$$
\begin{aligned}
G &= \int \eta_1(\vec{A},\alpha_1,\ell_1,m_1,n_1)(\vec{r}_{A1})\eta_2(\vec{B},\alpha_2,\ell_2,m_2,n_2)(\vec{r}_{B1}) \\
&\times \frac{1}{r_{12}}\eta_3(\vec{C},\alpha_3,\ell_3,m_3,n_3)(\vec{r}_{C2})\eta_4(\vec{D},\alpha_4,\ell_4,m_4,n_4)(\vec{r}_{D2})dV_1dV_2 \\
&= \Omega \sum_{\ell=0}^{\ell_1+\ell_2}\sum_{r=0}^{[\ell/2]}\sum_{\ell'=0}^{\ell_3+\ell_4}\sum_{r'=0}^{[\ell'/2]}\sum_{i=0}^{[(\ell+\ell'-2r-2r')/2]} \\
& B_{\ell,\ell',r,r',i}(\ell_1,\ell_2,\vec{A}_x,\vec{B}_x,\vec{P}_x,\gamma_1;\ell_3,\ell_4,\vec{C}_x,\vec{D}_x,\vec{Q}_x,\gamma_2) \\
&\times \sum_{m=0}^{m_1+m_2}\sum_{s=0}^{[m/2]}\sum_{m'=0}^{m_3+m_4}\sum_{s'=0}^{[m'/2]}\sum_{j=0}^{[(m+m'-2s-2s')/2]} \\
& B_{m,m',s,s',j}(m_1,m_2,\vec{A}_y,\vec{B}_y,\vec{P}_y,\gamma_1;m_3,m_4,\vec{C}_y,\vec{D}_y,\vec{Q}_y,\gamma_2) \\
&\times \sum_{n=0}^{n_1+n_2}\sum_{t=0}^{[n/2]}\sum_{n'=0}^{n_3+n_4}\sum_{t'=0}^{[n'/2]}\sum_{k=0}^{[(n+n'-2t-2t')/2]} \\
& B_{n,n',t,t',k}(n_1,n_2,\vec{A}_z,\vec{B}_z,\vec{P}_z,\gamma_1;n_3,n_4,\vec{C}_z,\vec{D}_z,\vec{Q}_z,\gamma_2) \\
&\times F_\nu(\vec{p}^2/4\delta) \qquad (1)
\end{aligned}
$$

where

$$
\begin{aligned}
\nu &= \ell+\ell'+m+m'+n+n'-2(r+r'+s+s'+t+t')-(i+j+k) \\
\delta &= \frac{1}{4\gamma_1}+\frac{1}{4\gamma_2}
\end{aligned}
$$

and the "Gaussian product factor" Ω, involving the original factors K_1 and K_2, is given by

$$
\Omega = \frac{2\pi^2}{\gamma_1\gamma_2}\left(\frac{\pi}{\gamma_1+\gamma_2}\right)^{1/2}\exp\left(-\frac{\alpha_1\alpha_2\vec{AB}^2}{\gamma_1}-\frac{\alpha_3\alpha_4\vec{CD}^2}{\gamma_2}\right)
$$

One thing is clear from this rather awesome formula; the electron-repulsion integral is simply a weighted sum of the integrals $F_\nu(x)$. The coefficients which multiply the $F_\nu(x)$ involve

1. The powers of x, y, and z in the Cartesian factors of each of the GTFs.
2. The exponents of each of the GTFs.

3. The components of the position vectors of each GTF.

The B terms can be simplified by the definition of

$$\theta(\ell, \ell_1, \ell_2, a, b, r, \gamma) = f_\ell(\ell_1, \ell_2, a, b)\frac{\ell!\gamma^{r-\ell}}{r!(\ell - 2r)!}$$

Then the B involving the "x-components" is

$$\begin{aligned} & B_{\ell,\ell',r_1,r_2,i}(\ell_1, \ell_2, \vec{A}_x, \vec{B}_x, \vec{P}_x, \gamma_1; \ell_3, \ell_4, \vec{C}_x, \vec{D}_x, \vec{Q}_x, \gamma_2) \\ = \;& (-1)^\ell \theta(\ell, \ell_1, \ell_2, \vec{PA}_x, \vec{PB}_x, r, \gamma_1)\theta(\ell', \ell_3, \ell_4, \vec{QC}_x, \vec{QD}_x, r', \gamma_2) \\ \times \;& \frac{(-1)^i (2\delta)^{2(r+r')}(\ell + \ell' - 2r - 2r')!\delta^i \vec{p}_x^{\,\ell+\ell'-2(r+r'+i)}}{(4\delta)^{\ell+\ell'} i![\ell + \ell' - 2(r + r' + i)]!} \end{aligned}$$

With completely analogous expressions for the other two B factors.