are permitted to be combined with automatic sprinkler systems per Section BC 905.3; **and as indicated above, combining the standpipe and the sprinkler system must be considered first, whenever possible.**
 - a. **A class I standpipe shall be installed as is permitted by BC 905.3.1, and provided that the conditions relating to the requisite number of storage cabinets plus tools for combatting a fire, and signage, as outlined in the exception provision of Section BC 905.3.1, are complied with. A class I standpipe shall be installed in the following buildings:**
 - 1) In buildings two stories or more in height with floor area of 10,000 square or greater on any story;
 - 2) In buildings 3 stories or more in height with floor area of 7,500 square feet or greater on any story;
 - 3) In buildings of any area with a floor level having an occupant load of 30 or more that is located 55 feet or more above the lowest level of fire department vehicle access.
 - 4) In buildings of any area, constructed in accordance with Section BC 403 (high-rise buildings), with occupied floors located 75 feet or more above the lowest level of fire department vehicle access.
 - b. **As per Section BC 905.3.8, buildings with a rooftop garden, landscaped roof, green roof or roof used for any purpose other than weather protection or maintenance that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the rooftop garden, landscaped roof, green roof or roof used for any purpose other than weather protection or maintenance.**

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- c. As per Section BC 905.3.5, underground buildings shall be equipped throughout with a class I automatic wet or manual wet standpipe system.
 - 1) **Where an automatic wet standpipe system is provided in a high-rise school, such automatic wet standpipe system shall be extended to portion of the building that is located below grade.**
- 3. Additions/Major Modernizations/Capital Improvement Projects
 - a. As per Section BC 901.9.3, fire protection system shall be provided in enlarged portions of schools and where the fire protection provisions of Section BC 901 would require a standpipe system for a space or building.
 - b. As per Section BC 901.9.4.1, if the value of alterations to a school equals or exceeds 60% of the value of the existing school, the entire school shall be made to comply with the fire protection requirements of Section BC 901 as if the school were hereafter erected.
 - c. As per Section BC 901.9.4.2, if the value of alterations of a space is between 30% and 60% of the value of the existing school, those portions of the school being altered shall be made to comply with the fire protection requirements of Section BC 901
 - d. As per Section BC 901.9.2, where a change is made in the main use or dominant occupancy in a building, the entire school shall be provided with a standpipe system as if the building were hereafter erected.
 - e. Per Section BC 901.9.5.2, where an alteration includes the addition or replacement of an entire exit stair shaft that is a required means of egress, the entire shaft shall be equipped with a standpipe in accordance with Section BC 905.
 - f. Per Section BC 901.9.5.3, where the alteration involves the addition of stories to a school with an existing standpipe system, and one or more stair shafts are not currently equipped with standpipes, standpipes shall be provided to all stair shafts in accordance with Section BC 901.

Exception: additional standpipes are not required where:

- 1) The alteration involves the addition of only one (1) story.
- 2) Existing standpipe in existing stair shafts are extended in accordance with Section BC 901.
- 3) Standpipe hose connections are provided in compliance with Section BC 905.4 Item 6; and
- 4) The demand on the standpipe system, including any additional demand, with respect to flow and pressure does not exceed the capacity of the existing approved system



- g. As per Section BC 901.9.5.4, where an alteration involves the addition of stories to a school with no existing standpipe system, standpipes shall be provided to all stair shafts in accordance with Section BC 901.

Exception: standpipes are not required where:

- 1) The alteration involves the addition of only one (1) story
 - 2) The completed building does not exceed 7 stories; and
 - 3) The completed building does not exceed 85 ft. in height
4. Dry standpipes shall not be installed except where subject to freezing and in accordance with NFPA 14-16 as per Section BC 905.8.
5. Hydraulically designed standpipe system shall be designed to provide a minimum residual pressure of 65 psi (per **Section Q105** modifications to NFPA 14-16 Section 7.8.1).
6. As per Section BC 905.3.4, stages greater than 1,000 square feet in area and any assembly occupancy with a stage and an occupant load of 1,000.00 or greater shall be equipped with a Class III wet standpipe system with a hose station (with a 1.5-inch and 2.5-inch hose connections **per Section BC 905.6**) on each side of the stage.

B. General Design

1. Construction documents for standpipe systems (per Section BC 905.1.1) shall contain plans that include at least the following data and information:
 - a. The locations and sizes of all risers, cross-connections, hose racks, valves, hose connections, Fire Department connections, sources of water supply, piping, and other essential features of the system. As per Section 7.3.1.2 of NFPA 14-16, hose connections shall not be obstructed by the closed or open door or other objects on the stair landing. Size and location of cabinet must also take into account the likelihood that a pressure restricting device might be required for limiting the residual pressure at the hose connection. Coordinate location with Project Architect.
 - b. A floor plan for each group of floors that have typical riser locations and no special features within such group of floor levels, with the indication in title block of such plan indicating clearly the floors to which the arrangement is applicable.
 - c. A riser diagram showing the essential features of the system, including the risers, cross-connections, valves, Fire Department connections, tanks, pumps, sources of water supply, pipe sizes, capacities, floor heights, zone pressures, and other essential data and features of the system.
 - d. The available water pressure at the top and bottom floors of each zone, and at each floor where the weight pipe fittings change, shall be shown on the riser diagram.



- e. For street pressure-fed systems and fire/sprinkler booster pumps, a statement from the New York City Department of Environmental Protection, giving the minimum water pressure in the main serving the building.
- 2. Installation of Fire Standpipe Systems shall comply with the Special Inspection requirements of Section BC **1705.30**.
- 3. Refer to the Design Requirement, DR 6.3.5 for Seismic Requirements for Sprinkler and Standpipe Systems. In addition, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 Building Code and interpretations by the DOB relating to such determination. Any applicable seismic loads and requirements shall be permitted to be determined in accordance with Chapter 16 of the **2022 NYC** Building Code or Reference Standard RS-9-6 of the 1968 NYC Building Code.



6.3 Fire Protection

6.3.3 Sprinkler Floor Control Valve Assembly Location

Description/Design Approach:

- A. The preferred location for the floor control valve assembly for the sprinkler system is in a janitorial closet space. If the layout of the system piping will not facilitate placing the valve assembly in the janitor closet, it shall be located in a stairwell and enclosed in a recessed cabinet. Construction documents shall show the recessed cabinet. The floor control valve assembly is required for low-rise as well as high-rise buildings.**
- B. The floor control valve and its related piping, including the drainage pipe, shall run exposed when placed inside a janitorial closet.**
- C. When placed in the stairwell, the valve assembly mounted inside the cabinet shall be so arranged as to provide for proper clearance for valve operation. The cabinet shall be a lockable type with door and handle. It shall be labeled with permanently affixed white letters not less than 2 inches high on a red background that reads "Floor Control Valve". The Contractor has the option of creating a recessed panel instead of providing a recessed cabinet, but accessing the inside of the recessed panel shall be via custodial type tools and the wall fire rating in the stairwell must be maintained.**



6.3 Fire Protection

6.3.5 Fire Protection Seismic Design Criteria

Description/Design Approach:

- A.** As per Section BC 1613.1 of the **2022** NYC Building Code, every new school building structure, and portions thereof, including nonstructural components (architectural, MEP, fire protection) that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with **ASCE 7-16**, excluding Chapter 14 and Appendix 11A. The Seismic Design Category will be determined by the structural Engineer of Record and indicated on the structural drawings.
- B.** Per Section BC 1601.2.3, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 NYC Building Code and interpretations by the DOB relating to such determinations. Refer to Local Law 17/1995 and TPN 4/99. Any applicable seismic loads and requirements, including the bracing of the fire protection system and equipment, shall be permitted to be determined in accordance with Chapter 16 of the **2022** NYC Building Code or reference standard RS 9-6 of the 1968 NYC Building Code.
 - 1.** If an existing building is required to meet seismic requirements as per the criteria described in DR 3.1.3 and a waiver from the Department of Buildings (DOB) cannot be obtained, the fire protection retrofit work must then meet such requirements.
- C.** For new additions, any fire protection related item in the existing building that is integrated with the system in the new addition that is required to function after an earthquake shall also meet the seismic requirements of the addition. Existing bolting of equipment to its pad and doweling of pad to floor slab shall be analyzed.
- D.** New School Buildings and Additions constructed after LL17/1995 went into effect are subject to the seismic requirements of the New York City Construction Codes and are considered Structural Occupancy/Risk Category III, “Buildings and other structures that represent a substantial hazard to human life in the event of failure” for seismic design as per BC Table 1604.5.
 - 1.** Seismic Design Category shall be determined by the project structural engineer. The Seismic Design Category for a structure is determined in accordance with Section BC 1613. The Seismic Design Category is to be indicated on the Structural Drawings (Refer to Detail 0100054a) and Component Importance Factors related to fire protection shall be indicated on the Fire Protection drawings. (Refer to Standard Detail 1530301a).
 - 2.** Component Importance Factors (I_p) are prescribed in **Chapter 13 of ASCE 7-16**. The following components have $I_p=1.5$ (Refer to Standard Details 1550301a for a specific listing of common items):
 - a.** Life safety components required to function after an earthquake. This includes emergency generator systems/standby generators connected to fire pumps/sprinkler booster pumps, fire pumps, sprinkler booster pumps, jockey pumps, gravity storage tank, all piping, etc. Functioning after an earthquake means just long enough to evacuate the building as opposed to functioning as a disaster relief center. Per Section 13.2.2 of **ASCE 7-16**, these items to remain operable following the design earthquake ground

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motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5, analysis or experience data in accordance with Section 13.2.6, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval by the SCA after review and acceptance by the Contractor's registered design professional.

- b. Components with $I_p=1.0$ located above or in proximity to components with $I_p=1.5$ which could damage the $I_p=1.5$ equipment shall be braced.
3. For Seismic Design Category B, all fire protection components are exempt from seismic requirements.
4. For Seismic Design Category C, all fire protection components have an $I_p=1.5$ and shall be designed and constructed to seismic requirements.
5. Appropriate seismic coefficients to be utilized in the design of seismic resistance for the fire protection system shall be those listed in Table 13.6-1 of ASCE 7-16.
6. Fire protection components like pumps, control panels, etc. along with their attachments or supports to the structure shall be designed in accordance with Section 13.4 of ASCE 7-16. They shall be bolted, welded or otherwise positively fastened without consideration of the frictional resistance produced by the effects of gravity. A continuous load path of sufficient strength and stiffness between the component and the supporting structure shall be provided. The component forces shall be those as determined by the calculations outlined in Section 13.3.1.
7. As per Section 13.6.7.2 of ASCE 7-16, sprinkler and standpipe piping, pipe hangers, and bracing designed and constructed in accordance with NFPA 13 shall be deemed to meet the force and displacement requirements of Section 13.6.7. The exceptions listed in Section 13.6.7.3 do not apply.
8. When seismic design is required, generic seismic restraint details shall be shown on the contract drawing bid set. A note shall be added stating, "Details are shown to illustrate the scope of work. Contractor's registered professional engineer shall provide calculations and be responsible for providing signed/sealed coordinated shop drawings indicating locations of seismic restraints and the required connection details to file with the DOB/BCC".
9. All bracing devices shall be qualified through either analysis or be tested and certified in accordance with ICC-ES AC 156. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to seismic bracing designs must be stamped by the Contractor's Registered Professional Engineer with at least five years of seismic design experience in non-structural building components in New York State.
10. All attachments of hangers and bracing shall be positive attachments that shall be cast-in-place anchors, drill-in wedge anchors, or a welded or bolted connection to structure. Drill-in wedge anchors shall be epoxy adhesive base and shall have an evaluation report number

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from ICC-ES verifying their allowable loads. Anchors must be certified for use in cracked concrete.

- E. The following note is to be included on the fire protection drawings:

"For all items that are required to have seismic supports or restraints, seismic plans and seismic restraint calculations shall be prepared, sealed, and submitted by a Professional Engineer licensed in the State of New York engaged by the Contractor. The Engineer shall provide installation supervision of all seismic supports and restraints. The Contractor's Registered Professional Engineer shall submit signed and sealed affidavit stating that the installation is in full compliance with the signed/sealed shop drawings."



6.3 Fire Protection

6.3.6 Fire Protection Pump Selection

Description/Design Approach:

A. General

Fire protection for schools shall be by either a combined manual wet standpipe and **automatic** sprinkler system or a combined automatic wet standpipe and sprinkler system, depending on whether the structure is a low-rise or high-rise building. The capacity and the type of pump selected for boosting the pressure in a fire protection system **will** depend on the system that is chosen.

B. Low-Rise Buildings

1. For low-rise buildings, provide a **combination** manual wet standpipe and sprinkler system, **in which case the system relies on the** fire department pumper for (aka FDNY fire truck) **providing** the water flow rate and **the** pressure **necessary** for **operating** the standpipe portion of the system. The manual wet standpipe **and automatic wet sprinkler** system allows the designer to **select** a pump that only needs to meet the demands of the sprinkler portion of the fire protection system.
2. **Where** all of the conditions laid out in Appendix Q, **Section Q102**, of the **2022 NYC Building Code** for an accepted use of a sprinkler booster pump are complied with, increasing the water pressure for the fire protection system **shall** in most cases be done using a sprinkler booster pump as is **intended** in Section **9.1.4** of NFA 14-16. **The designer shall pay a special attention to ensure that if a sprinkler booster pump is selected that the water pressure from the city water mains can provide 5 psi at the most remote sprinkler head.** The 5 psi pressure requirement can be omitted if a secondary power supply is provided to drive the sprinkler booster pump and such power is controlled by automatic switching.
3. Determination of the water demand requirements for a sprinkler system shall be done as per the hydraulic calculation methods as outlined in Section 11.2.3 of NFA 13-16. As **permitted by Section 24.2.3.4 of Section Q102**, a sprinkler booster pump shall require only one (1) water service. However, **there shall be a secondary/back-up water source to the sprinkler system consisting of** a connection taken from the domestic water service **as described in DR 6.1.4.**

C. High-Rise Building

1. For high-rise buildings, a combination automatic wet standpipe and sprinkler system shall be provided. The high water flow and pressure demands of a combination automatic wet standpipe and sprinkler system are associated with the building height, **and when the water and pressure needs of the automatic standpipe system are factored into the hydraulic calculations, the pump choice shall be** a fire pump. The fire pump selection shall be made so as to account for the water demand and the residual pressure requirements for the standpipe system as outlined respectively in the hydraulic calculation requirements and the minimum/maximum pressure limits of Sections 7.10 & 7.8 of NFA 14-16 **as amended by Appendix Q, Section Q105, of the 2022 NYC Building Code.**

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2. The reliability and **the** adequacy of two (2) water services from two (2) different streets **for** supplying **water to** the fire pump in a high-rise building shall be investigated during the design, **as two separate sources are required by Section 9.1.4 of Section Q105**. Where **either** two water services are not available or if **one or both** of the two water services lack the capacity to supply the **required** system water flow rate demand, the design shall provide for suction tank(s) capable of storing sufficient volume of water for 1/2-hour worth of the rated capacity of the fire pump.



6.3 Fire Protection

6.3.7 Miscellaneous Fire Protection Drawing Requirements

Description/Design Approach:

- A. The following items shall be shown or taken into account on the Fire Protection Drawings:
1. While the POR provides for a room size for the fire pump room, it is intended as a place holder. Additional equipment, size of the pump, and required clearances may require the space to be larger. Designer is to determine what is needed to be placed in the space and pump size early in the project to determine if a larger room is needed.
 2. MEP equipment and systems not related to the fire pump shall not enter or transverse a fire pump room, which per Section **4.13.1.1.5** of NFPA 20-16 states that fire pump rooms shall be free from storage and penetrations not essential to the operation of the pump and related components. Sprinkler booster bumps may be located in mechanical rooms that have a 2-hour enclosure as per exception 3 of BC 913.2.1 of the **2022** NYC Building Code.
 3. As per Section 110.26(E) of the NYC Electrical Code, ensure that no fire protection piping or equipment is run in the dedicated electrical space above switchboards, panelboards and motor control centers, as a structural ceiling above those items would then be required or a means to collect water from the condensate or leaks that may be produced from the system. In general, avoid running any items other than what is required to service the room. If the space is required to be sprinklered, provide a pan protection system under all piping to keep area protected from condensate and leaks.
 4. Designers must be aware that many older schools have cinder concrete framed slabs and this is to be investigated with the structural engineer. It is not permitted to use post-installed anchors in cinder concrete, and thus drawings should clearly take into account that support of piping, etc. is to be from the structural beams either by direct connection to the beams or from installation of 'unistrut' type supports running between beams. Indicate removal and repair of the beam encasement to facilitate the attachment.

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6.4 Elevators

6.4.1 Elevator Design

Description/Design Approach:

A. New Construction

1. General Background

- a. Traction and hydraulic drives represent the two basic types of passenger/service elevator applications currently acceptable for Authority projects, though for most applications traction elevators are to be utilized.
- b. With respect to the hydraulic application, both the in-ground and holeless type have acceptable track records though both types are very dependent on a plumb installation to prevent leaking of hydraulic fluid. The troublesome well drilling for the jack and the potentially negative environmental impact associated with the in-ground type has contributed to a decline in its popularity. Additionally, watertight casings and PVC liners are required for all in-ground applications and the assurance that the pits are located above the current or anticipated water tables. For new construction, in-ground applications are not to be used. Eclipsing the in-ground is the holeless type with all jacking equipment located above ground, thereby eliminating well drilling and contributing to a more “green” product.
- c. In its simplest form, a single stage holeless is limited to a travel distance of approximately 13’-0”, with a second stage added to the jacking system to extend the travel to approximately 22’-0”. However, additional stages are not recommended. Higher travel distances using hydraulic types are typically achieved through the use of a dual roped hydraulic unit, a variant of the holeless type. Roped hydraulic elevators were developed to expand the travel of hydraulic elevators to approximately 60’-0” of travel. Another version of the roped hydraulic is the counterweighted roped hydraulic, which utilizes a counterweight mounted on top of the jack assembly. The introduction of a counterweight reduces the overall power requirement of the unit and makes the system more economical, but due to the limited number of manufacturers they are not widespread and thus the counterweighted roped hydraulic elevators are not to be considered for Authority projects.
- d. Holeless applications employing a cantilever design create considerable torque upon the guide rails, necessitating supplemental structural supports and are not considered for Authority Projects.
- e. Most elevator travel distances for SCA projects are expressed in the number of floors based on the 14 to 15 feet of travel. Thus specific selection at the limits of the elevators is to be discussed and actual travel distance in feet determined.

2. Elevator Selection Criteria

All proposed application designs shall be submitted to the Authority for review during the Design Development Phase. The Consultant is required to obtain the services of an elevator

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consultant to recommend the selection and provide the Contract Documents for the elevator, as well as provide the other required design data to the other trades.

- a. For travel distances of one floor, provide a direct acting holeless hydraulic elevator with a rated speed of 125 fpm.
- b. For travel distances of two floors or greater, provide an overhead gearless traction 1:1 roped unit (with regenerative drive) with a rated speed of 200 fpm. As an alternate in existing or new schools, if the design does not lend itself to an overhead traction, a roped hydraulic elevator may be used for up to five floors of travel with a rated speed of 125 fpm.
- c. For travel distances of greater than five floors where the general school population must be moved utilizing the elevators, provide an overhead gearless traction 1:1 roped unit (with regenerative drive) with a rated speed of 350 fpm.

3. Elevator Cab Size and Capacity

- a. For all buildings, except those serving a high population of limited mobility students where a larger elevator may be required, elevators are to be of 3500 lb capacity with a clear cab size of 6'-8" wide x 5'-4" deep (38 SF maximum inside area) and designed to accommodate a 24" by 84" ambulance stretcher (as required by Section BC 3002.4.2 of the 2022 NYC Building Code) in the horizontal, open position. Door must be a 3'-6" side slide door, with single-speed being preferable. Indicate in documents for contractor to provide international symbol for emergency medical services (star of life) for such cabs. All cabs shall have rigidized stainless panels and VCT flooring that complies with Sections 302 and 407.4.2 of ICC 117.1-2009. Elevators sharing a shaft shall be of the same size and capacity regardless of whether they serve a different number of floors and could be of different sizes.
- b. For schools serving a high population of limited mobility students, or where the general student population must be moved to upper floors, elevators are to have a 6,000 lb capacity with a cab size of approximately 6'-0" wide by 9'-8" deep (58 SF maximum inside area) with a preferred 4'-0" single-speed center-opening door. All efforts are to be made to assure the proposed elevator will accommodate three wheel chairs and attendants (if center-opening will not work, provide a 4'-0" two-speed side-slide door).
- c. For 3K and Pre-K leased spaces, which are typically only 2 or 3 stories, elevators are to be if 2100 lb. capacity meeting ADA requirements with a clear cab size of 6'-8" x 4'-3" with single speed side opening door.
- d. Where a dedicated elevator is required to serve the kitchen, provide a 3500 lb. capacity elevator with 4'-0" center opening door.

4. Elevator Quantity

Refer to SCA Design Requirement 1.3.4.5. If building design is such that it will require substantial use of vertical transportation to move students, a written traffic analysis is to be performed by the Architect/Elevator consultant indicating how the population will be moved within a class change period. This may require banks of elevators or elevators of different sizes.

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5. Codes

ASME A17.1, A17.2, A17.3 (for year referenced per Appendix K of the 2022 NYC Building Code and as modified per Appendix K, Chapters K1 and K3) and the 2022 NYC Building Code are the governing codes.

6. Design Criteria

a. Elevator Machine Room

1) For hydraulic elevators, the machine room shall be located adjacent to the hoistway at the lowest landing. For overhead traction elevators, the machine room shall be located directly over the hoistway. In all cases, the machine room shall be sized to accommodate maintenance and replacement of equipment. Provide a minimum of 3'-6" clearance around or in front of equipment as required by the electrical code. Provide 3'-0" minimum clearance above gear housing in traction elevator machine rooms to allow removal. Position vent duct to avoid interferences and maintain appropriate clearance depending on equipment. Coordinate with the electrical engineer to provide adequate power for the elevator, including all auxiliary equipment such as oil heaters, oil coolers, control equipment, etc.

2) Notify the design team of the following:

- Machine room must have the same rating as the hoistway as per Section BC 3005.4.
- Machine rooms shall not be sprinklered or have such piping in the room as per Section BC 3005.5.
- Plumbing systems not related to the elevator machinery shall not enter or traverse the room as per Section BC 3005.6.
- MEP systems not related to the elevator machinery or elevator machine room shall not enter or traverse the room as per ASME A17.1-2013.

b. Fixtures and Entrances

The Authority uses vandal-proof fixtures and standard entrances. They are described in each section of the specifications as well as shown on design details. Approval from the Authority must be obtained prior to any deviation from these details.

- To assist emergency personnel, all elevators shall be provided with digital position indicators located on the car operating panel and in all hall call stations.
- The car-operating panel shall be provided with engraving indicating the "Elevator Inspection Certificate is on file in the Custodial Engineer's Office".
- A master push button/card operated keyswitch shall be integral with the main floor hall fixture. This keyswitch will permit the selection of the access control feature for the elevators.
- If all elevators connected to the emergency generator can run simultaneously (typically for high-rise buildings with three or less elevators), provide an indicator light with the wording "Elevator Emergency Power" on the hall push button station.



c. Controls

Gearless traction elevators shall use a permanent magnet alternating current (PMAC) gearless traction machine. Motor controls for all hydraulic operations shall have solid state starting. Geared traction elevators shall use AC Variable Voltage Variable Frequency drives. Signal controllers shall be solid-state microprocessors.

d. Machine Room Heating/Ventilation

An ambient temperature between 50°F and 90°F and relative humidity of no greater than 95% is to be always maintained in the Elevator Machine Room (EMR). Additionally, hydraulic elevator machine rooms must be vented directly to outside air. Mechanical ventilation is the Authority's preference in order to minimize odors associated with hydraulic oil. Refer to HVAC Design Requirement DR 6.2.28.

e. Generic Equipment

Use only "generic" type equipment in nature and design. This means that the equipment is manufactured by an independent supplier that will sell to any installer and will support any maintenance contractor of the equipment. This applies to, but not limited to, controllers, pump units complete, motor drives, car and hoistway door operating equipment including interlocks and door operators and fixtures. Refer to the specifications for approved manufacturers.

All solid-state signal control equipment must be furnished with complete diagnostic kits and full maintenance information including passwords and codes.

f. Rope Grippers

Rope grippers shall be provided on all new traction elevators. Rope grippers may also be provided on modernized elevators, depending on the scope of upgrading.

g. Hydraulic Elevator Power Unit Design Requirement

For hydraulic elevators, do not use submersible pump motors. Pump motor shall be external w/ v-belt drive or vertical mounted. Hydraulic elevators are to be designed for 120 starts per hour regardless of intended usage in order to provide a factor of safety for future performance. This is typically accomplished by providing more oil in tank and using an oil cooler and is intended to keep the oil viscosity constant.

h. Roped Hydraulic Elevator Overspeed Governor

The governor shall be pit mounted and must be provided with NEMA 4 governor switches and protective cage. Remote set/reset governors are not permitted.

i. Hydraulic Elevator Pits

The pit shall be a minimum of 5'-0" deep and provided with a 2'-0" X 2'-0" X 2'-0" deep bucket sump pit covered with flush-mounted steel grating. All pits are to be equipped with a hard-piped sump pump. An Oil Minder sump pump, or equivalent, shall be provided with an alarm system to prevent the possibility of hydraulic fluid being pumped into the sewer. Provide a dedicated non-GFCI outlet for the sump pump at 4'-0" above

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- 2) A means to display video to observe passengers at any location on the car floor to authorized personnel for entrapment assessment shall be provided as per Section 2.271.1.3(k) of Appendix K, Chapter K1. The location shall be at the same location as the two-way communication systems.

n. Guide Rail Systems

Provide rail backing as required. With respect to 6,000-pound capacity elevators, verify and if necessary coordinate the need for structural supports for the guide rail system, if rail backing is inadequate. For dual roped hydraulics, the designer is to provide to the structural engineer the guide rail forces to be withstood by the guide track, which is required to maintain the plumbness of the pistons. The guide rail track may be attached to the guide rail, and thus supplementary supports are to be indicated on the structural drawings. The guide tracks are a different entity than the guide rails.

o. Miscellaneous Steel Members and Structural Work

Provide the structural engineer with size and location of hoist beams and other miscellaneous steel members required so they are indicated on the structural drawings. Provide size of openings and locations for smoke vents and hatches, etc.

p. Fire Command Center (Applicable to High-Rise Buildings Only)

Provide at the Fire Command Center a digital position indicator, visual "in-use" indicator, elevator emergency power selector switches and two-way communication and visual communication for each elevator in the school.

q. Cab Lighting (Normal and Emergency)

- 1) Cab light energy usage shall comply with the 2020 NYC Energy Conservation Code (NYCECC).
- 2) A battery operated emergency lighting system shall be provided for the elevator car if there is no emergency generator provided to the building. The system shall have the capacity to meet code requirements with respect to lighting and emergency signaling. A minimum of two of the existing cab light fixtures shall be used to provide adequate lighting of the car station.

r. Emergency Power

- 1) The elevator control system shall be designed to interface with existing or future emergency power operation. The emergency power system shall comply with Section 2.27.2 of ASME A17.1-2013 as modified by Chapter K1. Signal wiring from the ATS must be provided to each controller.
- 2) For hydraulic elevators, provide a battery operated auto-lowering device to allow the elevators to descend in case of power failure even if the building has emergency power, as the emergency power will be shut down prior to activation of the sprinkler in the elevator pit. Coordinate with the Electrical Engineer to provide a microswitch for the elevator disconnect switch. Batteries are to be located in the elevator machine room.



- 3) For traction elevators where emergency power is not provided to the building, provide a battery operated auto-lowering device to allow for lowering the elevator to the next lower floor. Batteries are to be located in the elevator machine room.
- 4) Standby power shall be provided for elevators that are part of an accessible means of egress in accordance with Section BC 1009.4.

s. Floor Designations

On elevators with front and rear entrances, the landings served by the rear opening shall have the standard floor designation followed by an "R" to indicate a rear opening. This designation shall be used on the call buttons, Braille plates and position indicators. Elevator landings below grade shall be designated "C" for cellar or "B" for Basement depending on the height of the space above grade.

t. Cab Heater

On elevators with an exterior wall, a cab heater shall be installed. The heater must be powered by an isolated single phase 120VAC electrical feed protected by a NYC approved, fused and lockable disconnect switch. Suitable wiring must be provided in the traveler and hoistway wiring. The cab heater must be designed for elevator use, thermostatically controlled, and provide thermal protection to prevent overheating. Coordinate with the electrical engineer to provide the required power and control systems on the Contract Documents.

u. High-rise Requirements

For buildings with an occupied floor greater than 120 feet above grade, as per Section BC 403.6.1 a minimum of one Fire Access elevator is required to be provided in accordance with Section BC 3007.

v. Signage

Elevators shall have numeric designations. The designation shall be posted at the designated level above or adjacent to the elevator entrance and be a minimum of 2" in height. Each bank of elevators shall be identified by an alphabetic letter. A permanently secured sign indicating the letter of identification shall be posted at each elevator landing. The letter on the sign shall be bold font, minimum of three inches in height and of contrasting color from the background. The sign shall also read "IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE THE EXIT STAIRS" in one-half inch red lettering on white background. The sign shall include a diagram showing location where it is posted and the location and letter identification of the exit stairs on that floor.

w. Other Standards

Refer to other Design Requirements for such items as emergency recall, smoke detection, intercom requirements, etc.

B. Modernizations

- 1. Modernization of elevators should retain the original application type and consist of component replacement in kind, though gearless traction elevators are to be used in lieu of

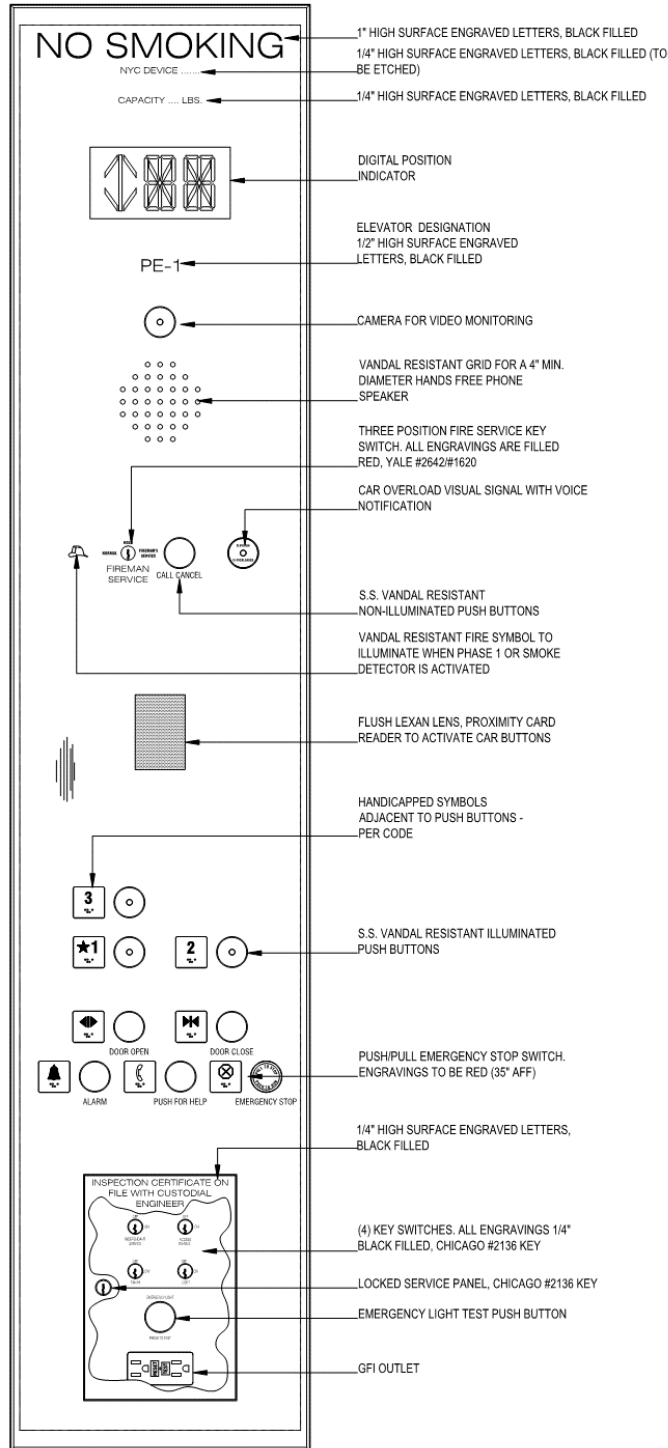
Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



- Dwg. No. 3 - Typical Hall Push Button Stations (Duplex)
- Dwg. No. 4 - Typical Access Stations
- Dwg No. 5- Typical Car Direction Lanterns
- Dwg No. 6 - Typical Fire Service Panel (Simplex and Duplex)
- Dwg No. 7 - Typical Cab Front Center-Opening Enclosure (Top View)
- Dwg No. 8 - Typical Cab Front Center-Opening Enclosure (Elevation)
- Dwg No. 9 - Typical Cab Front & Rear Center Opening Enclosure (Top View)
- Dwg No. 10 - Typical Cab Front & Rear Center Opening Enclosure (Elevation)
- Dwg No. 11 - Typical Cab Single Speed Side Slide Opening Enclosure (Top View)
- Dwg No. 12 - Typical Cab Single Speed Slide Opening Enclosure (Elevation)
- Dwg No. 13 - Typical Cab Deep Enclosure (Top View)
- Dwg No. 14 - Typical Cab Deep Enclosure (Elevation)
- Dwg No. 15 - Typical Center-Opening Elevator Entrance (Top View)
- Dwg No. 16 - Typical Center-Opening Elevator Entrance (Elevation)
- Dwg No. 17 - Typical Single-Speed Side Opening Entrance (Top View)
- Dwg No. 18 - Typical Single-Speed Side Opening Entrance (Elevation)
- Dwg No. 19 - Typical Well Casing Construction for In-Ground Direct Acting Hydraulic Elevators Only
- Dwg No. 20 - Emergency Power Panel (Duplex)



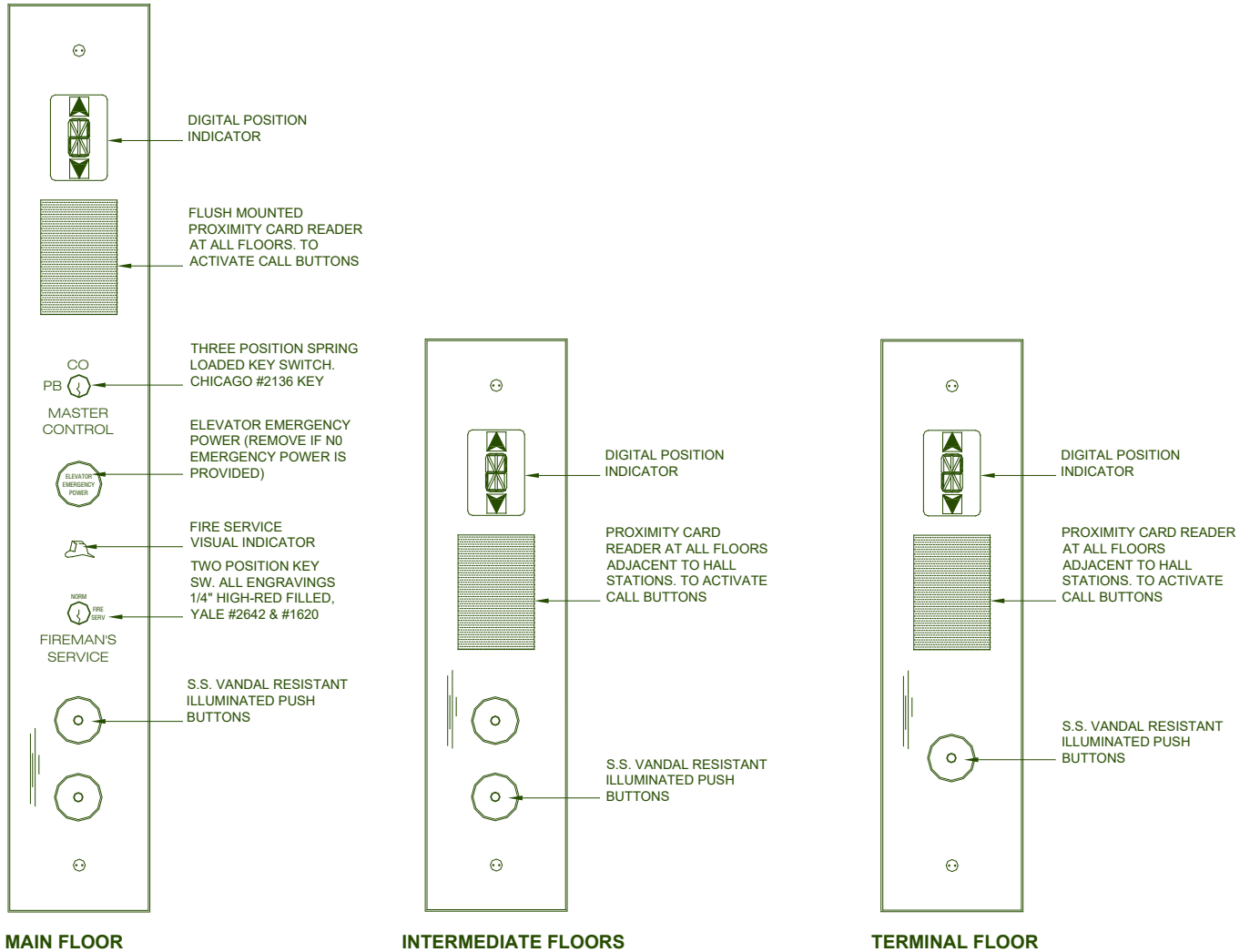
DRAWING No. 1 – TYPICAL CAR OPERATING PANEL



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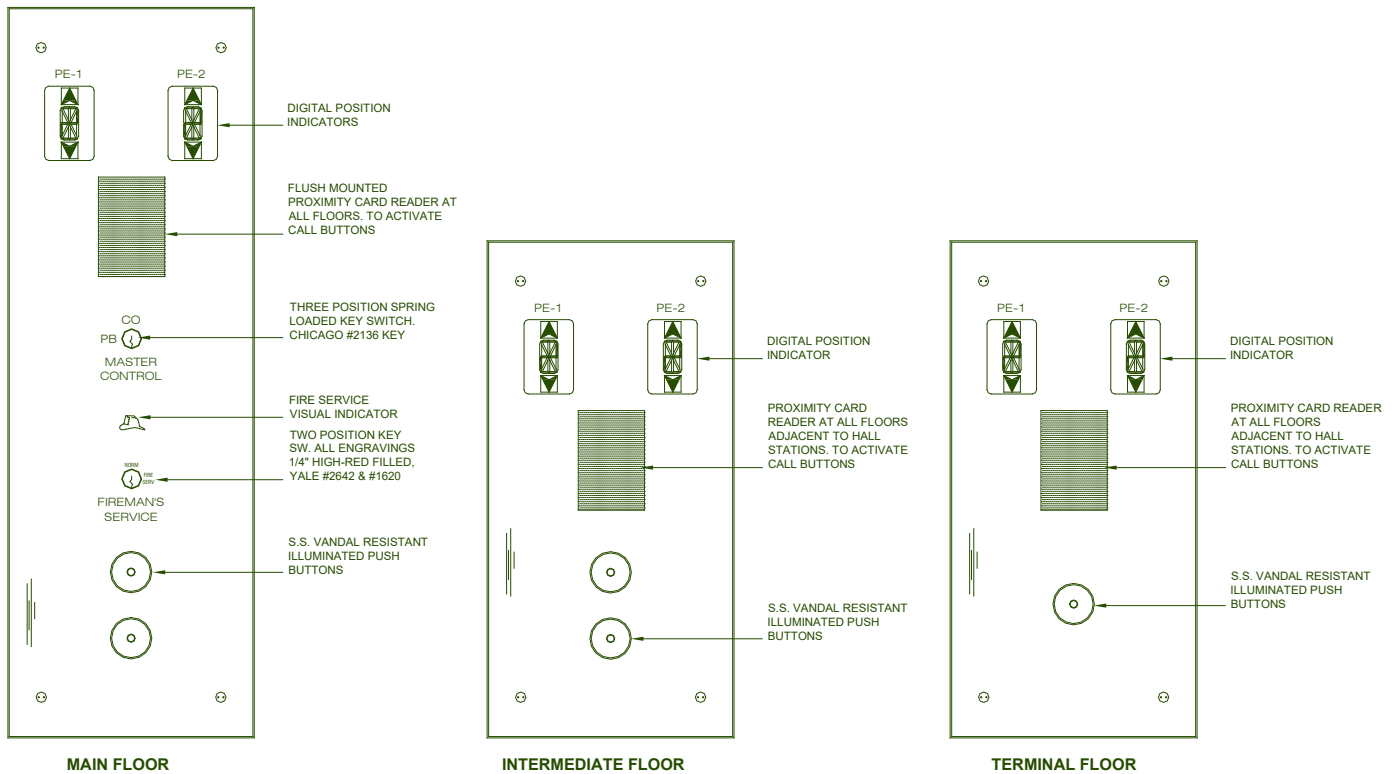
DRAWING No. 2 – TYPICAL HALL PUSH BUTTON STATIONS (SIMPLEX)



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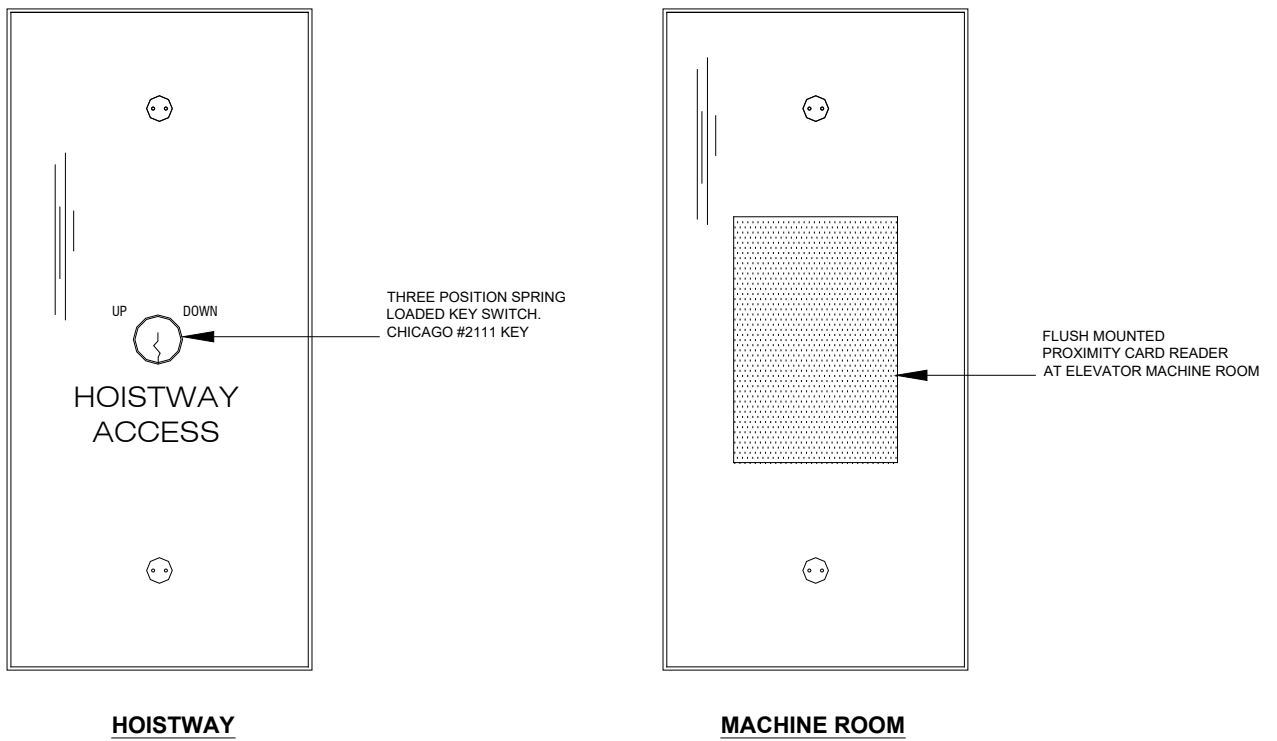
DRAWING No. 3 – TYPICAL HALL PUSH BUTTON STATIONS (DUPLEX)



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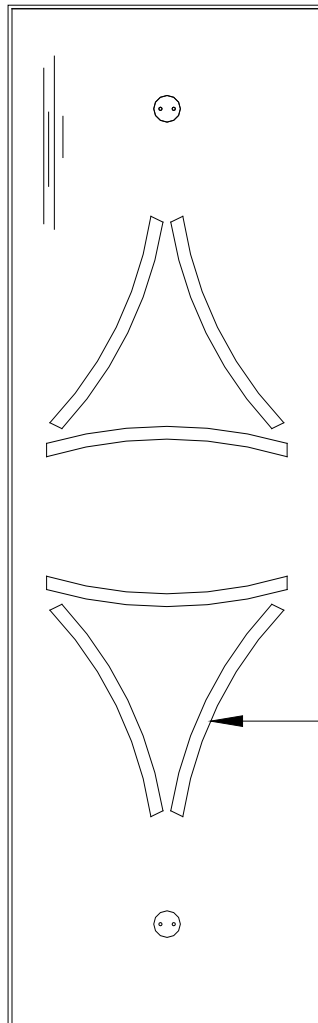
DRAWING No. 4 – TYPICAL ACCESS STATIONS



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DRAWING No. 5 – TYPICAL DIRECTIONAL LANTERNS

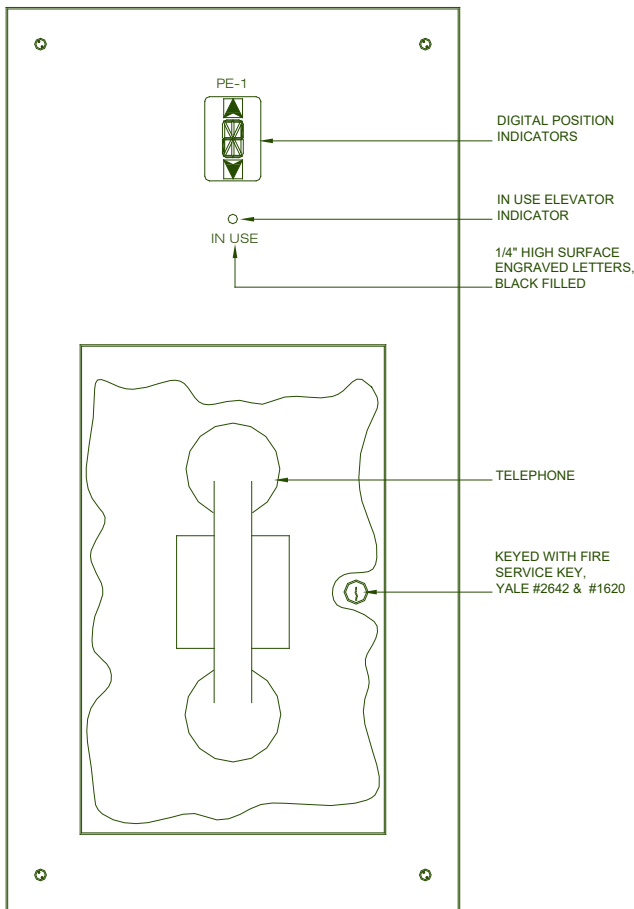


FLUSH EPOXY FILLED DIRECTIONAL
ARROWS TO ILLUMINATE GREEN
FOR "UP" AND RED FOR "DOWN"

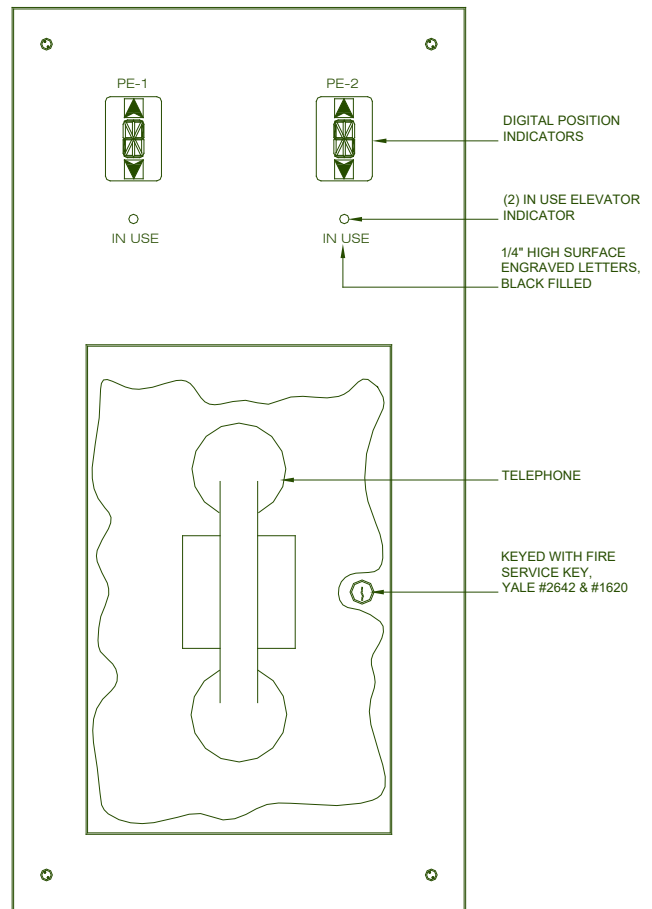
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DRAWING No. 6 – TYPICAL FIRE SERVICE PANEL @ FIRE COMMAND CENTER (SIMPLEX AND DUPLEX)



FIRE SERVICE PANEL (SIMPLEX SERVICE)

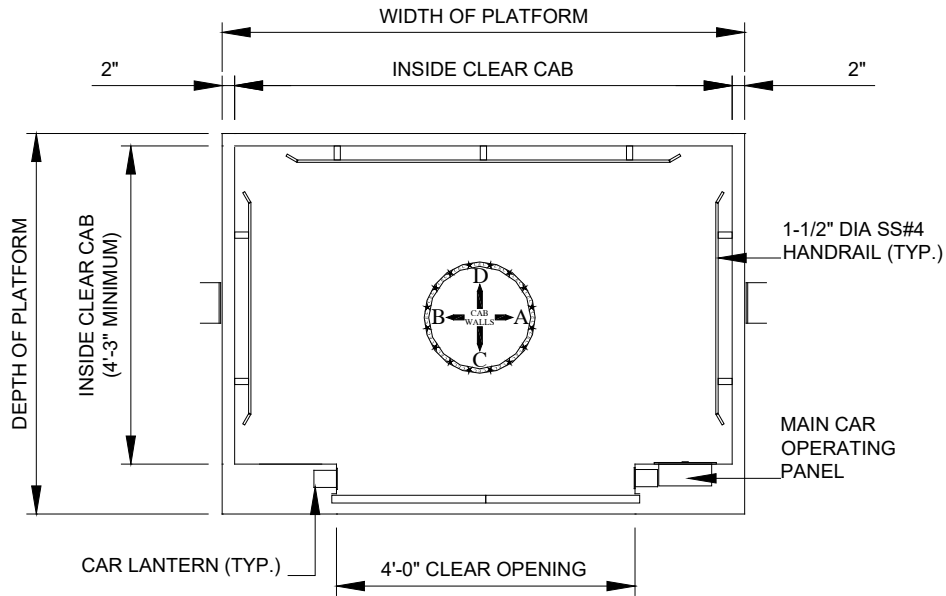


FIRE SERVICE PANEL (DUPLEX SERVICE)

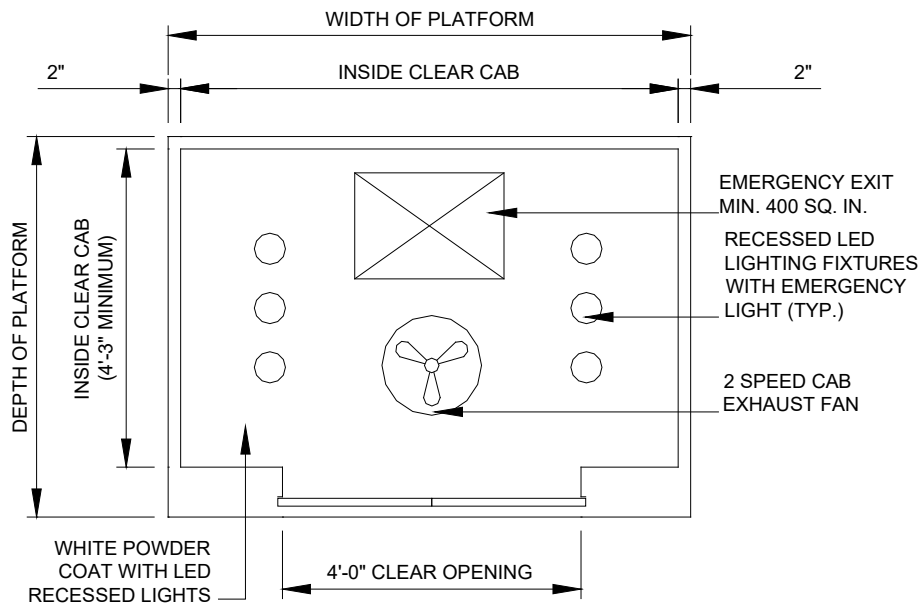
Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



DRAWING No. 7 – TYPICAL CAB FRONT CENTER-OPENING ENCLOSURE (TOP VIEW)



PLAN VIEW

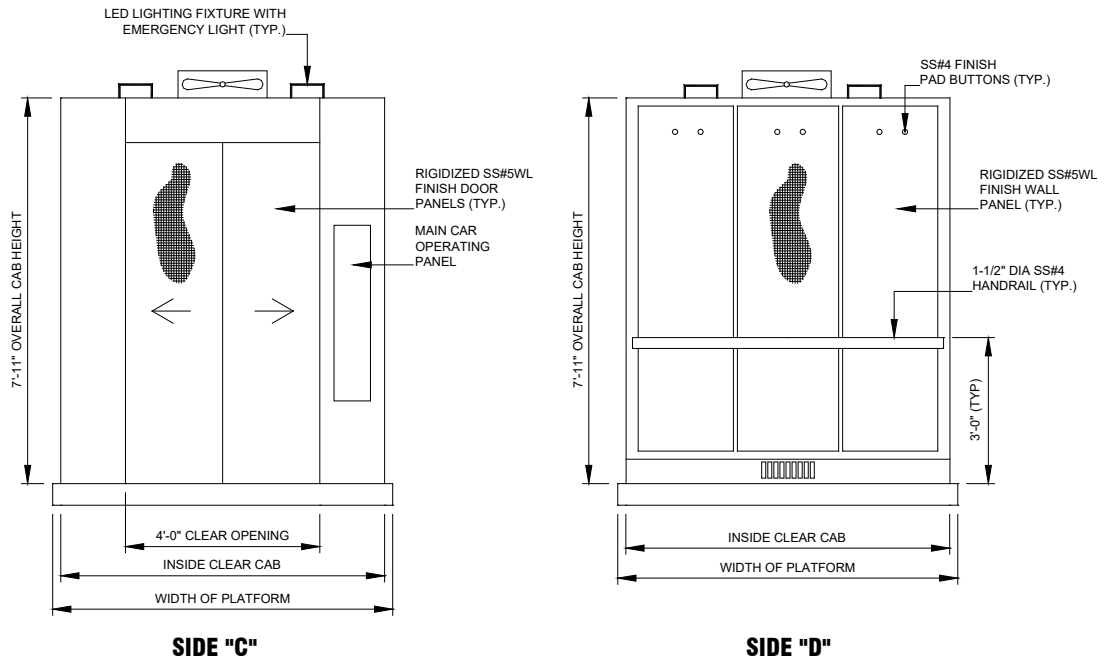
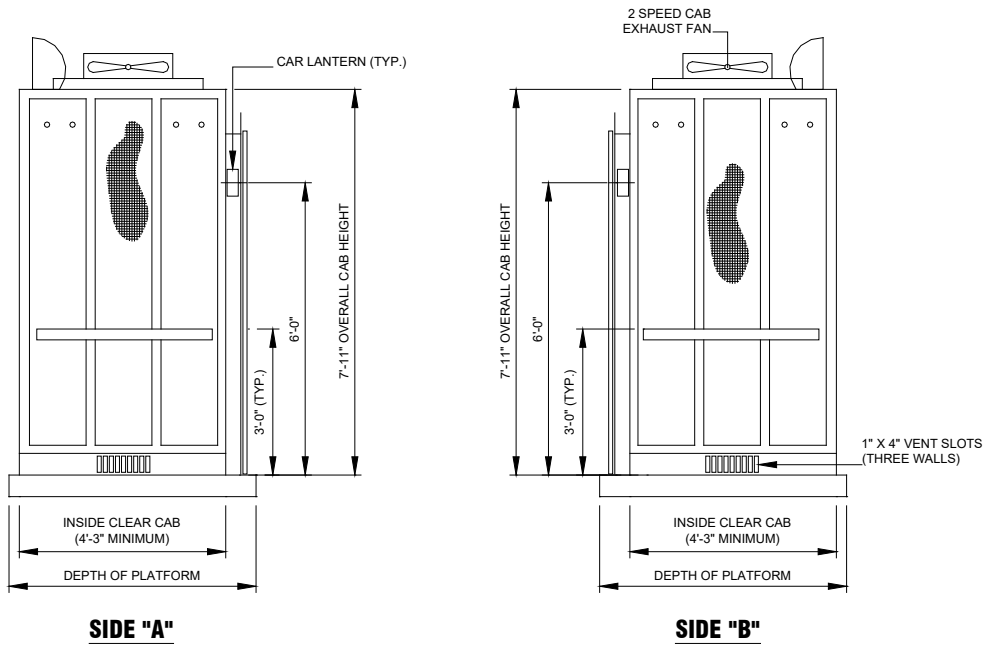


REFLECTED CEILING PLAN

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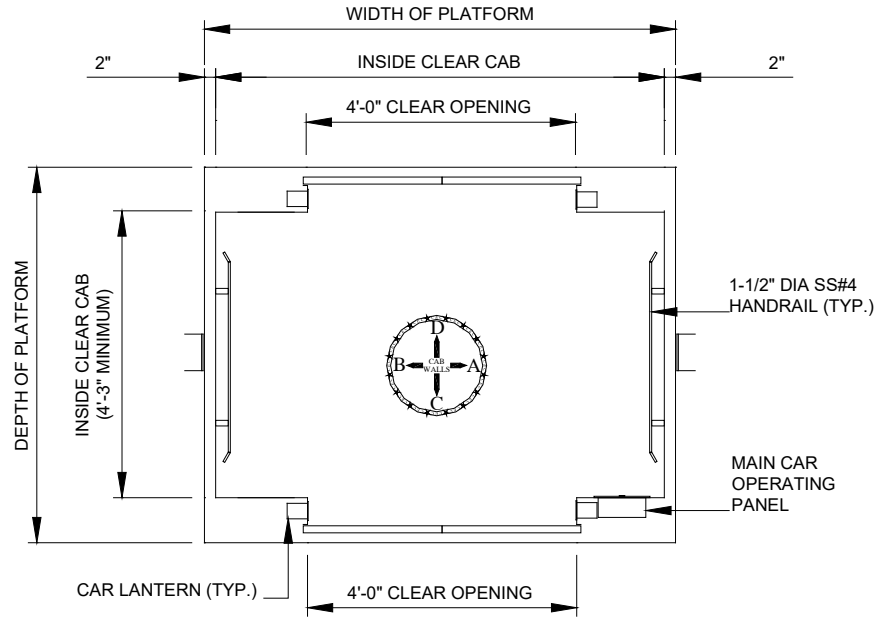
DRAWING No. 8 – TYPICAL CAB FRONT CENTER-OPENING ENCLOSURE (ELEVATION)



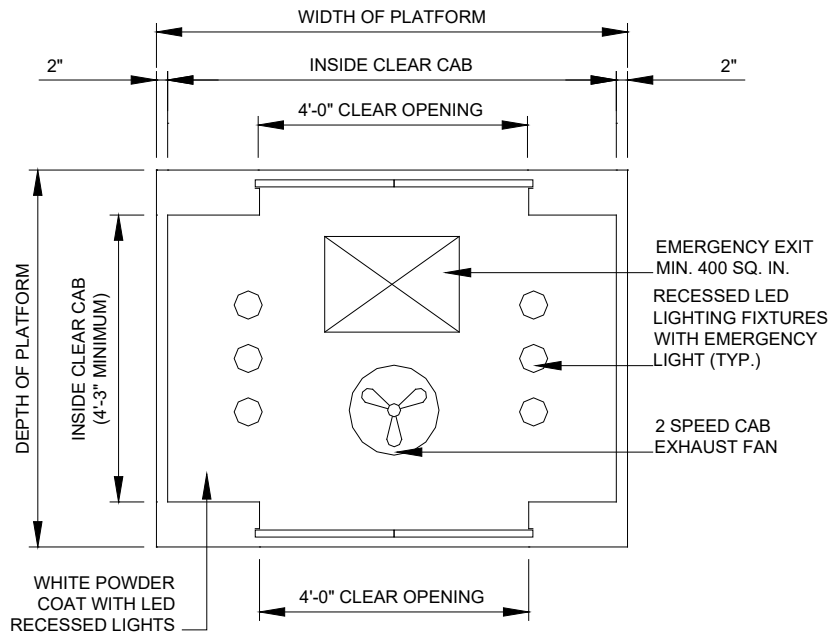
Requirement Applies to: New Construction Major Modernizations Capital Improvement Projects



DRAWING No. 9 – TYPICAL CAB FRONT & REAR CENTER OPENING ENCLOSURE (TOP VIEW)



PLAN VIEW

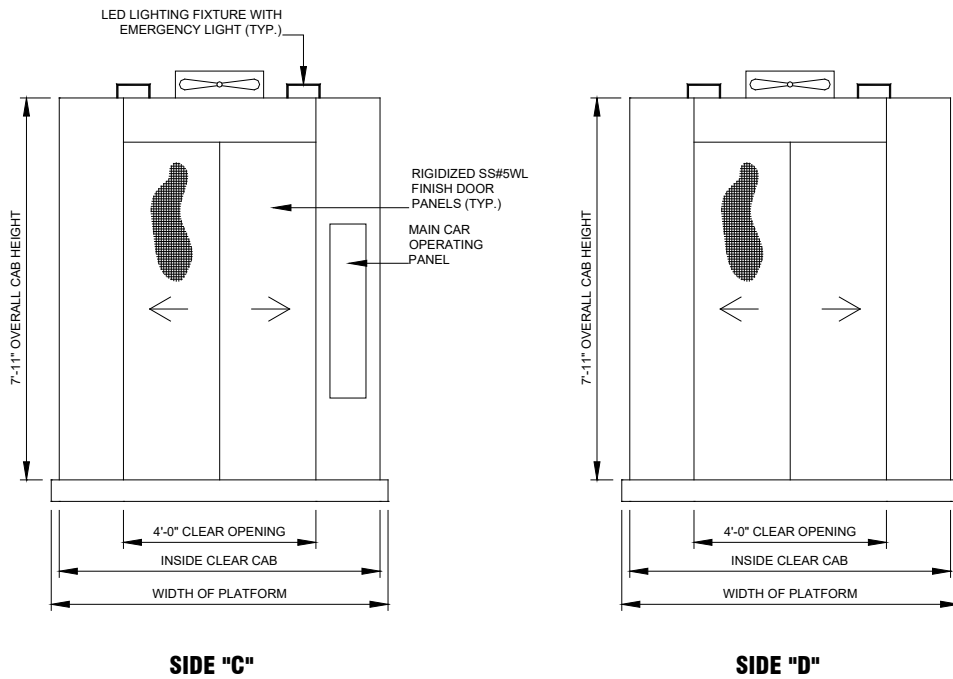
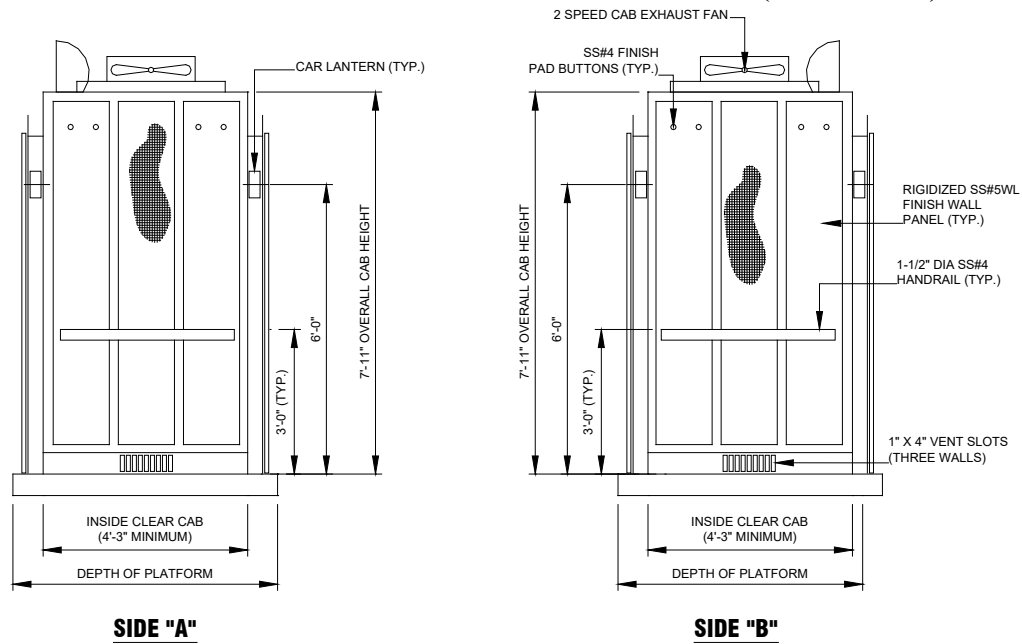


REFLECTED CEILING PLAN

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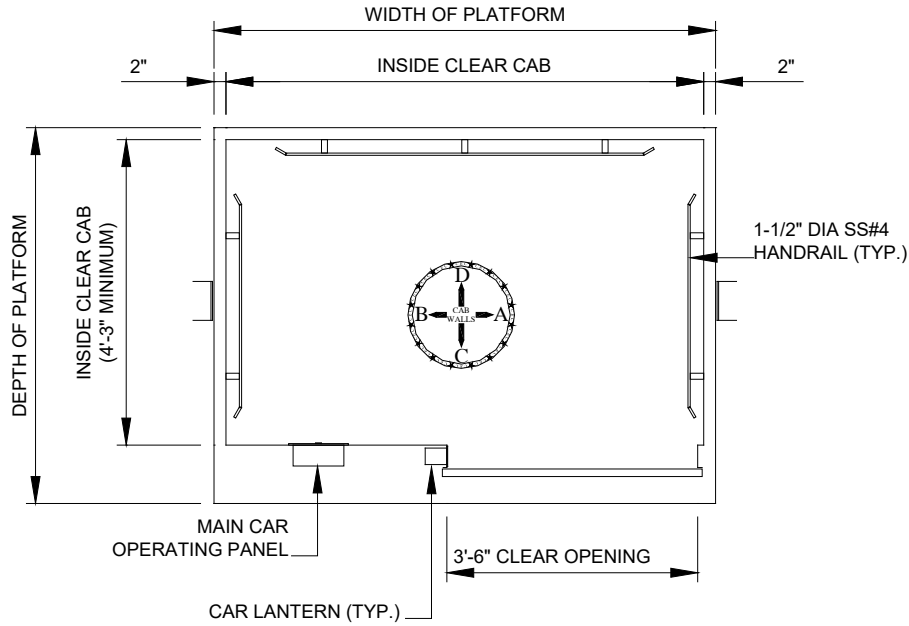


DRAWING No. 10 – TYPICAL CAB FRONT & REAR OPENING ENCLOSURE (ELEVATION)

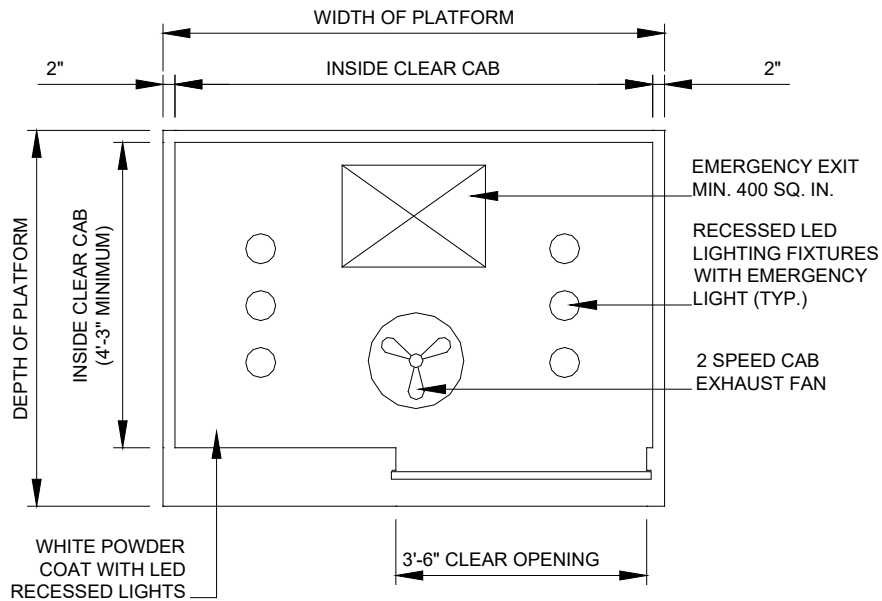


Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects

DRAWING No. 11 – TYPICAL SINGLE SPEED SIDE SLIDE ENCLOSURE (TOP VIEW)



PLAN VIEW

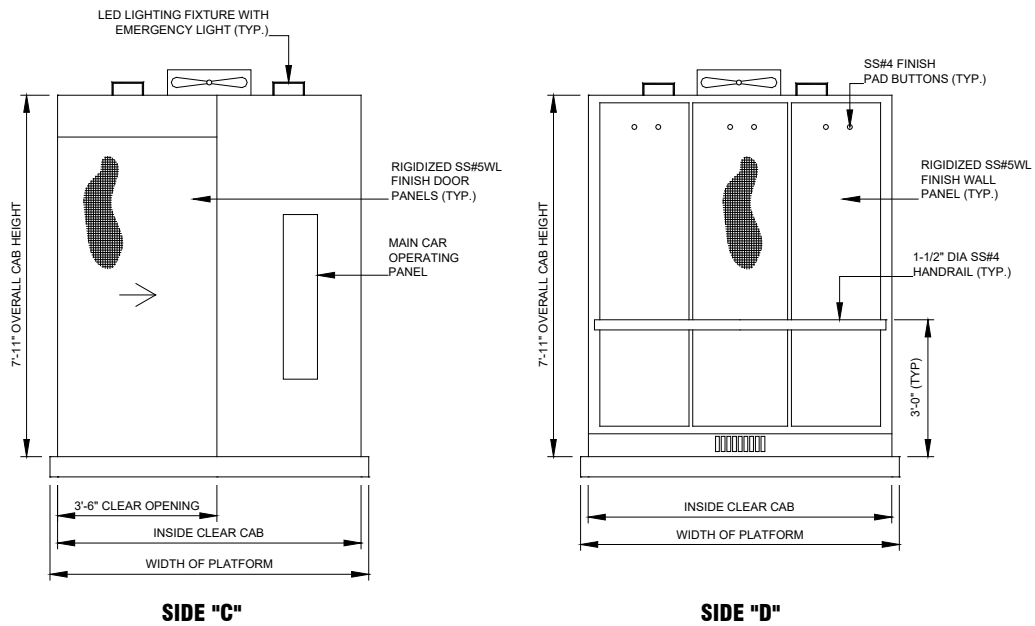
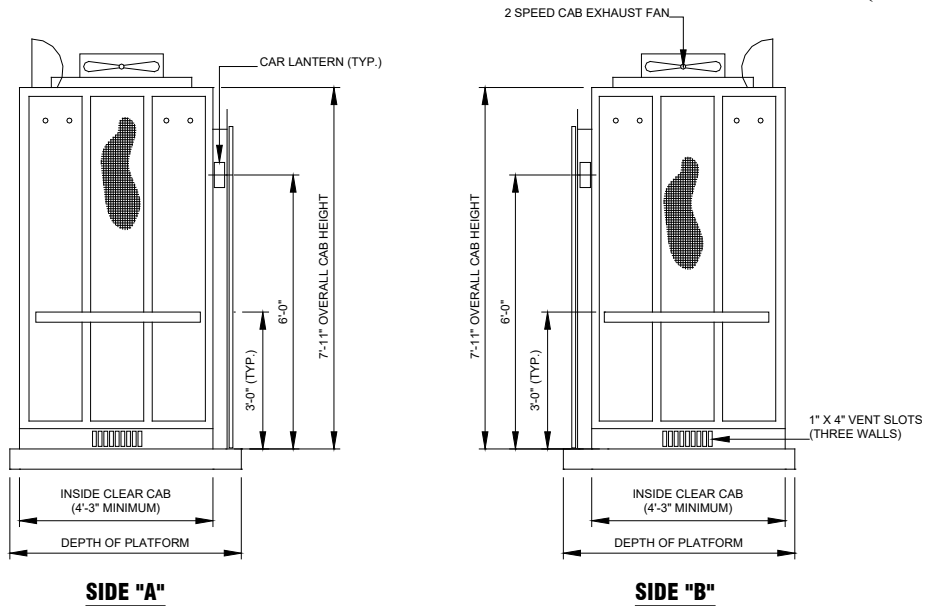


REFLECTED CEILING PLAN

Requirement Applies to: ✓ New Construction ✓ Major Modernizations ✓ Capital Improvement Projects



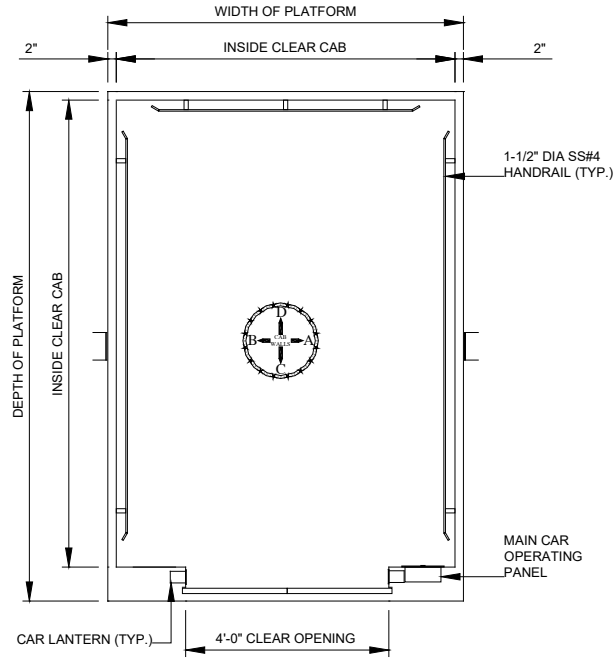
DRAWING No.12 – TYPICAL CAB SINGLE SPEED SIDE SLIDE OPENING ENCLOSURE (ELEVATION)



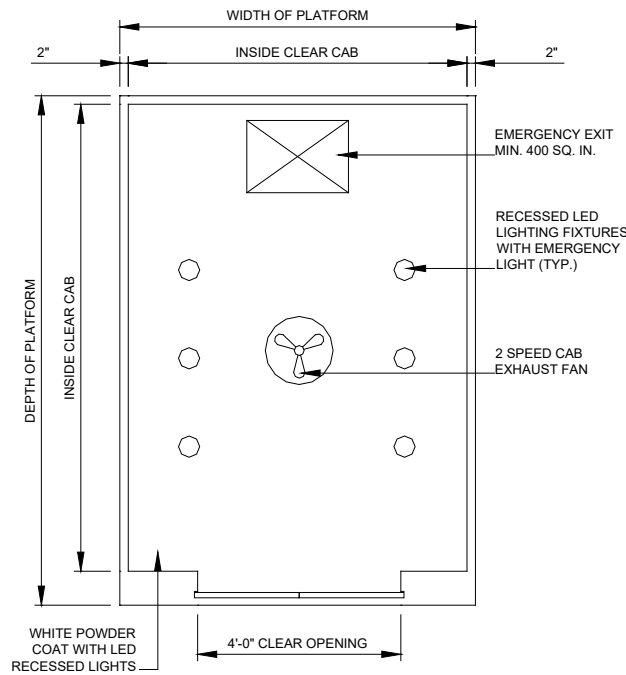
Requirement Applies to: New Construction Major Modernizations Capital Improvement Projects



DRAWING No. 13 – TYPICAL DEEP CAB ENCLOSURE (TOP VIEW)



PLAN VIEW

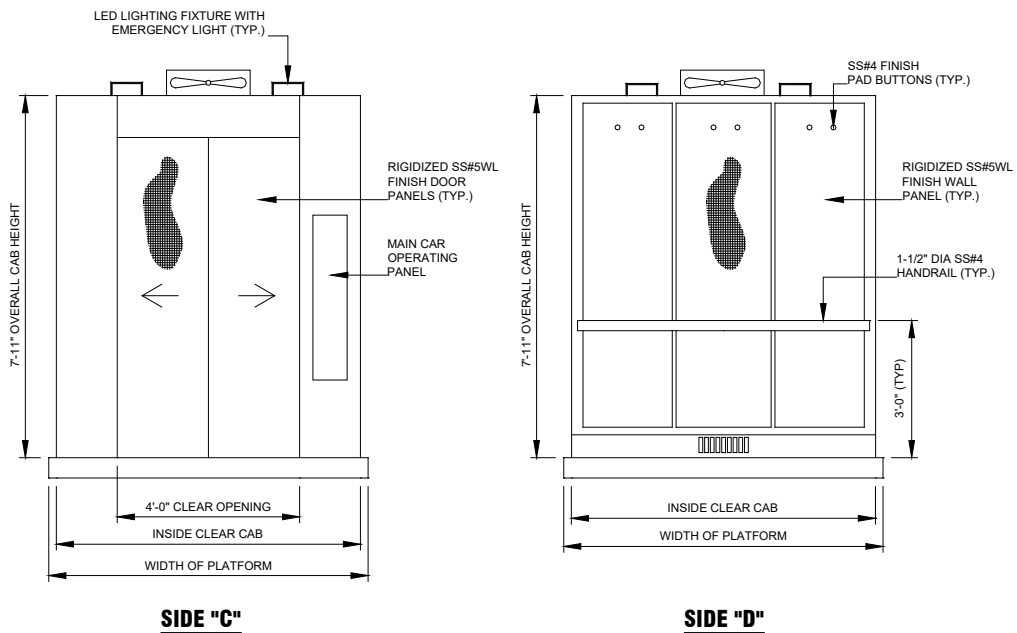
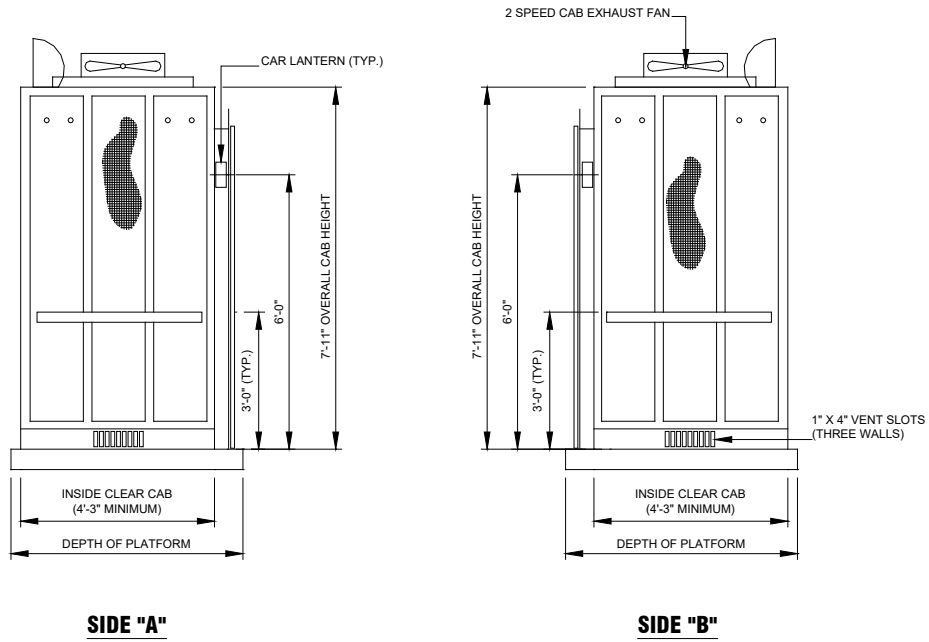


REFLECTED CEILING PLAN

Requirement Applies to: ✓ **New Construction** ✓ **Major Modernizations** ✓ **Capital Improvement Projects**



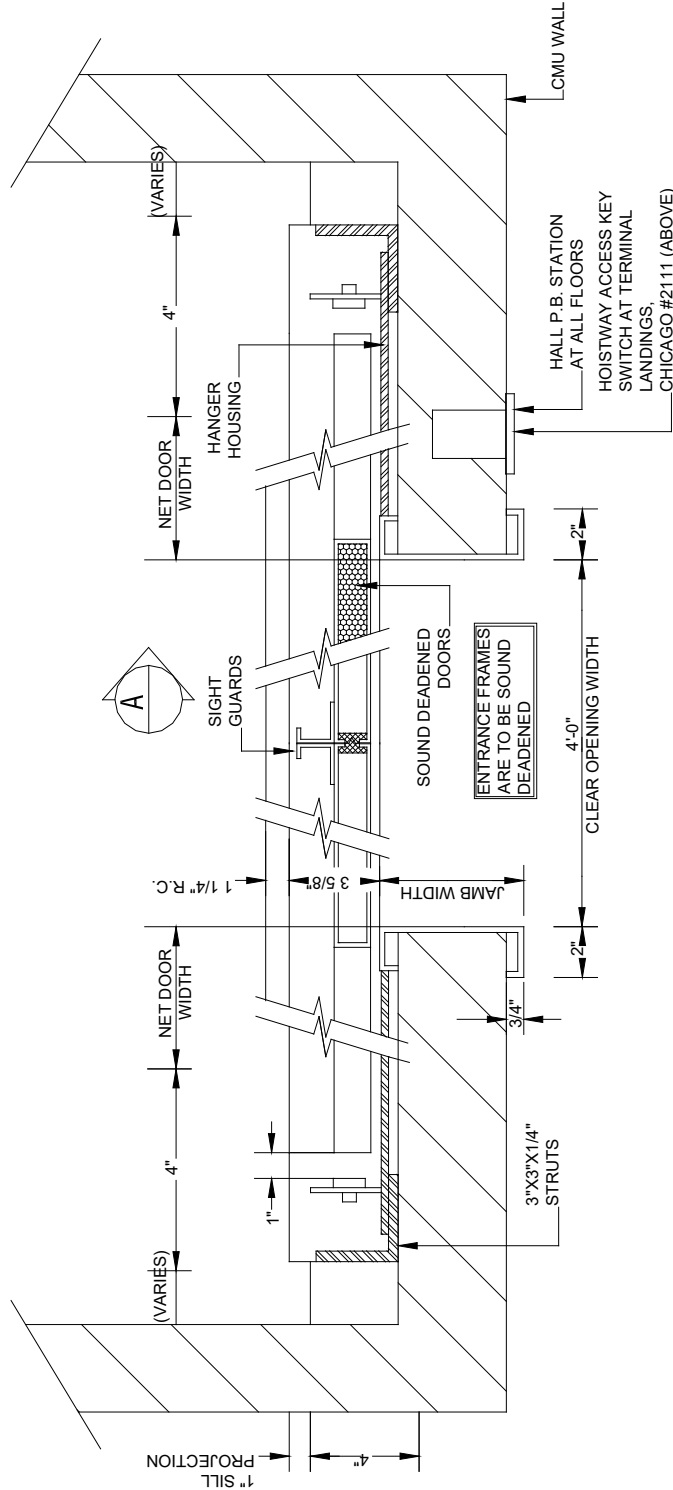
DRAWING No. 14 – TYPICAL DEEP CAB ENCLOSURE (ELEVATION)



Requirement Applies to: ✓ **New Construction** ✓ **Major Modernizations** ✓ **Capital Improvement Projects**



DRAWING No. 15 – TYPICAL CENTER OPENING ENTRANCE (TOP VIEW) – Refer to DR 5.2.2 for wall make-up.

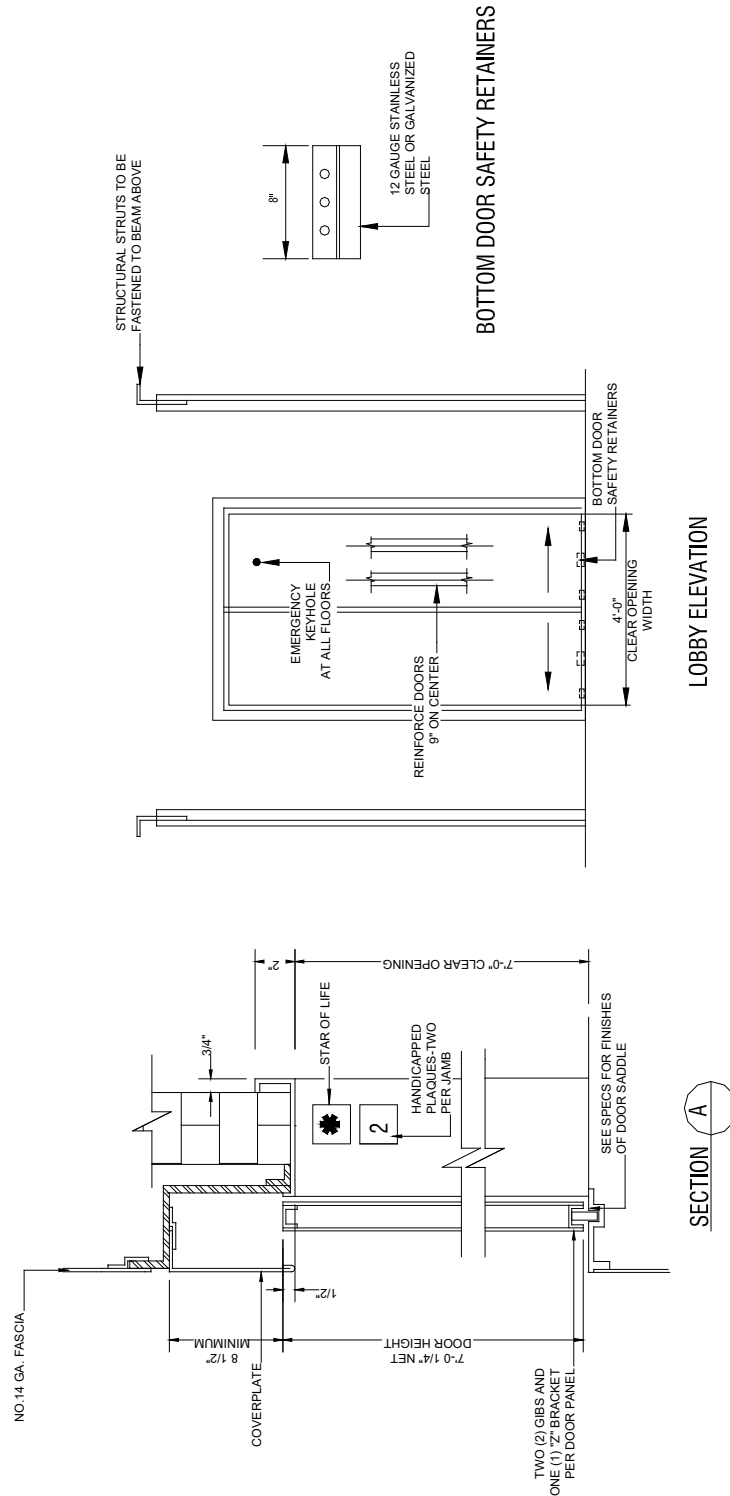


() CENTER OPENINGS-AS SHOWN

Requirement Applies to: New Construction Major Modernizations Capital Improvement Projects



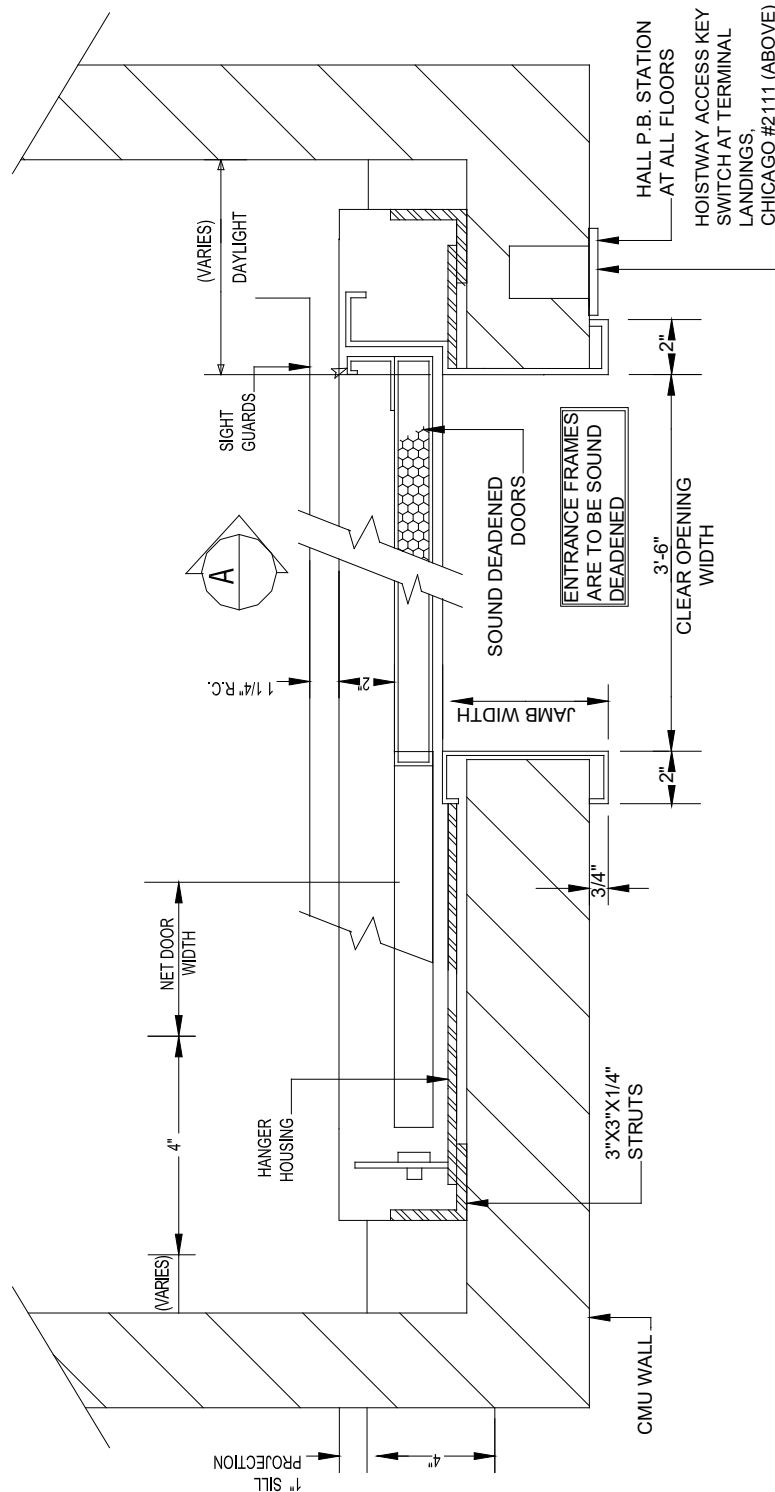
DRAWING No. 16 – TYPICAL CENTER OPENING ENTRANCE (ELEVATION)



Requirement Applies to: ✓ **New Construction** ✓ **Major Modernizations** ✓ **Capital Improvement Projects**



DRAWING No. 17 – TYPICAL SINGLE SPEED SIDE OPENING ENTRANCE (TOP VIEW) – Refer to DR 5.2.2 for wall make-up.

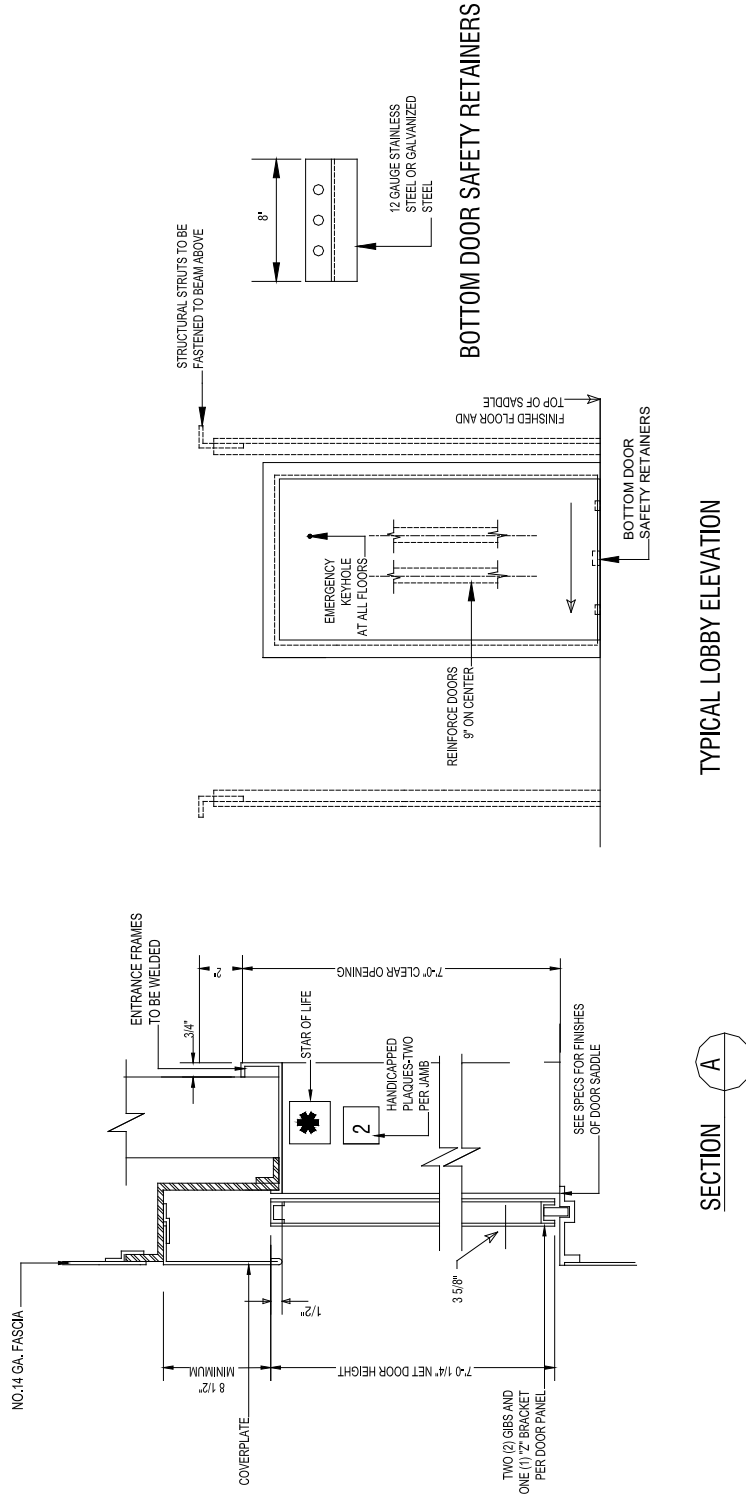


() R.H. OPENINGS-AS SHOWN
() L.H. OPPOSITE-AS SHOWN

Requirement Applies to: ✓ **New Construction** ✓ **Major Modernizations** ✓ **Capital Improvement Projects**

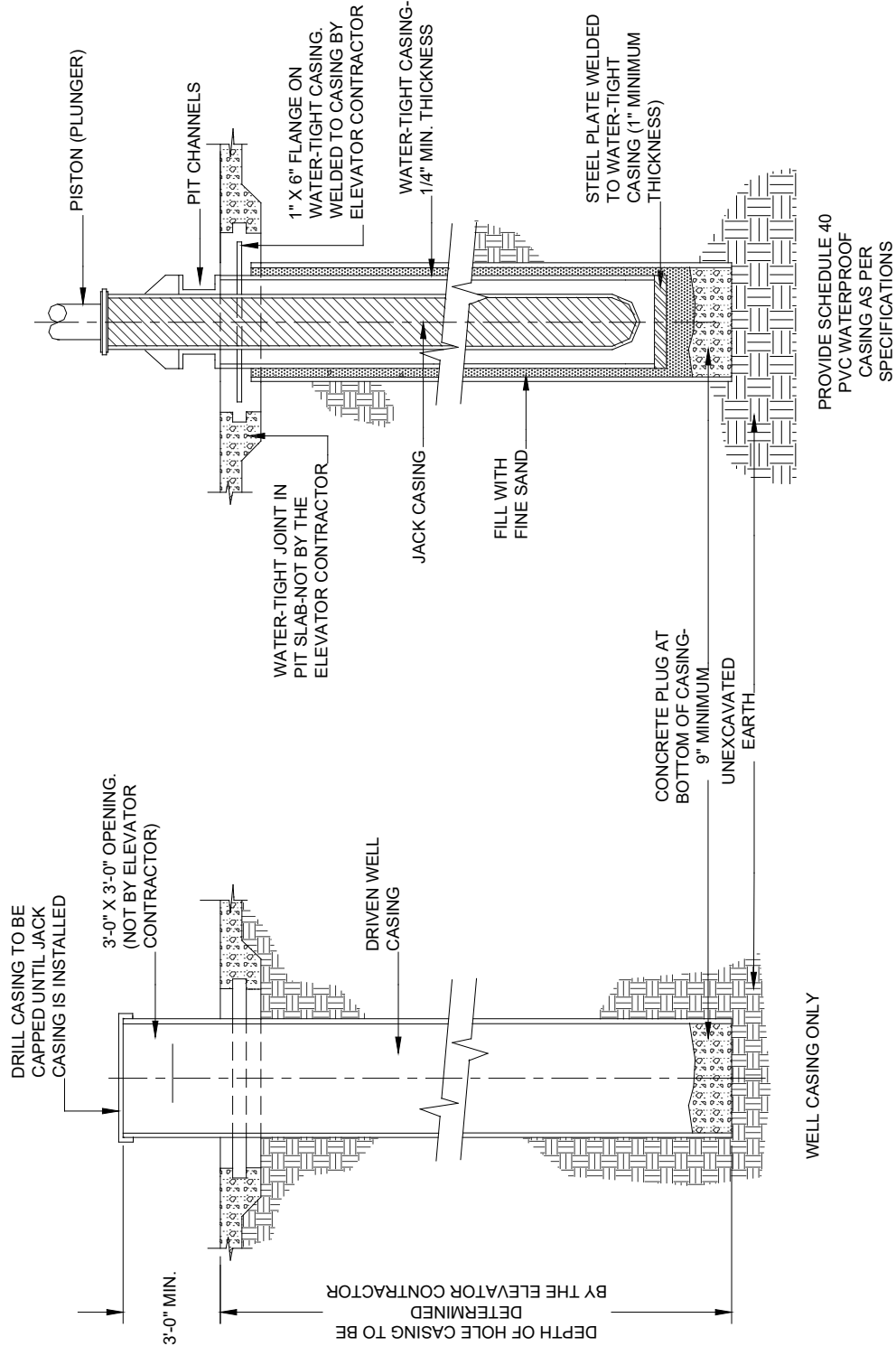


DRAWING No. 18 – TYPICAL SINGLE SPEED SIDE OPENING ENTRANCE (ELEVATION)



Requirement Applies to: ✓ **New Construction** ✓ **Major Modernizations** ✓ **Capital Improvement Projects**

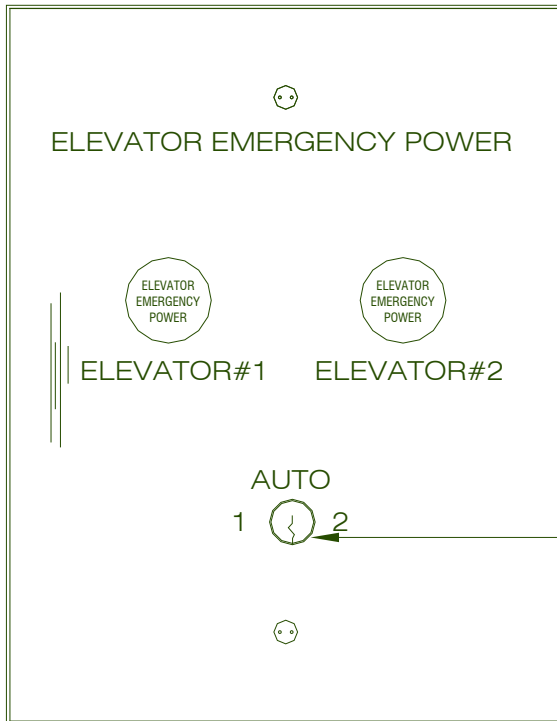
DRAWING No. 19 – TYPICAL WELL CASING CONSTRUCTION FOR IN-GROUND DIRECT-ACTING HYDRAULIC ELEVATORS ONLY



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DRAWING No. 20 – EMERGENCY POWER PANEL (DUPLEX)



THREE POSITION KEY SWITCH.
YALE #2642 & #1620

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6.3 Elevators

6.4.3 Elevator Seismic Design Criteria

Description/Design Approach:

- A.** As per Section BC 1613.1 of the **2022** NYC Building Code, every new school building structure, and portions thereof, including nonstructural components (architectural, MEP, fire protection) that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7-16, excluding Chapter 14 and Appendix 11A. The Seismic Design Category will be determined by the structural Engineer of Record and indicated on the structural drawings.

- B.** Per Section BC 1601.2.3, the determination as to whether seismic requirements apply to an alteration shall be made in accordance with the 1968 NYC Building Code and interpretations by the DOB relating to such determinations. Refer to Local Law 17/1995 and TPN 4/99. Any applicable seismic loads and requirements, including the bracing of the fire protection system and equipment, shall be permitted to be determined in accordance with Chapter 16 of the **2022** NYC Building Code or reference standard RS 9-6 of the 1968 NYC Building Code.
 - 1. If an existing building is required to meet seismic requirements as per the criteria described in DR 3.1.3 and a waiver from the Department of Buildings (DOB) cannot be obtained, the elevator retrofit work must then meet such requirements.

- C.** For new additions, any elevator related item in the existing building that is integrated with the system in the new addition that is required to function after an earthquake shall also meet the seismic requirements of the addition. Existing bolting of equipment to its pad and doweling of pad to floor slab shall be analyzed.

- D.** New School Buildings and Additions constructed after LL17/1995 went into effect are subject to the seismic requirements of the New York City Construction Codes and are considered Risk Category III, “Buildings and other structures that represent a substantial hazard to human life in the event of failure” for seismic design as per Table BC 1604.5.
 - 1. Seismic Design Category shall be determined by the project structural engineer. The Seismic Design Category for a structure is determined in accordance with Section BC 1613. The Seismic Design Category is to be indicated on the Structural Drawings (Refer to Detail 0100054a) and Component Importance Factors related to elevators shall be indicated on the Elevator drawings.
 - 2. Component Importance Factors (I_p) are prescribed in **Chapter 13 of ASCE 7-16**. The following components have $I_p=1.5$:
 - a. Life safety components required to function after an earthquake. This includes elevators designated as a required means of egress, which would not be typical on many school projects. Functioning after an earthquake means just long enough to evacuate the building as opposed to functioning as a disaster relief center. Per Section 13.2.2, these items to remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with

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Section 13.2.5, analysis or experience data in accordance with Section 13.2.6, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval by the SCA after review and acceptance by the Contractor's registered design professional.

- b. Components with $I_p=1.0$ located above or in proximity to components with $I_p=1.5$ which could damage the $I_p=1.5$ equipment shall be braced.
3. For Seismic Design Category B, all elevator components are exempt from seismic requirements. **For Seismic Design Category C, unless elevator is part of a required means of egress (i.e. $I_p=1.5$), all elevator components are also exempt from seismic requirements.**
4. For Seismic Design Category C if part of a required means of egress (i.e. $I_p=1.5$), elevator is to be designed for seismic requirements.
5. Elevator and escalators designed and constructed in accordance with the seismic requirements of ASME A17.1-2013 shall be deemed to meet the force and displacement requirements of Section 13.6 of ASCE 7-16. The exemptions listed in Section 13.6.7.3 do not apply for elevator piping. As per Section 13.6.11.2, escalator, elevator, and hoistway structural systems shall be designed to meet the force and displacement requirements of Section 13.3. Coordinate with the project structural engineer. As per Section 13.6.11.3, elevator equipment and controller supports and attachments shall be designed to meet the force and displacement requirements of Section 13.3.
6. Appropriate seismic coefficients to be utilized in the design of seismic resistance for the elevator shall be those listed in Table 13.6-1 of ASCE 7-16.
7. Elevator components along with their attachments or supports to the structure shall be designed in accordance with Section 13.4 of ASCE 7-16. They shall be bolted, welded or otherwise positively fastened without consideration of the frictional resistance produced by the effects of gravity. A continuous load path of sufficient strength and stiffness between the component and the supporting structure shall be provided. The component forces shall be those as determined by the calculations outlined in Section 13.3.1.
8. As per Section 13.6.11.3 of ASCE 7-16, any elevator travelling over 150 ft/min must be provided with seismic switches. Provide for all elevators in Seismic Zone C. Seismic switches in accordance with Section 8.4.10.1.2 of ASME A17.1-2013 shall be deemed to meet the requirements of Section 13.6.11.3 of ASCE 7-16.
9. When seismic design is required, generic seismic restraint details shall be shown on the contract drawing bid set. A note shall be added stating, "Details are shown to illustrate the scope of work. Contractor's registered professional engineer shall provide calculations and be responsible for providing signed/sealed coordinated shop drawings indicating locations of seismic restraints and the required connection details to file with the DOB/BCC".
10. All bracing devices shall be qualified through either analysis or be tested and certified in accordance with ICC-ES AC 156. Use ASME 17.1-2013 to compute seismic forces. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on

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independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to seismic bracing designs must be stamped by the Contractor's Registered Professional Engineer with at least five years of seismic design experience in non-structural building components in New York State.

11. All attachments of hangers and bracing shall be positive attachments that shall be cast-in-place anchors, drill-in wedge anchors, or a welded or bolted connection to structure. Drill-in wedge anchors shall be epoxy adhesive base and shall have an evaluation report number from ICC-ES verifying their allowable loads. Anchors must be certified for use in cracked concrete.

- E.** The following note is to be included on the elevator drawings:

"For all items that are required to have seismic supports or restraints, seismic plans and seismic restraint calculations shall be prepared, sealed, and submitted by a Professional Engineer licensed in the State of New York engaged by the Contractor. The Engineer shall provide installation supervision of all seismic supports and restraints. The Contractor's Registered Professional Engineer shall submit signed and sealed affidavit stating that the installation is in full compliance with the signed/sealed shop drawings."