$$
\begin{aligned}
q_i^j f_j &= \phi f_i \\
q_i^j g_j &= \gamma g_i \\
f^i g_i &= 0
\end{aligned}
$$

$$
Q_{ij}^{kl} = q_j^l \delta_i^k + q_i^k \delta_j^l + q_i^k \delta_i^l \delta_j^k + q_i^l \delta_i^k \delta_j^l
$$

$$
\begin{aligned}
H_{ij} &= f_i g_j - g_i f_j \\
Q_{ij}^{kl} H_{kl} &= \left(q_j^l \delta_i^k + q_i^k \delta_j^l + q_i^k \delta_i^l \delta_j^k + q_i^l \delta_i^k \delta_j^l \right) \cdot \left(f_k g_l - g_k f_l \right) \\
&= q_j^l f_i g_l - q_j^l g_i f_l + q_i^k f_k g_j - q_i^k g_k f_j + q_i^j f_j g_i - q_i^j g_j f_i + q_i^j f_i g_j - q_i^j g_i f_j \\
&= \gamma f_i g_j - \phi g_i f_j + \phi f_i g_j - \gamma g_i f_j + \phi f_i g_i - \gamma g_i f_i + \gamma f_j g_j - \phi g_j f_j \\
&= (\gamma + \phi) H_{ij}
\end{aligned}
$$