Let $J$ be the Lévy density of a symmetric Lévy process in $\mathbb{R}^d$ with its Lévy exponent satisfying a weak lower scaling condition at infinity. Consider the non-symmetric and non-local operator

$$L^\kappa f(x) := \lim_{\epsilon \downarrow 0} \int_{\{z \in \mathbb{R}^d : |z| > \epsilon\}} (f(x + z) - f(z)) \kappa(x, z) J(z) dz,$$

where $\kappa(x, z)$ is a Borel measurable function on $\mathbb{R}^d \times \mathbb{R}^d$ satisfying $0 < \kappa_0 \leq \kappa(x, z) \leq \kappa_1$, $\kappa(x, z) = \kappa(x, -z)$ and $|\kappa(x, z) - \kappa(y, z)| \leq \kappa_2 |x - y|^\beta$ for some $\beta \in (0, 1)$. We construct the heat kernel $p^\kappa(t, x, y)$ of $L^\kappa$, establish its upper bound as well as its fractional derivative and gradient estimates. Under an additional weak upper scaling condition at infinity, we also establish a lower bound for the heat kernel $p^\kappa$. (Received August 15, 2016)