

# Part 494 Variance Application Form

version 1.4

(Submission #: HQA-XAFT-ZD26T, version 2)

## Details

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**Submitted** 4/7/2025 (2 days ago) by Jennifer Leone

**Submission ID** HQA-XAFT-ZD26T

**Status** Submitted

## Form Input

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### Application Information

#### Instructions

Provide the information requested in the fields below to begin your application.

#### Application Contact Information

##### Contact Information

**First Name** Jennifer  
**Last Name** Leone

**Title**  
Chief Sustainability Officer/ Assistant Commissioner

**Organization Name**  
NYC Department of Housing Preservation & Development

**Phone Type**      **Number**      **Extension**

**Email**

##### Business Address

100 GOLD ST # 9P2  
NEW YORK, NY 10038-1605  
USA

#### Business Ownership Status

Other: HPD is a government entity.

#### Description of business activity or product description. Any supporting documents can be added below.

HPD is a city housing agency that provides funding for affordable housing in NYC.

#### Description of Applicant's relationship to the product. (For example: product or system manufacturer, distributor, reseller, owner/operator, etc.) Any supporting documents can be added below.

We are a city housing agency that sets design standards for/ funds housing retrofits and new construction. Many HPD projects include heat pumps in their designs.

#### For which Part 494 section(s) is a variance being requested?

Section 494-1.4: Prohibitions

#### Attachments

[HPD About.pdf - 03/07/2025 03:47 AM](#)

##### Comment

NONE PROVIDED

## Variance Request

## Instructions

In this section, the Applicant will indicate the type of variance for which they are applying.

Please see [§ 494-1.8 Variances](#) for more information on the types of variances.

### Which type of variance is this application for?

Impossibility

### What is the length of time for which this variance is requested? (years, months, etc)

2 years

### Provide the earliest date for when compliance will be achieved.

12/31/2028

## Impossibility Variance Justification

### Instructions

A complete application for an Impossibility Variance must demonstrate that the Applicant cannot comply with the regulatory requirements. To apply for this variance, the Applicant shall submit an Application that demonstrates the following criteria:

1. A compliant substance is not currently or potentially available or a component needed for repair is not currently or potentially available; and
2. A variance will not increase the overall risk to human health or the environment; and
3. The Applicant has used best efforts to anticipate and address the impossibility and any potential noncompliance, including minimizing any adverse effects of the greenhouse gas emissions related to noncompliance or making all efforts to repair all identified leaks and to operate and maintain equipment in accordance with manufacturer recommendations, where applicable.

### Explain why the compliant substance(s) or component(s) are not currently or potentially available

The leading manufacturers of VRF systems used by affordable housing projects in New York City, including Mitsubishi, Daikin and LG Appliances, have informed us that neither equipment with A2L refrigerants nor the critical specifications and information for designers are currently available in the market, making it impossible for building designers to redesign in anticipation of the new equipment.

While compliant system types like hydronic loops or packaged units exist - it would require major redesign beyond just the heating/cooling equipment itself, possibly including modifications to the building's layouts, electrical infrastructure, building envelope, etc. which would be impossible to achieve under the current timeline and financing. There are further limitations including refrigerant line length limits (e.g., for residential split systems), space constraints and envelope penetrations (e.g., for packaged systems).

### Explain how an approved variance will not increase the overall risk to human health or the environment. Additional documentation can be attached below.

Based on our GHG Assessment of these projects and our Mitigation Plan, we do not believe that this variance will yield significant emissions compared to a compliant strategy in fact our projections show a reduction in emissions. Details for how we arrived at this are outlined in the Mitigation Strategy (outlining how HPD will reduce refrigerant leaks) and GHG Assessment Methodology (which compares the emissions from our proposed Mitigation Strategy to a Compliant Strategy which assumes the projects would be redesigned using R32 refrigerant and follow the legal requirements for leak protections rather than HPD's enhanced protections which were written specifically to address R410A).

This is because HPD has rigorous protections, outlined in our Technical Requirements for Split System Heat Pumps and our Mitigation Strategy, to reduce refrigerant leaks based on concerns about R410A.

### Explain how the Applicant has put forth their best efforts to anticipate and address the impossibility and any potential noncompliance, including minimizing any adverse effects of the greenhouse gas emissions related to noncompliance or making all efforts to repair all identified leaks and to operate and maintain equipment in accordance with manufacturer recommendations, where applicable. Include any attachments as needed below.

HPD has increasingly steered design teams away from central VRF systems. However, certain projects in our current financing pipeline utilize this technology to address some specific challenges related to electrification of multi-family buildings in NYC where other solutions have not been viable due to space, building height, Landmarks considerations, restrictions on tenant-paid heating, and where new solutions are only just emerging.

To mitigate harmful GHG impacts from potential leakage of R410A refrigerant where other solutions are not viable, HPD requires all projects with split VRF systems regardless of federal requirements or Part 494 for systems > 50 lbs - to follow HPD's Technical Requirements for Split System Heat Pumps, which include Appendix A - Refrigerant Charging and Leak Prevention Requirements for split systems to reduce refrigerant leaks. This includes requirements for flared and brazed joints, pressure testing, leaks testing and contractor certifications.

## Attachments

[technical-requirements-space-heating-split-systems.pdf - 03/07/2025 03:53 AM](#)

[HPD R410A Mitigation and Compliance Plan\\_Justification.pdf - 04/07/2025 04:16 PM](#)

### Comment

NONE PROVIDED

## Compliance Plan

### Compliance Plan Instructions

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Provide a compliance plan that describes in detail how, if a variance is granted, compliance will be achieved as expeditiously as possible. The Compliance Plan must demonstrate all of the following criteria:

1. The method by which compliance will be achieved.
2. Milestone achievements and dates.
3. Description of any negative impacts to human health or the environment that may result from the granting of a variance.
4. A detailed explanation of efforts that may be implemented to curtail noncompliance in lieu of obtaining a variance.
5. A mitigation plan that demonstrates how the Applicant will reduce excess emissions of regulated substances to a level equal to or below what would have been emitted had the Applicant complied, and how the Applicant will mitigate any negative impacts to human health or the environment (see further below within this section).
6. A greenhouse gas analysis (see further below within this section, where applicable). For variance requests based on impossibility quantification of GHG emissions resulting from normal business-as-usual operations as it directly relates to the continued use of a regulated substance in sectors listed in section 494-1.4. This includes quantification of the direct emissions of regulated substances resulting from the manufacture, use, and disposal of equipment and products in New York State with all calculations, based on the average lifetime of the equipment or product that will continue to use prohibited substances. Applicant must include all calculations used to calculate GHG emissions estimates, including emission factors (e.g., refrigerant charge capacity and leak rate as defined in section 494-1.3, and regulated substances used over the average lifetime of the equipment, system, or product).

### Compliance Plan Checklist: All items below are required.

The submitted compliance plan includes a detailed explanation of efforts that may be implemented to curtail noncompliance in lieu of obtaining a variance.

The submitted compliance plan describes milestone achievements and dates

(For Impossibility Variance requests ONLY) Greenhouse gas (GHG) Emissions from Business-As-Usual Operations analysis (see next question, if applicable).

The mitigation plan (see next form)

The submitted compliance plan describes any negative impacts to human health or the environment that may result from the granting of a variance

The submitted compliance plan describes the method by which compliance will be achieved

### Compliance Plan Documents

[HPD R410A Mitigation and Compliance Plan\\_Compliance Plan.pdf - 04/07/2025 04:19 PM](#)

### Comment

NONE PROVIDED

## Greenhouse gas (GHG) Emissions from Business-As-Usual Operations

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For variance requests based on impossibility, quantification of GHG emissions resulting from normal business-as-usual operations as it directly relates to the continued use of any regulated substance in sectors listed in section 494-1.4.

This includes quantification of the direct emissions of regulated substances resulting from the manufacture, use, and disposal of equipment and products in New York State with all calculations, based on the average lifetime of the equipment or product that will continue to use prohibited substances.

Applicant must include all calculations used to calculate GHG emissions estimates, including emission factor and other factors, such as refrigerant charge capacity, leak rate (as defined in section 494-1.3), and regulated substances used over the average lifetime of the equipment, system, or product.

**Business-as-Usual Emissions Checklist: All items below are required.**

The submitted emissions assessment includes quantification of the direct emissions of regulated substances resulting from the manufacture, use, and disposal of equipment and products in New York State that will continue to use prohibited substances in sectors listed in section 494-1.4 of this Part.

The submitted emissions assessment includes emission factors (e.g., refrigerant charge capacity and leak rate as defined in section 494-1.3, and regulated substances used over the average lifetime of the equipment, system, or product)

The submitted emissions assessment includes all calculations

The submitted emissions assessment considers the average lifetime of the equipment, system, or product(s)

**Business-As-Usual Emission Calculation Documents**

[HPD R410A Mitigation and Compliance Plan\\_GHG Assessment.pdf - 04/07/2025 04:43 PM](#)

[R410-A Phaseout Tracker\\_3-31-2025.xlsx - 04/07/2025 04:45 PM](#)

**Comment**

NONE PROVIDED

**Mitigation Plan**

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Submit a mitigation plan that demonstrates how the Applicant will reduce excess emissions of regulated substances to a level equal to or below what would have been emitted had the Applicant complied and how the Applicant will mitigate any negative impacts to human health or the environment.

The mitigation plan may include actions such as: to minimize usage of regulated substances, efforts to reduce leaks or venting of regulated substances, or actions to recycle or destroy high-GWP refrigerant(s).

For variance requests based on impossibility, the Applicant must include all calculations used to calculate emissions estimates, including emission factors. These calculations may include refrigerant charge capacity and leak rate as defined in section 494-1.3 and regulated substances used over the average lifetime of the equipment, system, or product.

**Mitigation Plan Checklist: All items below are required.**

(For Impossibility Variance requests ONLY) The submitted mitigation plan includes all calculations used to estimate emissions, including emission factors.

The submitted mitigation plan demonstrates how the Applicant will reduce excess emissions of regulated substances to a level equal to or below what would have been emitted had the Applicant complied and how the Applicant will mitigate any negative impacts to human health or the environment

**Mitigation Plan Documents**

[HPD R410A Mitigation and Compliance Plan\\_Mitigation Plan.pdf - 04/07/2025 04:43 PM](#)

**Comment**

NONE PROVIDED

**Confidential Business Information Declaration**

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**Instruction**

This section is for applicants to self-identify whether there is Confidential Business Information (CBI) in this application. For guidance on what CBI entails and the process, please review the Form instructions and 6 NYCRR Part 616.7.

**If the Applicant self-identifies Confidential Business Information to be within this form, once determined by the Department, certain information for this specific process will be kept confidential with restricted access to the public (as described in 6 NYCRR Part 616.7) provided adequate justification is attached as supporting documentation to the application.**

There IS confidential business information in this application

**As described in 6 NYCRR Part 616.7, adequate justification must be provided to support the request for confidentiality. Please attach supporting documents and confirm that they satisfy the following:**

This submission attachment states the reasons for excepting the information from public disclosure

This submission attachment specifically identifies which information is to be designated as proprietary

This submission attachment details the reason(s) why the information should be considered proprietary or why its release would cause substantial injury to the competitive position of the business.

**Confidential Business Information Justification**

[HPD R410A Mitigation and Compliance Plan\\_Confidentiality.pdf - 04/07/2025 04:53 PM](#)

**Comment**

There is no confidential information in this application or any of the uploaded pdf files. The information is ONLY located in the excel document.



The New York City Department of Housing Preservation and Development (HPD) is the largest municipal housing preservation and development agency in the nation. The agency's mission is to promote housing equality and create and sustain viable neighborhoods for New Yorkers through housing education, outreach, loan and development programs and enforcement of housing standards.

Thanks to the programs and partnerships created by HPD most of the property formerly owned by the City is now back in private hands, having been developed or preserved as affordable housing. The agency has developed innovative community revitalization initiatives that promote private investment and productive public-private partnerships such as Mortgage Assistance Program (MAP), HomeFirst Down Payment Assistance Program and Real Estate Owned (REO). HPD works with its governmental, community, non-profit, and for-profit partners to strengthen neighborhoods increase the supply of well-maintained, affordable housing and to enable more New Yorkers to become homeowners.

Today, vacant buildings and lots that were once a blight on many of the City's neighborhoods have been transformed into safe, affordable homes for families. Communities that were devastated are now vibrant with dynamic new construction and large scale developments that feature commercial space, community space and open spaces for public and private use. HPD's housing programs have helped to restore and rebuild housing as well as to improve the quality of life in New York City's richly diverse communities.

**MEMORANDUM**

**Date:** 4/7/2025 (final revisions)  
**To:** Department of Environmental Conservation  
**Cc:** Crista Shopis (Taitem Engineering) and Kevin McDonald (Steven Winter Associates)  
**From:** Jennifer Leone, Assistant Commissioner/ Chief Sustainability Officer  
**Re:** DEC Blanket Variance: Part 494. Impossibility Variance Justification

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**Impossibility Variance Justification:**

The New York City Department of Housing Preservation (HPD) finances the construction and preservation of over 25,000 units of affordable housing per year in New York City, a critical source of affordable housing to New Yorkers, especially during the current housing crisis. Without adequate housing, families often face increased stress and financial strain, impacting mental and physical health, their safety, and their children's education.

HPD has committed to fast-track equitable decarbonization and beneficial electrification to serve low-income households in New York City through our Design Guidelines and programs (e.g., HPD's Retrofit Electrification Pilot). This goes above and beyond NYC's ambitious climate laws, which include Local Law 97, requiring existing buildings to decarbonize by 2050, and Local Law 154 which phases out fossil fuels in new construction.

HPD is strongly supportive of the goals of the AIM Act. As such, we have increasingly (and plan to continue to do so) steered design teams away from central VRF systems and have incorporated rigorous requirements into our mandatory technical standards to address refrigerant leaks. However, there are projects in our current financing pipeline that utilize this technology to address some of the specific challenges related to electrification of new and existing multi-family buildings in NYC where other solutions have not been viable due to space, building height, Landmarks considerations, restrictions on tenant-paid heating, and where new solutions are only just emerging.

As such, a small portion of our current pipeline of electric new construction and retrofits that is scheduled to close on financing before late 2025 includes VRFs containing R410A as the basis of the design and financing - and where realistic alternatives are not yet available. That is because at this time, the manufacturers of these systems (Mitsubishi, LG and Daikin - who participated in HPD's recent webinar about the R410A phaseout) have informed us that they do not expect to have compliant equipment (or specifications for such equipment) available until late summer or fall. In addition, the new equipment will require rated and ventilated shafts for the refrigerant lines which most projects would be unable to accommodate due to space or other construction constraints that are baked into their current designs.

It is also infeasible to require these projects to redesign to accommodate alternative but compliant system types like hydronic loops or packaged units - which would require major redesign beyond just the heating/cooling equipment itself, possibly including modifications to the building's layouts, electrical infrastructure, building envelope, etc. which would be impossible to achieve under the current timeline and financing. There are further limitations - including refrigerant line length limits (e.g., for residential split systems) and space constraints and envelope penetrations (e.g., for packaged systems).

Based on our GHG Assessment of these projects and our Mitigation Plans, we do not believe that this variance will yield significant emissions compared to a "compliant" strategy - in fact would yield significantly less. This is because HPD has rigorous protections, outlined in our Technical Requirements for Split System Heat Pumps, to reduce refrigerant leaks.



**Office of Policy and Strategy  
Sustainability Unit**

In summary, while we support the goals of the AIM Act, and will continue to push current and future projects toward low GWP systems and natural refrigerants, any change to the design for this cohort of projects would and jeopardize the projects' financing and ability to be constructed – even though the variance will not increase emissions. We strongly urge DEC to approve this variance because New York City is facing an urgent housing crisis, and it is critical that don't delay the provision of safe, low carbon, climate resistant housing.

**MEMORANDUM**

**Date:** 4/7/2025 (final revisions)  
**To:** Department of Environmental Conservation  
**Cc:** Crista Shopis (Taitem Engineering) and Kevin McDonald (Steven Winter Associates)  
**From:** Jennifer Leone, Assistant Commissioner/ Chief Sustainability Officer  
**Re:** DEC Blanket Variance: Part 494. Compliance Plan

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**Compliance Plan:**

We are requesting until December 31, 2028 to complete the installations of the small subset of electrification projects in our current pipeline scheduled close in Fiscal Year 2025 – that include VRFs containing R410A as the basis of the design and financing - and where we have determined that realistic alternatives are not yet available. This request is based on the following milestones:

- The projects in this variance request have well developed designs and are scheduled to close on financing within this fiscal year (typically by June) although we are leaving a bit of leeway for projects whose closings pushed into summer or fall due to the challenges of finalizing all OF THE loan commitments and regulatory documentation for an affordable housing project.
- Typical construction timelines for project construction for which we typically estimate three years, especially for multi-building retrofits or large new construction projects.
- Note that smaller and simpler projects will likely need less time to complete
- Note that these are our current best estimates for timelines, and that we cannot forecast unforeseen issues.

Based on our GHG Assessment of these projects and our Mitigation Plan, we do not believe that this variance will yield significant emissions compared to a “compliant” strategy – in fact our projections show a reduction in emissions. Details for how we arrived at this are outlined in the Mitigation Strategy (outlining how HPD will reduce refrigerant leaks) and GHG Assessment Methodology (which compares the emissions from our proposed Mitigation Strategy to a “Compliant Strategy” which assumes the projects would be redesigned using R32 refrigerant and follow the legal requirements for leak protections rather than HPD’s enhanced protections which were written specifically to address R410A).

This is because HPD has rigorous protections, outlined in our Technical Requirements for Split System Heat Pumps and our Mitigation Strategy, to reduce refrigerant leaks based on concerns about R410A.

Note that in the absence of this variance being granted, projects would need to be halted in order for project teams to (1) secure funding to redesign the projects, and (2) implement a redesign of the projects to accommodate new equipment – which could result in loss of dwelling units and/or increased construction cost. This would put projects at significant risk of losing commitments for financing entirely, which would be devastating (1) for delaying much needed critical repairs in existing buildings, and (2) by curtailing supply of much needed new affordable housing to address NYC’s housing crisis.

**MEMORANDUM**

**Date:** 4/7/2025 (final revisions)  
**To:** Department of Environmental Conservation  
**Cc:** Crista Shopis (Taitem Engineering) and Kevin McDonald (Steven Winter Associates)  
**From:** Jennifer Leone, Assistant Commissioner/ Chief Sustainability Officer  
**Re:** DEC Blanket Variance: Part 494. GHG Assessment

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**GHG Assessment Summary & Methodology:**

To determine the GHG impact of this variance request, we compared the following outcomes: A “Business as Usual Strategy” where this cohort of projects was installed with R410A in the absence of HPD’s Technical Requirements, a “Compliant Strategy” where the refrigerant would be replaced with R32, which is allowed, and a “Mitigated Strategy” where this cohort of projects would be installed with R410A but following HPD’s Technical Requirements, and. To assess this, we performed the following analysis:

- 1) Collected detailed information about the systems included in projects seeking to participate in the Variance Request. This included retrofits and new construction – that:
  - a) Use split VRF systems
  - b) Are expecting to close on HPD financing before October 2025, which is when we believe that new equipment will be available, AND
  - c) Cannot redesign to a different system type due to budget and/or space constraints (e.g., cannot accommodate ventilated shafts)
- 2) We calculated the total amount of refrigerant for each heat pump system in each project based on information provided by the Engineer of Record:
  - a) Pounds of R410A per heat pump (including equipment + field charge) based on the VRF system type, system size/ capacity, total estimated refrigerant piping length, and estimated # of refrigerant connections
  - b) Quality checked by system size/ capacity
  - c) Equipment lifetime of 20 years was assumed
- 3) We then estimated the GHG emissions for each system based on:
  - a) GWP20 of 4715 for R410A and 2690 for R32, per DEC’s requirements
  - b) Leakage rates of 10% for commercial VRF and 6% for residential systems, per Part 494-1.3 (47)
  - c) End of life disposal: 10% loss
- 4) We then calculated emissions for each project under several scenarios:
  - a) BAU Scenario: As designed with R410A, but without leak protections that are not required by code
  - b) Compliant Scenario: The same system, as if the projects were designed with R32 in lieu of R410A and using standard installation practices
  - c) Mitigated Scenario: As designed with R410A, but assuming a mitigated leak rate due to HPD’s Technical Requirements, for which we assumed a 5% leak rate for VRF and 3% for multi-splits (a 50% reduction).
  - d) The GHG Impact when comparing the Mitigated Scenario with the Compliant Scenario

- 5) We then converted the GHG Impact into a “cars on the road” equivalent using the EPA’s [Greenhouse Gas Equivalencies Calculator | US EPA](#), which notes that each 1,000 tons of CO<sub>2</sub>e is equivalent to 233 car years (cars driven for 1 year)

Further detail is provided in Appendix A, Summary of GHG Assessment

Appendix A: Summary, GHG Assessment for projects included in Variance Request

GHG Impact Summary by Project										
	Dwelling Units in Project	Heat Pumps In Project	Total Cooling Tons	Sum of lbs of refrigerant	Sum of 1 BAU- GHG Tons CO2e	Sum of 2 Compliant- Tons CO2e	Sum of 3 Mitigated- Tons CO2e	GHG impact Tons CO2e (delta)	Car Year Equivalents	Tons CO2e Mitigated / Dwelling
	72	20	187	1,142	5,354	3,055	2,681	(374)	(625)	(37)
	95	17	125	643	2,685	1,532	1,386	(146)	(323)	(15)
	21	4	28	158	745	425	372	(53)	(87)	(18)
	55	12	134	475	2,217	1,265	1,111	(154)	(259)	(20)
	255	15	68	1,005	1,672	954	1,219	265	(284)	(5)
	34	5	30	183	863	492	431	(61)	(101)	(13)
	78	23	269	915	4,050	2,311	2,039	(271)	(475)	(26)
	67	13	156	620	2,923	1,668	1,462	(206)	(341)	(22)
	180	4	27	218	905	516	461	(56)	(107)	(3)
	145	13	156	875	4,126	2,354	2,063	(291)	(481)	(14)
	103	16	172	652	3,003	1,713	1,510	(203)	(352)	(15)
	453	106	764	3,369	15,764	8,994	7,897	(1,097)	(1,840)	(17)
	166	67	626	3,292	14,586	8,322	7,315	(1,006)	(1,705)	(44)
	89	9	29	179	169	96	169	72	(39)	(2)
	191	9	41	193	746	426	389	(37)	(91)	(2)
	85	26	122	1,829	7,190	4,102	3,622	(481)	(844)	(43)
	111	10	108	369	1,649	941	825	(116)	(192)	(7)
	62	5	30	145	604	345	312	(33)	(73)	(5)
<b>Grand Total</b>		374	3072	16,262	69,253	39,510	35,265	(4,245)	(8,217)	(239)

Names withheld from public access per HPD Policy

Notes: some projects noted above consist of multiple buildings  
Projects highlighted in green are rehab projects



**Office of Policy and Strategy  
Sustainability Unit**

**MEMORANDUM**

**Date:** 4/7/2025 (final revisions)  
**To:** Department of Environmental Conservation  
**Cc:** Crista Shopis (Taitem Engineering) and Kevin McDonald (Steven Winter Associates)  
**From:** Jennifer Leone, Assistant Commissioner/ Chief Sustainability Officer  
**Re:** DEC Blanket Variance: Part 494. Confidentiality Statement

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Due to risks of sharing project names and addresses for projects that have not yet closed on financing, HPD's policy requires that we do not share this information until financing has been secured and financial closing has occurred. The GHG assessment has this information redacted.

Note that the project names and addresses are included in the R410-A Phaseout Tracker for DEC's internal use and for tracking which projects are being proposed under the blanket variance.

**MEMORANDUM**

**Date:** 4/2/2025 (draft revisions)  
**To:** Department of Environmental Conservation  
**Cc:** Crista Shopis (Taitem Engineering) and Kevin McDonald (Steven Winter Associates)  
**From:** Jennifer Leone, Assistant Commissioner/ Chief Sustainability Officer  
**Re:** DEC Blanket Variance: Part 494. Mitigation Plan

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**Mitigation Plan:**

HPD is strongly supportive of the goals of the AIM Act. As such, we have increasingly (and plan to continue to) steered design teams away from central VRF systems. However, there remain a few projects in our current financing pipeline that utilize this technology to address some of the specific challenges related to electrification of new and existing multi-family buildings in NYC where other solutions have not been viable due to space, building height, Landmarks considerations, restrictions on tenant-paid heating, and where new solutions are only just emerging.

To mitigate harmful GHG impacts from potential leakage of R410A refrigerant where other solutions are not viable, HPD requires all projects with split VRF systems to follow HPD's Technical Requirements for Split System Heat Pumps, which include Appendix A - Refrigerant Charging and Leak Prevention Requirements for split systems to reduce refrigerant leaks. This requirement includes:

- Requirements for flared and brazed joints to minimize leak potential
- Requirements for pressure and vacuum testing to catch leaks before refrigerant pipes are enclosed and systems are operational
- Final leak tests during charging and provision of a charging report
- Requirement that all technicians working with refrigerant charging and connecting refrigerant piping:
  - Have reviewed and certified in writing that they have received and read Appendix A - Refrigerant Charging and Leak Prevention Requirements
  - Be certified to EPA 608 and shall have copies of their certification on-site.

We believe that these requirements will reduce refrigerant leaks and the resulting emissions by at least 50%. As such, the estimated GHG emission impact of the variance request is, per our calculations, LESS than what a "compliant" strategy would yield:

- A "Compliant Strategy" where this cohort of projects would switch to R32 refrigerant (once available) using standard installation practices, would result in ~39,510 tons of CO<sub>2</sub>e
- Our proposed "Mitigated Strategy" where leaks reductions are reduced by 50% by complying with our Technical Requirements would result in ~35,265 tons of CO<sub>2</sub>e.
- The GHG Impact of our proposed Mitigated Strategy, compared to the "Compliant" Strategy, yields ~ 4,245 tons less than a compliant strategy.

Thus we believe that the excess impacts of this variance request are mitigated by our efforts to reduce refrigerant leaks. However, although our Mitigated Strategy emits less carbon than a "Compliant Strategy" there are still resulting emissions from leaks. Therefore it is important to contextualize this issue within the context of the work HPD is and will continue to do to address climate change through our ambitious design standard and programs, which include:

- Mitigating Impacts for emissions we are not offsetting: Per HPD's mandatory Design Guidelines, **all HPD projects must go above and beyond code requirements for climate resilience**. Specifically:
  - Flood Resistance: All new construction projects must elevate residential units, critical equipment, and at least one point of egress above the 2080s sea-level-rise adjusted design flood elevation. For Substantial Rehabilitation projects, all new equipment and residential units must be elevated above the 2050s sea-level-rise adjusted design flood elevations, or floodproofed if this is not feasible. Additional flood resiliency measures are also required.
  - Extreme Heat: Air conditioning is required in all new construction and Substantial Rehabilitation projects. In Moderate Rehabs, all senior housing must include cooling and all other projects must be designed to accommodate window air conditioners. There are additional provisions for senior and low-mobility populations, including requirements for a "place of refuge."
- Overall goals to reduce GHG emissions: HPD estimates that we avoid **340,000 metric tons of CO<sub>2</sub>e each year** (the equivalent of removing nearly 75,000 car years) through our rigorous decarbonization standards and programs, including:
  - Reducing ~40,000 metric tons of CO<sub>2</sub>e (~9,000 cars years) through our Solar Where Feasible program which supports ~ 3 megawatts of solar per year across our projects.
  - Reducing ~300,000 metric tons of CO<sub>2</sub>e (~66,000 car years) by reducing onsite combustion of fossil fuels through HPD's efficiency and electrification requirements for the nearly 6,000 units of new housing and 9,000 units of housing that we retrofit each year that are subject to our Design Guidelines or are participating in our Retrofit Electrification Pilot. While this accounting does not account for refrigerant leaks, many projects already, and all projects moving forward, will utilize systems with reduced risk of leakage (e.g., packaged systems or hydronic loop systems) and be designed using equipment with lower GWP or natural refrigerants, and will thus achieve significant GHG emissions reductions.
- To further reduce the impact of refrigerant leakage, HPD commits to:
  - Providing guidance to projects about the importance of end-of-life refrigerant recycling, including asking building owners to post signage in their mechanical rooms.
  - Ramping up efforts to push design teams away from central VRF systems that rely on field-installed refrigerant piping and toward packaged systems where leak risk is reduced (e.g., PTHPs and hydronic loop systems) and systems with natural refrigerants. This will be done via the following:
    - Prioritizing these strategies in our upcoming Design Guidelines, which will be released in early 2026
    - Providing guidance during Design Consultations in our regular and special programs
    - Delivering training and resources to stakeholders on a regular basis, to keep them abreast of best practices.
  - Continuing to work with our Technical Assistance Providers, NYSERDA and other stakeholders to pilot and promote best practices for decarbonization.

# Space Heating Heat Pump Technical Requirements: Split Systems

**August 2024**

The following practices shall be followed for all projects. These are in addition to all requirements outlined in NYC codes, zoning, NYS/ConEd Clean Heat Program Requirements, and the HPD specifications. In some cases, these requirements are more stringent than required by codes or by the NYS/ConEd Clean Heat requirements, and in those cases, these requirements shall be followed. In addition, consider best practices as outlined by HPD, including:

- FAQ: Roof Considerations for Heat Pumps
- FAQ: Heat Pump System Design
- FAQ: Energy Apportionment
- HPD-NYSERDA VRF and Split System Maintenance Plan and Maintenance Service Contract Checklist

These can be found at the following web site: [HPD's REDi webpage](#)

*These requirements shall be found on the drawings and/or specs of the construction documents. We recommend that, for simplicity and clarity, these requirements be copied and pasted onto drawings on relevant pages and details. A Word version of this document can be made available for this purpose.*

## Split Systems

- Must meet or exceed NYS Clean Heat requirements.  
Minimum 10-year parts warranty, 1-year warranty on labor.

## Design Requirements

- System shall be designed to meet Clean Heat “Full Load” requirements. Furthermore, heat pumps shall be used for all spaces, with limited exceptions in select areas (e.g. bathrooms, spaces that require freeze protection). Heating is discouraged in spaces with limited duration of occupancy (e.g. corridors, stairwells, basements).
- Size the heat pump to the building load per code requirements. Size to either the heating or cooling load, whichever is the dominant load. Size systems to an indoor design heating temperature of 72 degrees, as allowed by the Energy Code. Note that NYC requires that systems be capable of ensuring that the indoor temperature is at least 68 degrees.
- Size systems to a design outdoor temperature of 13 degrees.
- VRF heat pumps (non-heat recovery) shall be zoned with similar thermal exposures, typically vertical zones by apartment line.

## HPD-NYSERDA TECHNICAL REQUIREMENTS

- Electric resistance backup shall not be used for heat pumps.
- Radiant or Electric resistance heaters in minor spaces with short occupancy (e.g. bathrooms) shall have timer control to turn off automatically, e.g., a manual crank timer.
- Electric resistance heaters that are used for freeze protection (e.g. common area spaces with water piping, gas meter rooms, etc.) shall have temperature limits set at 50 degrees maximum.
- Heat pump shall have a variable speed compressor.
- Locate outdoor units to minimize length of outdoor piping.
- Condensate tubing shall be minimum ¾" PEX, PVC, CPVC. Vinyl tubing and corrugated tubing shall not be used. Note that code-approved materials (Mechanical Code 307.2.2) for condensate disposal does not include plain steel, and so abandoned steam piping can generally not be used for condensate disposal on its own. Ensure that drainage is located such that it does not cause condensate to land on balconies or other appurtenances below. Condensate discharge to building drainage shall be through indirect waste connection by means of an air gap.
- Drawings shall show the length of each refrigerant pipe (typically on the riser diagram).
- A 7-day programmable thermostat is required, per the energy code. See Appendix C for additional information.

### Installation requirements

- Contractor shall be an approved Participating Contractor in the Clean Heat program.
- Contractor shall provide proof of design-appropriate heat pump manufacturer training.
- Outdoor units shall be installed 18" above grade to avoid snow
- Outdoor units shall be located to avoid melting condensate from one unit dripping onto another or from other sources of excessive moisture (e.g., melting snow from roof edge)
- Outdoor piping must be insulated to meet the energy code, but this shall be confirmed with energy code requirements specific to each installation. Drawings may show the energy code insulation table, but shall also specify the refrigerant temperatures for piping, to allow correct sizing of pipe insulation.
- Pipe insulation shall be insulated the full length of the piping from outdoor units to indoor units, without gaps in the insulation that would allow condensate to form. Insulation shall be protected from UV exposure per code requirements, typically with a metal or plastic cover (as required for exterior walls, see below), or with UV-resistant paint. It should be noted that some jacketed insulations have been found to cause pipe corrosion and leaks – these insulations shall not be used.
- Fastening of condensate tubing shall be hose clamp (worm drive clamp) or approved crimp rings, for PEX or approved connectors or approved adhesive for PVC or CPVC.
- Pipe and wiring penetrations of walls and roofs shall be sealed on both sides of the penetration. Sealing material used outdoors shall be UV-resistant. Sealing should be around and between all pipes and wires/conduit.
- Piping and wiring indoors shall be concealed unless otherwise approved. "Concealed" means: In chases, in ceiling or floor cavities, in basements or attics, or in drywall-finished soffits, or other

## HPD-NYSERDA TECHNICAL REQUIREMENTS

approved means of concealment. Avoid enclosing line sets in wall cavities, where they cannot be inspected and where they may be inadvertently punctured. If line sets are enclosed in a wall, there must be a proposed method to protect the line sets from being accidentally punctured

- Exposed piping and wiring on exterior walls shall be concealed in a cover in a color to match the wall. Cover type and color to be submitted and approved by owner prior to ordering.
- Piping shall be structurally supported per Mechanical Code requirements, and these code requirements shall be spelled out on the drawings:

*Mechanical Code 305.3 Structural attachment. Hangers and anchors shall be attached to the building structure.*

*Mechanical Code 305.4 Interval of support. Piping shall be supported at distances not exceeding the spacing specified in Table 305.4, or in accordance with MSS SP-69.*

- Piping and wiring shall be routed plumb/level and either parallel to or at right angles to buildings lines (wall vertical lines, roof horizontal lines, etc.).
- Contractor shall notify HPD-NYSERDA Technical Assistance Provider (TAP) after piping is installed and supported, but before locations such as chases or soffits are sealed, to allow for inspection before these locations are concealed.

### Ground Source Heat Pump Systems

Ground source heat pump (GSHP) systems are permitted by HPD, but detailed technical requirements beyond the Clean Heat program have not yet been developed. Consult HPD or the TAP team for requirements if a GSHP system is being considered.

### Water Loop Heat Pump Systems

Water loop heat pump systems OTHER than ground source heat pumps are NOT currently permitted in the NYSEDA HPD Retrofit Electrification Pilot or REDi: EB program. Examples include boiler/tower water loop heat pump systems, or water loop heat pump systems that use an air source heat pump to heat the water loop.

### Refrigerant Charging and Leak Prevention

Comply with refrigerant charging and leak prevention requirements in Appendix A.

### Required Systems Testing

- Program indoor units to 70 F heating and 78 F cooling (occupied mode)
- Setpoint limits: 76 F heating and 72 F cooling
- Ensure that filters on indoor units are clean and free of construction dust.
- For outdoor temperatures above 60 F, force heat pump into cooling at maximum compressor speed (for example, by calling for cooling in all zones), and then record outdoor air temperature in the shade,

total heat pump electric current (amps), and, for one zone only, return air temperature and relative humidity (%) and supply air temperature.

- For outdoor temperatures below 60 F, force heat pump into heating at maximum compressor speed (for example, by calling for heat in all zones), and then record outdoor air temperature in the shade, total system electric current (amps), and, for one zone only, return air temperature and supply air temperature.
- Provide a written report of test results (above) including:
  - note any errors, diagnostic faults, corrections, etc,
  - startup tests,
  - final refrigerant charge (pounds, ounces).
  - date and time of test
  - System tag
  - Company and technician name
- For further commissioning requirements, refer to the Energy Code and to: [Commissioning Requirements - New York City Commercial Code](#).

### Refrigerant Charging and Leak Prevention

Comply with refrigerant charging and leak prevention requirements in Appendix A.

### Removal of Fossil Fuel Equipment

Where existing fossil fuel equipment is being removed, comply with requirements in Appendix B.

## Appendix A - Refrigerant Charging and Leak Prevention Requirements

### Introduction

Refrigerant charging and leak prevention is critical for several reasons:

1. Refrigerant leaks contribute substantially to climate change. The beneficial effects of electrification can be lost if refrigerant leaks.
2. Refrigerant leaks can harm system energy efficiency, further contributing the climate change, and increasing the cost of electricity to the building.
3. Refrigerant leaks can cause poor comfort, including inadequate heating in winter and inadequate cooling in summer, resulting in substantial health risks and also in potential code violations for indoor temperature control.
4. Refrigerant overcharging increases compressor wear & tear and energy use.

### General

- Digital pressure and vacuum gauges shall be used for pressure and vacuum measurement.
- Minimize refrigerant pipe lengths (locate outdoor unit as close as possible to indoor units), to minimize refrigerant quantity.
- Use continuous line sets unless the length of refrigerant piping is longer than standard line sets.
- Use brazed joints in less accessible locations.
- Protect line sets from damage during transportation and storage, before installation.
- Allow for pipe expansion, and properly support and protect line sets both inside and outside the structure.
- Avoid enclosing line sets in wall cavities, where they cannot be inspected and where they may be inadvertently punctured. If line sets are enclosed in a wall, there must be a proposed method to protect the line sets from being accidentally punctured
- Avoid joints in hidden locations such as wall cavities, where leaks are harder to find and repair. Where joints must be located in such locations, provide an access panel at each joint to allow finding and repairing leaks at joints.
- All technicians working with refrigerant charging and connecting refrigerant piping shall:
  - o Have reviewed and certified in writing that they have received and read Appendix A - Refrigerant Charging and Leak Prevention Requirements (this document).
  - o Be certified to [EPA 608](#) and shall have copies of their certification on-site.
- Contractor shall confirm pipe lengths by field measurements of refrigerant piping (line sets), the total length of one pipe only (not the total length of both pipes), from the connection at the outdoor unit to the connection at all indoor units. Calculate the refrigerant charge to add using manufacturer requirements. Submit this record of measured pipe lengths and refrigerant charge calculation with the charging report (see Quality Control below).

### Flare Joints

- Cut tubing, leaving a few inches of slack in case a flare is defective and must be re-made.
- Use a good quality tubing cutter, work gradually to avoid deforming the tubing, and inspect to make sure that the cut is square.
- Deburr to remove the thin lip of copper inside the tubing but be careful not to gouge or thin the tubing wall
- Some line sets come shipped from the factory pre-flared. Inspect carefully for damage in transport. If damaged, cut tubing and make new flares.
- Use good quality flaring tools that have the following features:
  - A gauge or stop that ensures that tubing is positioned at the correct depth
  - An “eccentric” cone that rolls around the interior of the tubing, forming it into shape
  - A clutch that disengages the cone when the flare is complete
  - Use battery-powered flaring tools to anneal the copper and make it less brittle.
  - Check the size and roundness of the flare using a flare sizing gauge.
- Prior to assembly, inspect the flare to ensure that it is symmetrical and that contact surfaces are clean, shiny, and free of scratches.
- Apply a thin coat of refrigeration oil or an approved assembly lubricant to the contact surface to improve the seal and to the back of the flare nut to keep it from binding.
- Align the cones and hand-tighten the flare nut.
- Tighten the flare nut to the manufacturer-recommended torque using a torque wrench. If the assembly is too loose, the surfaces will not form a good seal; if it is too tight, the flare will crack or split. Torque specs are found in manufacturers’ instructions and range from around 13 ft-lbs for 1/4” tubing to around 56 ft-lbs for 5/8” tubing. Use a torque wrench with a digital gauge.
- Only use flare nuts supplied with the equipment. Manufacturers’ torque specs are for OEM flare nuts, which tend to be longer (with more threads) and of better quality than aftermarket ones.
- If subsequent testing reveals a leak at any flare connection, do not attempt to tighten it further; cut out the defective flare and make a new flare.

### Brazed Joints

- Use brazed joints in locations recommended by the heat pump manufacturer, and in difficult-to-access locations for example, those enclosed in walls or high off the ground.
- Flow nitrogen through the tubing while brazing to prevent formation of copper oxide scale, and safety concerns around open flames.

### Pressure Testing

- Inspect lines sets for damage such as kinking.
- Fill the system with nitrogen for a standing pressure test. Once the system is pressurized, isolated, and allowed to stabilize, it must hold steady for a specified period. Pressurization

## HPD-NYSERDA TECHNICAL REQUIREMENTS

should be done gradually so that catastrophic leaks are caught with minimal waste. The target pressure, specified by the manufacturer, is typically 500-550 psig.

- Test for a minimum of one hour.
- Use a digital pressure gauge with a resolution of maximum 0.1 psi. Do not use analog pressure gauges. A drop in pressure indicates a leak, which should be repaired.
- Measure the outdoor air temperature in the shade at the beginning and end of the test. Correct for the air temperature by 1 psi for each degree Fahrenheit change in temperature. Note that if the outdoor air temperature increases, an increase in pressure could still indicate a leak. For example, if outdoor air temperature increases by 6 degrees, we would expect an increase in pressure of 6 psi. A smaller increase, for example 3 psi, indicates a likely leak. If any deviation from expected pressures is found, a leak should be suspected, investigated, and repaired.
- Apply an approved leak-testing solution (not household dish detergent) to all flares and other site-made connections. Check each fitting for bubble formation, using a flashlight and inspection mirror when necessary to inspect areas that are hidden.
- Make a record of test results using the standard test record card, below (fill out the card and include it in the photo).

### Drawing and Vacuum and the Vacuum Test

- Once the system has been successfully pressure-tested, evacuate the system.
- Use a correctly sized vacuum pump. If a vacuum pump is oversized, it can draw a vacuum too quickly and create ice from humidity in the system. If a vacuum pump is undersized, it will not draw a vacuum quickly enough. The purpose of evacuation is to remove air and moisture from the system, and as a secondary leak check.
- Use a digital vacuum gauge. Do not use an analog vacuum gauge.
- Once the system is pulled down into a deep vacuum of maximum 200 microns, isolate the system from the vacuum pump, and observe changes in vacuum pressure. If the system remains below a decay target of 500 microns after 10 minutes or more of isolation, the system passes. If the system fails, it may be because air is entering through a leak or because excess moisture remains in the system. If the initial deep vacuum or decay target vacuum specified by the manufacturer are less than 200 and 500 microns, respectively, use the manufactured-required vacuums. This best practice does not require a triple vacuum. If the heat pump manufacturer requires a triple vacuum, use the triple vacuum procedure, and use this procedure for the final of the three vacuums.
- Use a bluetooth-enabled vacuum gauge, paired with a mobile app, to provide a time-stamped record of the vacuum test result. Or take a photo of the measurements using the standardized test record card below (fill out the card and include it in each photo).

Standardized Test Record Card		
Date:	Time:	Technician:

Test type (check one): <input type="checkbox"/> Nitrogen <input type="checkbox"/> Vacuum		Check one: <input type="checkbox"/> Beginning of Test <input type="checkbox"/> End of Test
Air temperature: _____ degrees F		

Charging the System and Final Leak Checks

- Charge the system with refrigerant. Use a digital scale to accurately measure the required refrigerant into the system.
- Once the system has been charged with refrigerant, make a final leak check on the service valves and charging ports, with both an approved bubble solution and an electronic leak detector.
- Write the total measured liquid line lengths and final total charge in permanent marker on the outdoor unit and inside the control access panel of the outdoor unit.
- To minimize risk of tampering or refrigerant theft, install locking caps on charging ports.
- Do not use refrigerant gauges/hoses to charge systems for which the manufacturer does not require a superheat/subcool test. In most cases, for variable speed heat pumps, they are not required. Using gauges will causes unnecessary release of refrigerant that is trapped in the gauge hoses.

Quality Control

- Provide a refrigerant charging report, including:
  - the name of the project
  - address
  - heat pump tag (if more than one system)
  - measured line lengths
  - pounds/ounces of added refrigerant charge
  - a copy of manufacturer instructions
  - a copy of this Appendix A signed by all technicians who perform pipe connections and/or refrigerant charging
  - photographs of bubble testing
  - photographs of electronic leak tests
  - time-stamped reports of vacuum decay tests generated by mobile apps.
- Provide a sheet to the owner that allows the facility manager to track leak occurrences by heat pump.

## Appendix B - Removal of Fossil Fuel Equipment

- Permanently seal the bottom and top of chimneys/vents and outdoor air combustion intake openings, and air-seal and insulate these penetrations per energy code. Permanently seal, ridged as with plywood or masonry, air sealed, waterproofed, insulated, and with a vapor barrier. If a chimney is being reused, for example for a smaller hot water flue, the sealing should occur around new flue at top and bottom.
- Permanently cap abandoned gas piping. Do not simply close shutoff valves.
- Remove oil tanks and oil piping and accessories
- For the removal of existing oil tank(s), GC to submit all DEP and FDNY decommissioning documents of the oil tank(s) to HPD. Tanks 1100 Gallons or larger must comply with NYC DEC Requirements.

## Appendix C - Thermostats and Controls

### Equipment:

- A 7-day programmable thermostat is required, per the energy code. Controls shall be fixed, wall-mounted types that are simple and easy to read.

### Thermostat Locations

60" above finished floor, unless a lower height is required for accessibility, on an interior wall, not close to the heat pump indoor unit.

### Required Controls Information/Training for Residents

- Easy-to-read instructions must be provided to residents outlining thermostat settings, thermostat use, basic functions including overrides, "away" mode, Dry mode, information about energy savings, etc.
- A widely accepted approach is to "set and forget" temperature settings for indoor units, rather than to program them for occupied and unoccupied modes. This should only be done in situations for rooms in which unoccupied mode is predominantly at night.
- For rooms where unoccupied mode is during the day, setback can be used.
- Also, for rooms that are unoccupied for more than 24 hours (for example, a rarely used bedroom, or for periods of vacation), setback should be used.
- Thermostats should be set to an occupied/unoccupied schedule to be obtained in writing from the owner for each space.