

Backup Power Generator Exhaust Insulation Systems

- Many commercial and industrial buildings commonly install emergency backup power generators to temporarily operate electrical systems during interruptions to the primary power supply. These generators are fueled with diesel, natural gas, propane or other types of fuel sources.
- The combustion of fuel generates extremely hot flue gases that typically pass through a sound attenuating muffler and are then evacuated out of the building via exhaust piping. Insulated piping utilizes waste heat to improve generator efficiency.
- One emerging trend amongst Engineers is to consider the use of stainless steel piping due to an elevated risk of internal condensation corrosion and high-temperature sulfidation corrosion concerns especially with a diesel fuel source.
- Another important design criteria for these piping systems is the extreme temperature swings due to intermittent/continuous use during power outages and the weekly scheduled exercises to maintain the reliability of the unit.
- The piping spends much of its service life at the ambient air temperature of the mechanical room except during usage where the flue gas exhaust temperature can quickly rise to between 500°F - 1300°F (260°C - 704°C) and then cool back down to ambient over the next several hours/days after the generator stops running.
- This extreme cyclical service creates special design considerations that can be effectively addressed by considering the recommended mechanical insulation system described below.
- TPSX-12® Calcium Silicate Pipe and Block Thermal Insulation per ASTM C533 type I
- Install a **minimum of two layers** of insulation with both longitudinal and circumferential joints offset from previous layer.
 - Due to the rapid heat induced expansion of the metal pipe length, double layering the insulation ensures that gaps do not open up in the joints of the insulation creating excessive heat loss and higher jacketing temperatures.
 - If flue gas temperature exceeds 1200°F
 - Wrap pipe or muffler with 1" thick ceramic fiber blanket, then install calcium silicate over the blanket
 - If required for personnel protection to reduce potential for human contact burn injuries
 - Insulation thickness shall be sufficient to keep jacketing surface temperature below 140°F (60°C)
 - Jacketing surface temperatures can be calculated using this free website - <https://www.3eplus.org/>
 - All joints between insulation sections shall be tightly fitted to minimize gaps
- Each layer of insulation shall be secured individually to the metal asset with T304 stainless steel wire for smaller diameter piping
 - Stainless steel bands and wing seals shall be installed in lieu of wire for larger diameter piping and mufflers
- Insulation shall be covered with one of the following (Engineer's Preference)
 - Aluminum jacketing per ASTM C1729 type I, grade I, class A
 - Stainless steel jacketing per ASTM C1767 type I, grade I, class A
- Jacketing shall be installed and banded over the insulation using stainless steel bands and wing seals (max. 12" on center)
 - Jacketing shall be overlapped both circumferentially and longitudinally with a minimum of 2" overlap

Double Layer Installation Diagram

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