

GUIDELINE FOR THE INSTALLATION OF STATIONARY EMERGENCY & STANDBY GENERATORS

The information contained within this guideline is provided solely to help facilitate the plan review, permitting, and installation of stationary generators in compliance with the Denver Fire Code (DFC). Because every installation and building differs, this guideline is not intended to identify or discuss every code requirement applicable; therefore, it is the responsibility of the installer and/or responsible design professionals to follow all applicable Codes and Standards as adopted by the City and County of Denver. This guideline is based upon the 2016 Denver Building and Fire Code.

Part I – Permitting and Plan Review

I.A Permits

A Denver Fire Department (DFD) Generator Installation Permit shall be obtained for the installation of all stationary generators including legally required, optional standby, diesel, and natural gas generators. Submittals shall be logged in for review at the Development Services Commercial Log-In counter located at the 2nd floor of the Webb Municipal Building at 201 W. Colfax.

For new construction document permit submittals (i.e. construction documents submitted to the Building Department for permit) the following minimum information shall be included to allow a deferred generator permit submittal at a later date:

- Size of the fuel tank
- Location of the generator showing clearances
- Site plan for exterior generators showing clearances
- Piping plan for fuel tank vents and remote fueling
- Elevation view of the exterior building showing tank vent terminations, exhaust termination, exhaust and intake louvers and remote fuel fill with respect to building openings. Where it is not clear if openings are operable or not, they shall be labeled accordingly.
- Electrical and mechanical information as required for Development Services permitting requirements.

Additional electrical, mechanical and zoning permits may be required by Denver Development Services.

I.B Generator Installation Permit Submittal Requirements

- Submit two sets of scaled drawings signed and sealed by a Colorado licensed design professional; drawings must include the following (DFC N103.13):
 - Specific building address and contact information.
 - Code references used as the basis of design. Type of generator and reason(s) being provided.

- Building floor plan for interior generators showing room layout including room construction, clearances and exhaust and intake louvers. Show supply tanks where applicable.
 - Site plan for exterior generators including the location of the generator and separation distances to property lines, adjacent buildings, and other site features such as transformers, parking lots, drive lanes, doors, windows, etc.
 - Piping plan showing the routing, size, and piping material of all tank vents, exhaust piping, and fuel fill piping.
 - Elevation view of the exterior building showing tank vent terminations, exhaust termination, exhaust and intake louvers and remote fuel fill with respect to building openings.
 - Impact protection where required for exterior generators or remote fuel fill.
 - Location of remote fueling connection for interior generators.
 - Location of remote emergency stop button.
 - Location of generator remote status panel.
 - For exterior generators, submit a structurally designed generator pad.
 - Include Drawing Notes as noted in Section I.C of this document.
- Provide the size of the fuel tank and load duration calculations for the sizing of the fuel tank. (DFC 604.1.4)
Identify the low fuel alarm level (NFPA 110-5.5.2) and the 133% fuel tank capacity required by NFPA 110-5.5.3.

Sample Calculation:

Required Run Time = 8 Hours (full load running per NFPA 110)

Fuel Consumption = 41.2 Gallons/Hr (per manufacturer data)

Min Fuel Necessary & Low Fuel Alarm = 338 Gallons (Run Time x Fuel Consumption)

Minimum (useable) Fuel Tank Size = 383 Gallons (133% x Min Fuel Necessary)

- Where the fuel tank vent termination is located 25 or more feet above the generator, engineering calculations and supporting tank information shall be submitted showing the imposed static pressure from the liquid filled vent line does not exceed the tank rating or the tank is rated for the imposed static head. (IMC 1305.7)
- Provide manufacturer equipment data sheets for all proposed equipment or components (i.e. status panel, fuel piping, remote stop switch, fuel fill alarm, automatic fuel fill shutoffs, etc.). Clearly itemize data sheets where multiple options are available for equipment on a data sheet.
- Provide a manufacturer submittal clearly itemizing the tank UL listing and fuel tank capacity. Note that there are several subcategory types of UL 142 tanks, indicating the tank is "UL 142" is not adequate for specifying the tank construction.

I.C Permit Drawing Notes

Place the following notes on the generator drawing submittal:

DENVER FIRE DEPARTMENT NOTES

- 1) A DENVER FIRE DEPARTMENT INSPECTION IS REQUIRED PRIOR TO FUELING THE GENERATOR. CALL 720-913-3474 TO SCHEDULE INSPECTIONS.
- 2) LEGALLY REQUIRED EMERGENCY OR STANDBY GENERATORS SHALL BE ACCEPTANCE TESTED IN ACCORDANCE WITH NFPA 110. DOCUMENTATION SHALL BE PROVIDED TO THE DENVER FIRE DEPARTMENT OUTLINING THE NFPA 110 ACCEPTANCE TEST CONDUCTED AND RESULTS SHOWING CONFORMITY WITH NFPA 110 ACCEPTANCE TESTING REQUIREMENTS.
- 3) NFPA 704 SIGNAGE SHALL BE PROVIDED ON ABOVE GROUND FUEL TANKS AND ON THE EXTERIOR OF DOORS TO ROOMS CONTAINING FUEL TANKS. NFPA 704 HAZARD RATINGS: HEALTH: 2, FLAMMABILITY: 2, REACTIVITY: 0, SPECIAL HAZARDS: BLANK.



Part II – Generator Installation Fire Code Summary

II.A Location and Room Construction

- 1) Indoor Generators
 - a. Emergency and legally required standby generators must be located at grade or one level below grade. (DFC 604.1.9) See DFC for exceptions. NFPA 110-7.2.4 requires consideration of flood conditions which may prohibit a below grade installation or the requirement to raise the generator above flood level.
 - b. Optional (non-legally required) standby generators are allowed above and below grade however are restricted by fuel storage amount (DFC 604.1.1.1); see Section II.B for further details.
 - c. Indoor emergency generators are required to be located in a 2-hour room. (NFPA 110-7.2).
 - d. Indoor legally required standby generators have no room requirement in sprinklered buildings. Non-sprinklered buildings shall have 1-hour fire rated generator room. (NFPA 37-4.1.2)
 - e. Fire dampers are prohibited in any required ventilation or combustion air ductwork and therefore any ductwork from a fire rated generator room shall be provided with a fire rated shaft to the exterior of the building with the same fire rating as the room. (NFPA 110-7.7)
 - f. All penetrations of the generator room are prohibited by NFPA 110 unless the penetration serves the room. All non-dedicated mechanical, plumbing, or electrical penetrations or equipment in the generator room are prohibited.
 - g. Generators shall be situated with access for maintenance, repair, and firefighting. (NFPA 37-4.1.1)
Provide 3 feet minimum clearance around a generator to meet this requirement and for fuel tank clearance required by NFPA 110-7.9.12.1.
 - h. Battery powered emergency lighting is required in generator rooms with the charging system and normal room lighting supplied with normal power from the load side of the generator. (NFPA 110-7.3)
- 2) Exterior Generators
 - a. Generators shall be located with respect to a potential natural disaster affecting the operation of the power supply. (NFPA 110-7.2.4)
Generators shall not be located closer than 10' to a transformer unless a 2-hour fire barrier is provided between the transformer and generator. (DFC 604.1.9.1 b)
 - b. Impact protection is required for exterior generators where subject to vehicle impacts. Where 4" concrete filled bollards are used, they shall be set a minimum of 3 feet from the generator. (DFC 312)
 - c. Generators with UL 142 listed fuel tanks shall be located as follows based on the stored volume of fuel.

Tank Volume (Gallons)	Min Distance from Property Line of Property Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way (Feet)	Minimum Distance from Nearest Side of Any Public Way or from the Nearest Important Building On the Same Property (Feet)
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5

The distance to the property line may be reduced by one-half but not less than 5 feet when using a UL 2085 listed protected above-ground fuel tank. (DFC 5704.2.9.6.1.1, exception 3)

Where a generator is located within 5 feet of the building, the exterior wall shall be non-combustible and shall have a 2-hour fire resistance rating. (DFC 604.1.9.1 a)

- d. Generators shall be located at least 5 feet from building openings. (NFPA 37-4.1.4)
- e. Generators shall be situated with access for maintenance, repair, and firefighting. (NFPA 37-4.1.1)

Provide 3 feet minimum clearance around a generator to meet this requirement and for fuel tank clearance required by NFPA 110-7.9.12.1.

II.B Fuel Source and Fuel Storage

1) Diesel Fuel Supply

- a. Emergency and legally required standby generators shall be operated by a diesel-fueled prime mover. (DFC 604.1.1)

Diesel fuel storage outside shall comply with DFC 603.3.1.

Diesel fuel storage inside the building shall comply with DFC 603.3.2, DFC 604.1.9 and NFPA 37-6.3.2.

- b. Optional standby generators may be operated by a diesel fueled prime mover. Where optional standby diesel-fueled generators are located at other than grade level, individual fuel tank capacity shall not exceed 120 gallons, with a total capacity not to exceed 660 gallons on any building story or level.
- c. Listed (i.e., UL 142) generator sub-base secondary containment fuel tanks of 660-gallon capacity and below shall be permitted to be installed outdoors or indoors without diking or remote impounding. (NFPA 110-7.9.12)

Otherwise, fuel tanks within structures shall be provided with spill containment consisting of either a wall, a curb, or a dike having a capacity at least equal to that of the largest tank enclosed. (NFPA 37-6.3.2.4)

Listed secondary containment tanks and listed open top dike tanks are allowed indoors. Listed closed top dike tanks are only allowed outdoors.

2) Natural Gas Fuel Supply

- a. Natural gas fueled generators are only permitted for optional (non-legally required) standby generators. (DFC 604.1.1.1) Natural gas fuel shall be provided by a public utility and piped to the unit per NFPA 37-Chapter 5 and International Fuel & Gas Code (IFGC).

3) Liquefied Petroleum Gas (LP-Gas) Supply

- a. Liquefied Petroleum Gas (LP-Gas) fueled generators are not permitted.

II.C Generator Fuel Tank Venting

- 1) Normal and emergency venting shall be designed and sized in accordance with DFC 5703.6 and NFPA 30-22.7.
- 2) Fuel tanks located indoors shall have fuel tank vents (i.e., normal and emergency) piped to the exterior, terminating at a location 12' above grade, and a minimum of 5' from building openings. Vents shall be located such that flammable vapors will not be trapped by eave or other overhangs. (DFC 5704.2.7.3.3)
For Secondary Containment Fuel Tanks three vents are to be extended full size to the exterior; normal vent, emergency vent, and annular or interstitial space emergency vent.
- 3) Fuel tanks located outdoors shall have the fuel tank normal vent extended 12' above grade. Emergency vents may terminate inside the weatherproof housing.
- 4) When the outlet of an emergency vent must be extended more than 25 feet to a remote location, such as for tanks located in buildings, which require vent discharges to be located outside, a significant reduction in vent flow can occur unless the size of the vent and connecting piping is increased. In such cases, the size of vents and vent pipe extensions should be calculated to ensure that a tank will not be over pressurized during a fire exposure. Vent sizing formulas and prescriptive vent sizes, such as those established by ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, are typically based on the direct installation of a venting device onto a tank. Piping to or from approved emergency vent devices for atmospheric and low- pressure tanks shall be sized to provide emergency vent flows that limit the back pressure to less than the maximum pressure permitted by the design of the tank. Piping to or from approved emergency vent devices for pressure vessels shall be sized in accordance with the ASME *Boiler and Pressure Vessel Code*. (NFPA 30-27.8.1.6)
- 5) Where tank vents are located above the tank such that the static head of liquid filled vent pipe exceeds 10psi, the tank shall be rated for the maximum pressure imposed. (IMC 1305.7)
- 6) Weather proof caps shall be provided on all vents with the same free open vent area as the cross section of the vent pipe. Screens shall not be finer than No. 4 mesh. (IMC 1305.7)
- 7) Vent piping shall be installed such that they will drain toward the tank without sags or traps in which liquid can collect. Vent pipes shall be installed in such a manner so as not to be subject to physical damage or vibration. (DFC 5704.2.7.3.4)
- 8) Vent piping shall not utilize low-melting-point materials such as aluminum, copper, plastic. (DFC 5703.6.2.1)

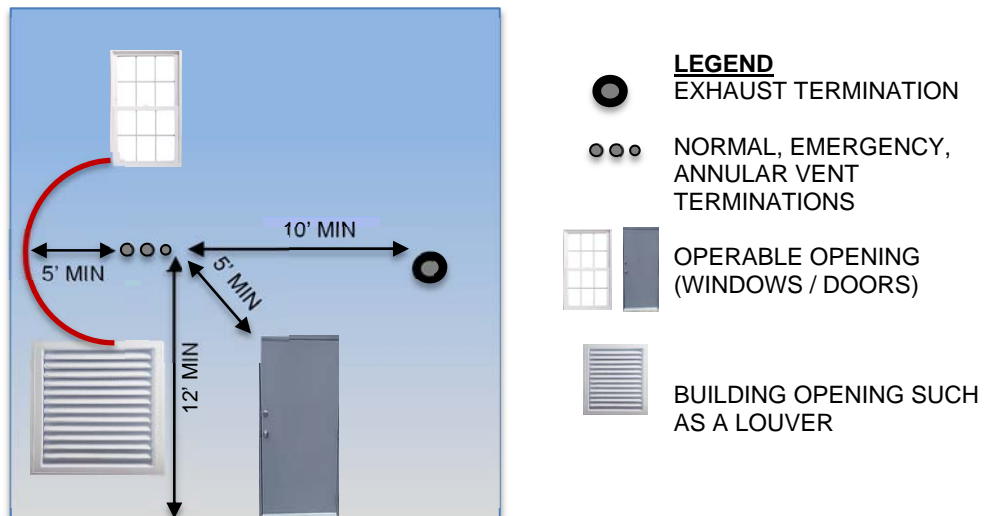


Figure II.C – Fuel Tank Vent Terminations

II.D Generator Exhaust

- 1) Exhaust shall terminate a minimum of 10' above grade and 10' from operable openings. (IMC 501.3.1)
The design engineer shall also comply with NFPA 110-7.10.2 which mandates that the exhaust shall terminate such that toxic fumes shall not enter the building; this requirement may exceed the 10' required by the IMC.
- 2) NFPA 37-8.2.3 requires the exhaust to terminate in a safe location and not into atmospheres containing flammable vapors. The exhaust termination shall be a minimum of 10' from the fuel tank vent termination releasing flammable vapors.

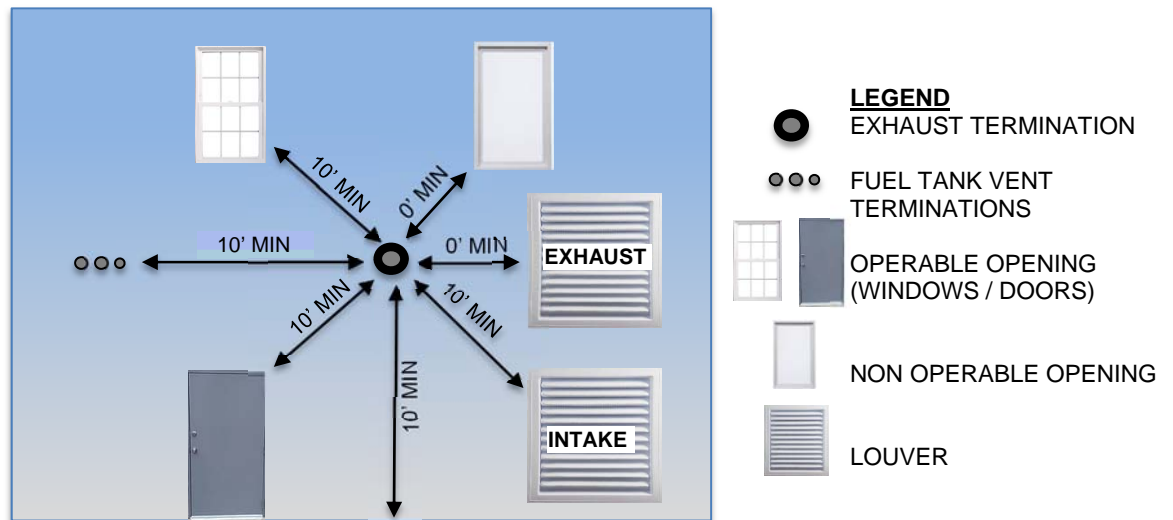


Figure II.D – Generator Exhaust Terminations

II.E Remote Fuel Fill

- 1) Remote fuel fill location shall be located outside of buildings, maximum of 5' above grade, and minimum of 5' away from building openings. (DFC 5704.2.7.5.6)
- 2) When subject to potential vehicle impact; impact protection shall be provided in accordance with DFC 312.

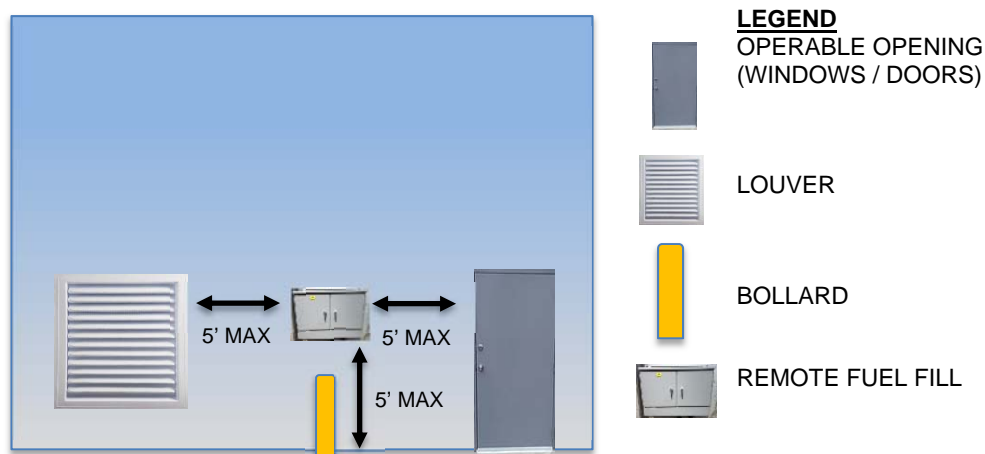


Figure II.E – Remote Fuel Fill Location

II.F Filling

- 1) Piping, connections and fittings and other appurtenances used for filling diesel fuel tanks shall comply with DFC 5703.6. 2.2. Closed double-wall steel piping and leak monitoring shall be required for bulk transfer and process transfer of flammable and combustible liquids inside buildings with the following exception:
Exception: Single wall metallic piping may be used where:
 - a. the fuel storage tank and fuel-burning equipment are located in a parking garage
 - b. the fuel storage tank and fuel-burning equipment are located aboveground exterior to the building
 - c. fuel is automatically transferred from a tank vehicle to a stationary tank, provided the piping system is exposed and continuously supervised by trained personnel during the transfer operation
 - d. fuel is manually transferred inside a building from a portable tank not greater than 55 gallons provided the piping system is exposed and continuously supervised by trained personnel during the transfer operation.

Pipe joints in double wall piping shall be welded and in single wall piping shall be welded or threaded. (DFC 5703.6.10)

Fill lines shall be sloped toward the tank.

- 2) Overfill prevention shall be provided to prevent the overfill of diesel fuel tanks. (DFC 5704.2.7.5.8)

Exception is outside above-ground tanks with a capacity of 1,320 gallons or less.

Overfill prevention system shall:

- a. Provide an independent means of notifying the person filling the tank that the fluid level has reached 90 percent of tank capacity by providing an audible or visual

alarm signal, providing a tank level gauge marked at 90 percent of tank capacity, or other approved means; and

- b. Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of tank capacity.

II.G Remote Generator Status Panel

- 1) All generators shall be provided with a remote status panel in accordance with NFPA 110 and complying with Section 907.2.13.7. Optional standby generators shall also be provided with a remote status panel. Panel location shall be in an area approved by the fire code official. (DFC 604.1.2)
- 2) The remote control panel functions shall include the required items listed in NFPA 110-5.6.5.
- 3) A low-fuel sensing switch shall be provided for the main fuel supply tank(s) to indicate when less than the minimum fuel necessary for full load running remains in the fuel tank. In no case shall the low-fuel alarm be less than 75% of the tank size. (NFPA 110-5.5.2)
- 4) A graphic map to assist the responding fire fighters shall be provided adjacent to the remote status panel indicating the location of the generator, equipment served by the generator, location of emergency disconnects and remote manual stop station.

II.H Remote Emergency Stop Button

- 1) Provide an identified/labeled remote manual stop station outside the room housing the generator or external to the weatherproof enclosure if located outside. This is in addition to the normal remote stop button. The purpose of the emergency stop button is to shut off the fuel supply and electrical power to the unit, leaving only essential lubricating oil and fire suppression services operational as applicable. The emergency stop button is usually colored red and conspicuously identified. (NFPA 110-5.6.5.6)

Part III – Inspection

III-A Acceptance Test

- Schedule the acceptance by contacting the flammables section of the Fire Prevention Division at 720-913-3474. Provide the generator install fire permit number.
- Generators shall not be placed in operation until after the acceptance test is performed by a Fire Code Official. FUEL SHALL NOT BE PLACED IN DIESEL FUEL TANKS PRIOR TO ACCEPTANCE TEST. The acceptance test shall include the following:
 - o Verification of generator location.
 - o Inspection of required signage.
 - o Inspection of fuel tank(s) venting.
 - o Inspection of generator exhaust.
 - o Inspection of fill piping and remote fuel fill station.
 - o Test of low level fuel alarm at remote status panel.
 - o Test of overfill prevention system.
 - o Test of remote status panel functions.
 - o Inspection of graphic map adjacent to remote status panel.
 - o Verify location of remote emergency stop button and test it while generator is running.

III-B Permits

- Operational permits shall be issued upon approval, issuance, and final inspection and acceptance test of required generator install fire permit.
 - a. A separate annual generator permit is required to maintain and operate a diesel (fuel oil) or natural gas fueled generator set(s).
 - b. A separate annual Flammable and Combustible Liquid Storage/use permit will be required for diesel fueled generators.
- **PERMIT COST** - See Permit Fee Table at www.denvergov.org/FIRE for current fees for both operational and installation permits.
- Operational permits shall be posted on site.

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