

Two Higgs Doublet Model + complex singlet
Lagrangian, Rotations and Interactions for eigenstates 'EWSB'
including Renormalization Group Equations
including one-loop Self-Energies

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References: **arXiv: 1309.7223** , **Comput.Phys.Commun.184:1792-1809,2011 (1207.0906)** , **Comput.Phys.Commun.182:833,2011 (1002.0840)** , **Comput.Phys.Commun.181:1077-1086,2010 (0909.2863)** , **arXiv: 0806.0538**

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1 Fields

1.1 Gauge Fields

Name	$SU(N)$	Coupling	Name
B	$U(1)$	g_1	hypercharge
W	$SU(2)$	g_2	left
g	$SU(3)$	g_3	color

1.2 Matter Superfields

Name	Spin	Generations	$(U(1) \otimes SU(2) \otimes SU(3))$
H1	0	1	$(\frac{1}{2}, \mathbf{2}, \mathbf{1})$
H2	0	1	$(\frac{1}{2}, \mathbf{2}, \mathbf{1})$
S	0	1	$(0, \mathbf{1}, \mathbf{1})$
q	$\frac{1}{2}$	3	$(\frac{1}{6}, \mathbf{2}, \mathbf{3})$
l	$\frac{1}{2}$	3	$(-\frac{1}{2}, \mathbf{2}, \mathbf{1})$
d	$\frac{1}{2}$	3	$(\frac{1}{3}, \mathbf{1}, \mathbf{\bar{3}})$
u	$\frac{1}{2}$	3	$(-\frac{2}{3}, \mathbf{1}, \mathbf{\bar{3}})$
e	$\frac{1}{2}$	3	$(1, \mathbf{1}, \mathbf{1})$

2 Lagrangian

2.1 Input Lagrangian for Eigenstates GaugeES

$$\begin{aligned}
L = & -\frac{1}{2}m_{Sp} sR^2 - \frac{1}{6}\mu_{s1} sR^3 - \frac{1}{24}l_{1pp} sR^4 - m_{11}|H_1^0|^2 - \mu_{11} sR|H_1^0|^2 - l_{4p} sR^2|H_1^0|^2 - m_{11}|H_1^+|^2 - \mu_{11} sR|H_1^+|^2 \\
& - l_{4p} sR^2|H_1^+|^2 - m_{22}|H_2^0|^2 - \mu_{22} sR|H_2^0|^2 - l_{5p} sR^2|H_2^0|^2 - m_{22}|H_2^+|^2 - \mu_{22} sR|H_2^+|^2 \\
& - l_{5p} sR^2|H_2^+|^2 - m_S |sR|^2 - \frac{1}{2}l_1|H_1^0|^4 - \frac{1}{2}l_1|H_1^+|^4 - \frac{1}{2}l_2|H_2^0|^4 - \frac{1}{2}l_2|H_2^+|^4 - \frac{1}{4}l_{3pp}|sR|^4 + H_2^0 m_{12} H_1^{0,*} \\
& - H_2^0 \mu_{12} sR H_1^{0,*} - H_2^0 l_{6p} sR^2 H_1^{0,*} - H_2^0 l_6 |H_1^+|^2 H_1^{0,*} - H_2^0 l_7 |H_2^+|^2 H_1^{0,*} - H_2^0 l_{3p} |sR|^2 H_1^{0,*} \\
& - \frac{1}{2}H_2^{0,2} l_5 H_1^{0,*2} - H_1^0 H_2^0 l_6 H_1^{0,*2} + H_2^+ m_{12} H_1^{+,*} - H_2^+ \mu_{12} sR H_1^{+,*} - H_2^+ l_{6p} sR^2 H_1^{+,*} \\
& - H_1^+ l_1 |H_1^0|^2 H_1^{+,*} - H_2^+ l_6 |H_1^+|^2 H_1^{+,*} - H_2^+ l_7 |H_2^0|^2 H_1^{+,*} - H_2^+ l_{3p} |sR|^2 H_1^{+,*} \\
& - H_2^0 H_2^+ l_5 H_1^{0,*} H_1^{+,*} - \frac{1}{2}H_2^{+,2} l_5 H_1^{+,*2} - H_1^+ H_2^+ l_6 H_1^{+,*2} - H_1^0 \mu_{21} sR H_2^{0,*} - H_1^0 l_{7p} sR^2 H_2^{0,*} \\
& - H_2^0 l_3 |H_1^0|^2 H_2^{0,*} - H_2^0 l_4 |H_1^+|^2 H_2^{0,*} - H_2^0 l_3 |H_1^+|^2 H_2^{0,*} - H_2^{0,2} l_7 H_1^{0,*} H_2^{0,*} \\
& - H_1^0 H_2^+ l_4 H_1^{+,*} H_2^{+,*} - H_1^+ \mu_{21} sR H_2^{+,*} - H_1^+ l_{7p} sR^2 H_2^{+,*} - H_2^+ l_3 |H_1^0|^2 H_2^{+,*} \\
& - H_2^+ l_3 |H_1^+|^2 H_2^{+,*} - H_2^+ l_4 |H_1^+|^2 H_2^{+,*} - H_2^+ l_2 |H_2^0|^2 H_2^{+,*} - H_1^+ H_2^0 l_4 H_1^{0,*} H_2^{+,*}
\end{aligned}$$

$$\begin{aligned}
& -H_2^{+,2}l_7H_1^{+,*}H_2^{+,*} - H_1^0|sR|^2H_2^{0,*}l_{3p}^* - H_1^+|sR|^2H_2^{+,*}l_{3p}^* - \frac{1}{2}H_1^{0,2}H_2^{0,*2}l_5^* \\
& - H_1^0H_1^+H_2^{0,*}H_2^{+,*}l_5^* - \frac{1}{2}H_1^{+,2}H_2^{+,*2}l_5^* - H_1^0|H_1^+|^2H_2^{0,*}l_6^* - H_1^{0,2}H_1^{+,*}H_2^{0,*}l_6^* \\
& - H_1^+|H_1^0|^2H_2^{+,*}l_6^* - H_1^{+,2}H_1^{+,*}H_2^{+,*}l_6^* - H_1^0|H_2^+|^2H_2^{0,*}l_7^* - H_1^0H_2^0H_2^{0,*2}l_7^* \\
& - H_1^+|H_2^0|^2H_2^{+,*}l_7^* - H_1^+H_2^+H_2^{+,*2}l_7^* + H_1^0H_2^{0,*}m_{12}^* + H_1^+H_2^{+,*}m_{12}^* - \frac{1}{2}\mu_{s2}sR^2\text{conj}(sR) - \frac{1}{6}l_{2pp}sR^3\text{conj}(sR) \\
& - l_{1p}sR|H_1^0|^2\text{conj}(sR) - l_{1p}sR|H_1^+|^2\text{conj}(sR) - l_{2p}sR|H_2^0|^2\text{conj}(sR) - l_{2p}sR|H_2^+|^2\text{conj}(sR) - |H_1^0|^2\mu_{11}^*\text{conj}(sR) - |H_1^+|^2\mu_{11}^*\text{conj}(sR) \\
& - H_1^0H_2^{0,*}\mu_{12}^*\text{conj}(sR) - H_1^+H_2^{+,*}\mu_{12}^*\text{conj}(sR) - H_2^0H_1^{0,*}\mu_{21}^*\text{conj}(sR) - H_2^+H_1^{+,*}\mu_{21}^*\text{conj}(sR) - |H_2^0|^2\mu_{22}^*\text{conj}(sR) \\
& - |H_2^+|^2\mu_{22}^*\text{conj}(sR) - |H_1^0|^2l_{4p}^*\text{conj}(sR)^2 - |H_1^+|^2l_{4p}^*\text{conj}(sR)^2 - |H_2^0|^2l_{5p}^*\text{conj}(sR)^2 - |H_2^+|^2l_{5p}^*\text{conj}(sR)^2 \\
& - H_1^0H_2^{0,*}l_{6p}^*\text{conj}(sR)^2 - H_1^+H_2^{+,*}l_{6p}^*\text{conj}(sR)^2 - H_2^0H_1^{0,*}l_{7p}^*\text{conj}(sR)^2 - H_2^+H_1^{+,*}l_{7p}^*\text{conj}(sR)^2 - \frac{1}{2}m_{Sp}^*\text{conj}(sR)^2 - \frac{1}{2}sR\mu_{s2}^* \\
& - \frac{1}{6}sRl_{2pp}^*\text{conj}(sR)^3 - \frac{1}{6}\mu_{s1}^*\text{conj}(sR)^3 - \frac{1}{24}l_{1pp}^*\text{conj}(sR)^4 - H_2^0d_{L,k\gamma}^*\epsilon_{d,jk}^*\delta_{\beta\gamma}d_{R,j\beta} - H_2^+\epsilon_{d,jk}^*u_{L,k\gamma}^*\delta_{\beta\gamma}d_{R,j\beta} \\
& - H_1^0d_{L,k\gamma}^*Y_{d,jk}^*\delta_{\beta\gamma}d_{R,j\beta} - H_1^+u_{L,k\gamma}^*Y_{d,jk}^*\delta_{\beta\gamma}d_{R,j\beta} - H_2^{0,*}d_{R,j\beta}^*\delta_{\beta\gamma}d_{L,k\gamma}\epsilon_{d,jk} \\
& - H_2^{0,*}e_{R,j}^*e_{L,k}\epsilon_{e,jk} + H_2^+u_{R,j\beta}^*\delta_{\beta\gamma}d_{L,k\gamma}\epsilon_{u,jk} - H_2^0e_{L,k}^*\epsilon_{e,jk}^*e_{R,j} - H_2^+\epsilon_{e,jk}^*\nu_{L,k}^*e_{R,j} \\
& - H_1^0e_{L,k}^*Y_{e,jk}^*e_{R,j} - H_1^+\nu_{L,k}^*Y_{e,jk}^*e_{R,j} - H_2^{+,*}d_{R,j\beta}^*\delta_{\beta\gamma}\epsilon_{d,jk}u_{L,k\gamma} \\
& - H_2^0u_{R,j\beta}^*\delta_{\beta\gamma}\epsilon_{u,jk}u_{L,k\gamma} + H_2^{+,*}d_{L,k\gamma}^*\epsilon_{u,jk}^*\delta_{\beta\gamma}u_{R,j\beta} - H_2^{0,*}\epsilon_{u,jk}^*u_{L,k\gamma}^*\delta_{\beta\gamma}u_{R,j\beta} \\
& + H_1^{+,*}d_{L,k\gamma}^*Y_{u,jk}^*\delta_{\beta\gamma}u_{R,j\beta} - H_1^0u_{L,k\gamma}^*Y_{u,jk}^*\delta_{\beta\gamma}u_{R,j\beta} - H_2^{+,*}e_{R,j}^*\epsilon_{e,jk}\nu_{L,k} \\
& - H_1^0d_{R,j\beta}^*\delta_{\beta\gamma}d_{L,k\gamma}Y_{d,jk} - H_1^+d_{R,j\beta}^*\delta_{\beta\gamma}u_{L,k\gamma}Y_{d,jk} - H_1^0e_{R,j}^*e_{L,k}Y_{e,jk} \\
& - H_1^{+,*}e_{R,j}^*\nu_{L,k}Y_{e,jk} + H_1^+u_{R,j\beta}^*\delta_{\beta\gamma}d_{L,k\gamma}Y_{u,jk} - H_1^0u_{R,j\beta}^*\delta_{\beta\gamma}u_{L,k\gamma}Y_{u,jk}
\end{aligned} \tag{1}$$

2.2 Gauge fixing terms

2.2.1 Gauge fixing terms for eigenstates 'GaugeES'

$$L_{GF} = -\frac{1}{2}|\partial_\mu B|^2\xi_B^{-1} - \frac{1}{2}|\partial_\mu g|^2\xi_g^{-1} - \frac{1}{2}|\partial_\mu W|^2\xi_W^{-1} \tag{2}$$

2.2.2 Gauge fixing terms for eigenstates 'EWSB'

$$\begin{aligned}
L_{GF} = & -\frac{1}{2}|\partial_\mu g|^2\xi_g^{-1} - \frac{1}{2}|\partial_\mu \gamma|^2\xi_\gamma^{-1} - \frac{i}{2}g_2(v_1H_1^{+,*} + v_2H_2^{+,*})\xi_{W-} + |\partial_\mu W^-|^2\xi_{W-}^{-1} \\
& - \frac{1}{2}|\sigma_1v_1 + \sigma_2v_2|\xi_Z(g_1\sin\Theta_W + g_2\cos\Theta_W) + \partial_\mu Z|^2\xi_Z^{-1}
\end{aligned} \tag{3}$$

2.3 Fields integrated out

None

3 Renormalization Group Equations

3.1 Anomalous Dimensions for fermions

$$\gamma_d^{(1)} = \frac{1}{15} (20g_3^2 + g_1^2) \mathbf{1Xi} \delta_{1,\text{col}2} + \epsilon_d \epsilon_d^\dagger + Y_d Y_d^\dagger \quad (4)$$

$$\gamma_d^{(2)} = 0 \quad (5)$$

$$\gamma_e^{(1)} = \frac{3}{5} g_1^2 \mathbf{1Xi} + \epsilon_e \epsilon_e^\dagger + Y_e Y_e^\dagger \quad (6)$$

$$\gamma_e^{(2)} = 0 \quad (7)$$

$$\gamma_u^{(1)} = \frac{4}{15} (5g_3^2 + g_1^2) \mathbf{1Xi} \delta_{1,\text{col}2} + \epsilon_u \epsilon_u^\dagger + Y_u Y_u^\dagger \quad (8)$$

$$\gamma_u^{(2)} = 0 \quad (9)$$

$$\gamma_l^{(1)} = \frac{1}{2} (\epsilon_e^T \epsilon_e^* + Y_e^T Y_e^*) + \frac{3}{20} (5g_2^2 + g_1^2) \mathbf{1Xi} \delta_{1,\text{lef}2} \quad (10)$$

$$\gamma_l^{(2)} = 0 \quad (11)$$

$$\gamma_q^{(1)} = \frac{1}{60} \delta_{\text{lef}1,\text{lef}2} \left((45g_2^2 + 80g_3^2 + g_1^2) \mathbf{1Xi} \delta_{1,\text{col}2} + 30 (\epsilon^{1\text{lef}1} \epsilon^{1\text{lef}2} (\epsilon_u^T \epsilon_u^* + Y_u^T Y_u^*) + \epsilon^{2\text{lef}1} \epsilon^{2\text{lef}2} \epsilon_u^T \epsilon_u^* + \epsilon^{2\text{lef}1} \epsilon^{2\text{lef}2} Y_u^T Y_u^* + \epsilon_d^T \epsilon_d^* + Y_d^T Y_d^*) \right) \quad (12)$$

$$\gamma_q^{(2)} = 0 \quad (13)$$

3.2 Anomalous Dimensions for real components of scalars

$$\gamma_{\text{iH}1}^{(1)} = -3\epsilon^{2\text{lef}2} \text{Tr}(Y_u Y_u^\dagger) + 3\text{Tr}(Y_d Y_d^\dagger) + \frac{3}{20} (5g_2^2 + g_1^2) (-3 + \text{Xi}) + \text{Tr}(Y_e Y_e^\dagger) \quad (14)$$

$$\gamma_{\text{iH}1}^{(2)} = 0 \quad (15)$$

$$\gamma_{\text{iH}2}^{(1)} = -3\epsilon^{2\text{lef}2} \text{Tr}(\epsilon_u \epsilon_u^\dagger) + 3\text{Tr}(\epsilon_d \epsilon_d^\dagger) + \frac{3}{20} (5g_2^2 + g_1^2) (-3 + \text{Xi}) + \text{Tr}(\epsilon_e \epsilon_e^\dagger) \quad (16)$$

$$\gamma_{\text{iH}2}^{(2)} = 0 \quad (17)$$

$$\gamma_{\text{iS}}^{(1)} = 0 \quad (18)$$

$$\gamma_{\text{iS}}^{(2)} = 0 \quad (19)$$

$$\gamma_{\text{rH}1}^{(1)} = -3\epsilon^{2\text{lef}2} \text{Tr}(Y_u Y_u^\dagger) + 3\text{Tr}(Y_d Y_d^\dagger) + \frac{3}{20} (5g_2^2 + g_1^2) (-3 + \text{Xi}) + \text{Tr}(Y_e Y_e^\dagger) \quad (20)$$

$$\gamma_{\text{rH}1}^{(2)} = 0 \quad (21)$$

$$\gamma_{\text{rH}2}^{(1)} = -3\epsilon^{2\text{lef}2} \text{Tr}(\epsilon_u \epsilon_u^\dagger) + 3\text{Tr}(\epsilon_d \epsilon_d^\dagger) + \frac{3}{20} (5g_2^2 + g_1^2) (-3 + \text{Xi}) + \text{Tr}(\epsilon_e \epsilon_e^\dagger) \quad (22)$$

$$\gamma_{\text{rH}2}^{(2)} = 0 \quad (23)$$

$$\gamma_{\text{rS}}^{(1)} = 0 \quad (24)$$

$$\gamma_{\text{rS}}^{(2)} = 0 \quad (25)$$

3.3 Gauge Couplings

$$\beta_{g_1}^{(1)} = \frac{21}{5} g_1^3 \quad (26)$$

$$\beta_{g_1}^{(2)} = 0 \quad (27)$$

$$\beta_{g_2}^{(1)} = -3g_2^3 \quad (28)$$

$$\beta_{g_2}^{(2)} = 0 \quad (29)$$

$$\beta_{g_3}^{(1)} = -7g_3^3 \quad (30)$$

$$\beta_{g_3}^{(2)} = 0 \quad (31)$$

3.4 Quartic scalar couplings

$$\begin{aligned} \beta_{l_6}^{(1)} = & +2l_{1p}l_{3p} - \frac{9}{5}g_1^2l_6 - 9g_2^2l_6 + 12l_1l_6 + 6l_3l_6 + 8l_4l_6 + 6l_3l_7 + 4l_4l_7 + 4l_{6p}l_{4p}^* + 10l_5l_6^* \\ & + 2l_5l_7^* + 4l_{4p}l_{7p}^* + 3l_6\text{Tr}(\epsilon_d\epsilon_d^\dagger) + 3l_5\text{Tr}(\epsilon_dY_d^\dagger) + l_6\text{Tr}(\epsilon_e\epsilon_e^\dagger) + l_5\text{Tr}(\epsilon_eY_e^\dagger) \\ & + 3l_6\text{Tr}(\epsilon_u\epsilon_u^\dagger) + 3l_1\text{Tr}(\epsilon_uY_u^\dagger) + 3l_3\text{Tr}(\epsilon_uY_u^\dagger) + 3l_4\text{Tr}(\epsilon_uY_u^\dagger) + 3l_1\text{Tr}(Y_d\epsilon_d^\dagger) \\ & + 3l_3\text{Tr}(Y_d\epsilon_d^\dagger) + 3l_4\text{Tr}(Y_d\epsilon_d^\dagger) + 9l_6\text{Tr}(Y_dY_d^\dagger) + l_1\text{Tr}(Y_e\epsilon_e^\dagger) + l_3\text{Tr}(Y_e\epsilon_e^\dagger) \\ & + l_4\text{Tr}(Y_e\epsilon_e^\dagger) + 3l_6\text{Tr}(Y_eY_e^\dagger) + 3l_5\text{Tr}(Y_u\epsilon_u^\dagger) + 9l_6\text{Tr}(Y_uY_u^\dagger) - 12\text{Tr}(\epsilon_uY_u^\dagger Y_uY_u^\dagger) \\ & - 6\text{Tr}(Y_d\epsilon_d^\dagger Y_dY_d^\dagger) - 6\text{Tr}(Y_dY_d^\dagger Y_d\epsilon_d^\dagger) - 2\text{Tr}(Y_e\epsilon_e^\dagger Y_eY_e^\dagger) - 2\text{Tr}(Y_eY_e^\dagger Y_e\epsilon_e^\dagger) \end{aligned} \quad (32)$$

$$\beta_{l_6}^{(2)} = 0 \quad (33)$$

$$\begin{aligned} \beta_{l_5}^{(1)} = & +2l_{3p}^2 - \frac{9}{5}g_1^2l_5 - 9g_2^2l_5 + 2l_1l_5 + 2l_2l_5 + 8l_3l_5 + 12l_4l_5 + 10l_6^2 + 4l_6l_7 + 10l_7^2 + 8l_{6p}l_{7p}^* \\ & + 6l_5\text{Tr}(\epsilon_d\epsilon_d^\dagger) + 2l_5\text{Tr}(\epsilon_e\epsilon_e^\dagger) + 6l_5\text{Tr}(\epsilon_u\epsilon_u^\dagger) + 6l_6\text{Tr}(\epsilon_uY_u^\dagger) + 6l_7\text{Tr}(\epsilon_uY_u^\dagger) \\ & + 6l_6\text{Tr}(Y_d\epsilon_d^\dagger) + 6l_7\text{Tr}(Y_d\epsilon_d^\dagger) + 6l_5\text{Tr}(Y_dY_d^\dagger) + 2l_6\text{Tr}(Y_e\epsilon_e^\dagger) + 2l_7\text{Tr}(Y_e\epsilon_e^\dagger) \\ & + 2l_5\text{Tr}(Y_eY_e^\dagger) + 6l_5\text{Tr}(Y_uY_u^\dagger) - 12\text{Tr}(\epsilon_uY_u^\dagger\epsilon_uY_u^\dagger) - 12\text{Tr}(Y_d\epsilon_d^\dagger Y_d\epsilon_d^\dagger) - 4\text{Tr}(Y_e\epsilon_e^\dagger Y_e\epsilon_e^\dagger) \end{aligned} \quad (34)$$

$$\beta_{l_5}^{(2)} = 0 \quad (35)$$

$$\begin{aligned} \beta_{l_7}^{(1)} = & +2l_{2p}l_{3p} + 6l_3l_6 + 4l_4l_6 - \frac{9}{5}g_1^2l_7 - 9g_2^2l_7 + 12l_2l_7 + 6l_3l_7 + 8l_4l_7 + 4l_{6p}l_{5p}^* + 2l_5l_6^* \\ & + 10l_5l_7^* + 4l_{5p}l_{7p}^* + 9l_7\text{Tr}(\epsilon_d\epsilon_d^\dagger) + 3l_5\text{Tr}(\epsilon_dY_d^\dagger) + 3l_7\text{Tr}(\epsilon_e\epsilon_e^\dagger) + l_5\text{Tr}(\epsilon_eY_e^\dagger) \\ & + 9l_7\text{Tr}(\epsilon_u\epsilon_u^\dagger) + 3l_2\text{Tr}(\epsilon_uY_u^\dagger) + 3l_3\text{Tr}(\epsilon_uY_u^\dagger) + 3l_4\text{Tr}(\epsilon_uY_u^\dagger) + 3l_2\text{Tr}(Y_d\epsilon_d^\dagger) \\ & + 3l_3\text{Tr}(Y_d\epsilon_d^\dagger) + 3l_4\text{Tr}(Y_d\epsilon_d^\dagger) + 3l_7\text{Tr}(Y_dY_d^\dagger) + l_2\text{Tr}(Y_e\epsilon_e^\dagger) + l_3\text{Tr}(Y_e\epsilon_e^\dagger) \\ & + l_4\text{Tr}(Y_e\epsilon_e^\dagger) + l_7\text{Tr}(Y_eY_e^\dagger) + 3l_5\text{Tr}(Y_u\epsilon_u^\dagger) + 3l_7\text{Tr}(Y_uY_u^\dagger) - 12\text{Tr}(\epsilon_d\epsilon_d^\dagger Y_d\epsilon_d^\dagger) \end{aligned}$$

$$-4\text{Tr}\left(\epsilon_e\epsilon_e^\dagger Y_e\epsilon_e^\dagger\right) - 6\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\epsilon_u Y_u^\dagger\right) - 6\text{Tr}\left(\epsilon_u Y_u^\dagger\epsilon_u\epsilon_u^\dagger\right) \quad (36)$$

$$\beta_{l_7}^{(2)} = 0 \quad (37)$$

$$\begin{aligned} \beta_{l_1}^{(1)} = & +\frac{27}{100}g_1^4 + \frac{9}{10}g_1^2g_2^2 + \frac{9}{4}g_2^4 - \frac{9}{5}g_1^2l_1 - 9g_2^2l_1 + 12l_1^2 + 2l_{1p}^2 + 4l_3^2 + 4l_3l_4 + 2l_4^2 + 8|l_{4p}|^2 \\ & + 2|l_5|^2 + 24|l_6|^2 + 6l_6\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 2l_6\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 6l_6^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 6l_6^*\text{Tr}\left(Y_d\epsilon_d^\dagger\right) \\ & + 12l_1\text{Tr}\left(Y_d Y_d^\dagger\right) + 2l_6^*\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + 4l_1\text{Tr}\left(Y_e Y_e^\dagger\right) + 6l_6\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 12l_1\text{Tr}\left(Y_u Y_u^\dagger\right) \\ & - 12\text{Tr}\left(Y_d Y_d^\dagger Y_d Y_d^\dagger\right) - 4\text{Tr}\left(Y_e Y_e^\dagger Y_e Y_e^\dagger\right) - 12\text{Tr}\left(Y_u Y_u^\dagger Y_u Y_u^\dagger\right) \end{aligned} \quad (38)$$

$$\beta_{l_1}^{(2)} = 0 \quad (39)$$

$$\begin{aligned} \beta_{l_4}^{(1)} = & +\frac{9}{5}g_1^2g_2^2 - \frac{9}{5}g_1^2l_4 - 9g_2^2l_4 + 2l_1l_4 + 2l_2l_4 + 8l_3l_4 + 4l_4^2 + 2|l_{3p}|^2 + 8|l_5|^2 + 10|l_6|^2 \\ & + 4|l_{6p}|^2 + 10|l_7|^2 + 4|l_{7p}|^2 + 2l_7l_6^* + 2l_6l_7^* + 6l_4\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) + 3l_6\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 3l_7\text{Tr}\left(\epsilon_d Y_d^\dagger\right) \\ & + 2l_4\text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right) + l_6\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + l_7\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 6l_4\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) + 3l_6^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) \\ & + 3l_7^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3l_6^*\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 3l_7^*\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 6l_4\text{Tr}\left(Y_d Y_d^\dagger\right) + l_6^*\text{Tr}\left(Y_e\epsilon_e^\dagger\right) \\ & + l_7^*\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + 2l_4\text{Tr}\left(Y_e Y_e^\dagger\right) + 3l_6\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 3l_7\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 6l_4\text{Tr}\left(Y_u Y_u^\dagger\right) \\ & - 12\text{Tr}\left(\epsilon_d Y_d^\dagger Y_d\epsilon_d^\dagger\right) - 12\text{Tr}\left(\epsilon_d Y_u^\dagger\epsilon_u Y_d^\dagger\right) + 12\text{Tr}\left(\epsilon_d Y_u^\dagger Y_u\epsilon_d^\dagger\right) - 4\text{Tr}\left(\epsilon_e Y_e^\dagger Y_e\epsilon_e^\dagger\right) \\ & + 12\text{Tr}\left(\epsilon_u Y_d^\dagger Y_d\epsilon_u^\dagger\right) - 12\text{Tr}\left(\epsilon_u Y_u^\dagger Y_u\epsilon_u^\dagger\right) - 12\text{Tr}\left(Y_d\epsilon_u^\dagger Y_u\epsilon_d^\dagger\right) \end{aligned} \quad (40)$$

$$\beta_{l_4}^{(2)} = 0 \quad (41)$$

$$\begin{aligned} \beta_{l_3}^{(1)} = & +\frac{27}{100}g_1^4 - \frac{9}{10}g_1^2g_2^2 + \frac{9}{4}g_2^4 + 2l_{1p}l_{2p} - \frac{9}{5}g_1^2l_3 - 9g_2^2l_3 + 6l_1l_3 + 6l_2l_3 + 4l_3^2 + 2l_1l_4 + 2l_2l_4 \\ & + 2l_4^2 + 2|l_5|^2 + 4|l_6|^2 + 4|l_7|^2 + 4l_{5p}l_{4p}^* + 4l_{4p}l_{5p}^* + 8l_7l_6^* + 8l_6l_7^* + 6l_3\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) \\ & + 3l_6\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 3l_7\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 2l_3\text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right) + l_6\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + l_7\text{Tr}\left(\epsilon_e Y_e^\dagger\right) \\ & + 6l_3\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) + 3l_6^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3l_7^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3l_6^*\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 3l_7^*\text{Tr}\left(Y_d\epsilon_d^\dagger\right) \\ & + 6l_3\text{Tr}\left(Y_d Y_d^\dagger\right) + l_6^*\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + l_7^*\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + 2l_3\text{Tr}\left(Y_e Y_e^\dagger\right) + 3l_6\text{Tr}\left(Y_u\epsilon_u^\dagger\right) \\ & + 3l_7\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 6l_3\text{Tr}\left(Y_u Y_u^\dagger\right) - 12\text{Tr}\left(\epsilon_d\epsilon_d^\dagger Y_d Y_d^\dagger\right) + 12\text{Tr}\left(\epsilon_d Y_u^\dagger\epsilon_u Y_d^\dagger\right) \\ & - 12\text{Tr}\left(\epsilon_d Y_u^\dagger Y_u\epsilon_d^\dagger\right) - 4\text{Tr}\left(\epsilon_e\epsilon_e^\dagger Y_e Y_e^\dagger\right) - 12\text{Tr}\left(\epsilon_u\epsilon_u^\dagger Y_u Y_u^\dagger\right) - 12\text{Tr}\left(\epsilon_u Y_d^\dagger Y_d\epsilon_u^\dagger\right) \\ & + 12\text{Tr}\left(Y_d\epsilon_u^\dagger Y_u\epsilon_d^\dagger\right) \end{aligned} \quad (42)$$

$$\beta_{l_3}^{(2)} = 0 \quad (43)$$

$$\beta_{l_2}^{(1)} = +\frac{27}{100}g_1^4 + \frac{9}{10}g_1^2g_2^2 + \frac{9}{4}g_2^4 - \frac{9}{5}g_1^2l_2 - 9g_2^2l_2 + 12l_2^2 + 2l_{2p}^2 + 4l_3^2 + 4l_3l_4 + 2l_4^2 + 2|l_5|^2$$

$$\begin{aligned}
& + 8|l_{5p}|^2 + 24|l_7|^2 + 12l_2 \text{Tr}(\epsilon_d \epsilon_d^\dagger) + 6l_7 \text{Tr}(\epsilon_d Y_d^\dagger) + 4l_2 \text{Tr}(\epsilon_e \epsilon_e^\dagger) + 2l_7 \text{Tr}(\epsilon_e Y_e^\dagger) \\
& + 12l_2 \text{Tr}(\epsilon_u \epsilon_u^\dagger) + 6l_7^* \text{Tr}(\epsilon_u Y_u^\dagger) + 6l_7^* \text{Tr}(Y_d \epsilon_d^\dagger) + 2l_7^* \text{Tr}(Y_e \epsilon_e^\dagger) + 6l_7 \text{Tr}(Y_u \epsilon_u^\dagger) \\
& - 12 \text{Tr}(\epsilon_d \epsilon_d^\dagger \epsilon_d \epsilon_d^\dagger) - 4 \text{Tr}(\epsilon_e \epsilon_e^\dagger \epsilon_e \epsilon_e^\dagger) - 12 \text{Tr}(\epsilon_u \epsilon_u^\dagger \epsilon_u \epsilon_u^\dagger)
\end{aligned} \tag{44}$$

$$\beta_{l_2}^{(2)} = 0 \tag{45}$$

$$\begin{aligned}
\beta_{l_{1p}}^{(1)} = & -\frac{9}{10}g_1^2 l_{1p} - \frac{9}{2}g_2^2 l_{1p} + 6l_1 l_{1p} + 4l_{1p}^2 + 4l_{2p} l_3 + 2l_{1p} l_{3pp} + 2l_{2p} l_4 + 16|l_{4p}|^2 + 8|l_{6p}|^2 + 8|l_{7p}|^2 + 2l_{4p} l_{2pp}^* \\
& + 2l_{2pp} l_{4p}^* + 6l_{3p} l_6^* + 3l_{3p} \text{Tr}(\epsilon_d Y_d^\dagger) + l_{3p} \text{Tr}(\epsilon_e Y_e^\dagger) + 6l_{1p} \text{Tr}(Y_d Y_d^\dagger) \\
& + l_{3p}^* (3 \text{Tr}(\epsilon_u Y_u^\dagger) + 3 \text{Tr}(Y_d \epsilon_d^\dagger) + 4l_{3p} + 6l_6 + \text{Tr}(Y_e \epsilon_e^\dagger)) + 2l_{1p} \text{Tr}(Y_e Y_e^\dagger) + 3l_{3p} \text{Tr}(Y_u \epsilon_u^\dagger) \\
& + 6l_{1p} \text{Tr}(Y_u Y_u^\dagger)
\end{aligned} \tag{46}$$

$$\beta_{l_{1p}}^{(2)} = 0 \tag{47}$$

$$\begin{aligned}
\beta_{l_{2p}}^{(1)} = & -\frac{9}{10}g_1^2 l_{2p} - \frac{9}{2}g_2^2 l_{2p} + 6l_2 l_{2p} + 4l_{2p}^2 + 4l_{1p} l_3 + 2l_{2p} l_{3pp} + 2l_{1p} l_4 + 16|l_{5p}|^2 + 8|l_{6p}|^2 + 8|l_{7p}|^2 + 2l_{5p} l_{2pp}^* \\
& + 2l_{2pp} l_{5p}^* + 6l_{3p} l_7^* + 6l_{2p} \text{Tr}(\epsilon_d \epsilon_d^\dagger) + 3l_{3p} \text{Tr}(\epsilon_d Y_d^\dagger) + 2l_{2p} \text{Tr}(\epsilon_e \epsilon_e^\dagger) + l_{3p} \text{Tr}(\epsilon_e Y_e^\dagger) \\
& + 6l_{2p} \text{Tr}(\epsilon_u \epsilon_u^\dagger) + l_{3p}^* (3 \text{Tr}(\epsilon_u Y_u^\dagger) + 3 \text{Tr}(Y_d \epsilon_d^\dagger) + 4l_{3p} + 6l_7 + \text{Tr}(Y_e \epsilon_e^\dagger)) + 3l_{3p} \text{Tr}(Y_u \epsilon_u^\dagger)
\end{aligned} \tag{48}$$

$$\beta_{l_{2p}}^{(2)} = 0 \tag{49}$$

$$\beta_{l_{3pp}}^{(1)} = 16|l_{3p}|^2 + 16|l_{4p}|^2 + 16|l_{5p}|^2 + 16|l_{6p}|^2 + 16|l_{7p}|^2 + 5l_{3pp}^2 + 6|l_{2pp}|^2 + 8l_{1p}^2 + 8l_{2p}^2 + |l_{1pp}|^2 \tag{50}$$

$$\beta_{l_{3pp}}^{(2)} = 0 \tag{51}$$

$$\beta_{l_{1pp}}^{(1)} = 6 \left(8 \left(2l_{6p} l_{7p} + l_{4p}^2 + l_{5p}^2 \right) + l_{1pp} l_{3pp} + l_{2pp}^2 \right) \tag{52}$$

$$\beta_{l_{1pp}}^{(2)} = 0 \tag{53}$$

$$\begin{aligned}
\beta_{l_{4p}}^{(1)} = & + l_{1p} l_{2pp} - \frac{9}{10}g_1^2 l_{4p} - \frac{9}{2}g_2^2 l_{4p} + 6l_1 l_{4p} + 8l_{1p} l_{4p} + l_{3pp} l_{4p} + 4l_3 l_{5p} + 2l_4 l_{5p} + 4l_{3p} l_{7p} + 6l_6 l_{7p} + 4l_{6p} l_{3p}^* \\
& + l_{1pp} l_{4p}^* + 6l_{6p} l_6^* + 3l_{6p} \text{Tr}(\epsilon_d Y_d^\dagger) + l_{6p} \text{Tr}(\epsilon_e Y_e^\dagger) + 3l_{7p} \text{Tr}(\epsilon_u Y_u^\dagger) + 3l_{7p} \text{Tr}(Y_d \epsilon_d^\dagger) \\
& + 6l_{4p} \text{Tr}(Y_d Y_d^\dagger) + l_{7p} \text{Tr}(Y_e \epsilon_e^\dagger) + 2l_{4p} \text{Tr}(Y_e Y_e^\dagger) + 3l_{6p} \text{Tr}(Y_u \epsilon_u^\dagger) + 6l_{4p} \text{Tr}(Y_u Y_u^\dagger)
\end{aligned} \tag{54}$$

$$\beta_{l_{4p}}^{(2)} = 0 \tag{55}$$

$$\begin{aligned}
\beta_{l_{6p}}^{(1)} = & + l_{2pp} l_{3p} + 4l_{3p} l_{4p} + 4l_{3p} l_{5p} + 6l_{4p} l_6 - \frac{9}{10}g_1^2 l_{6p} - \frac{9}{2}g_2^2 l_{6p} + 4l_{1p} l_{6p} + 4l_{2p} l_{6p} + 2l_3 l_{6p} + l_{3pp} l_{6p} + 4l_4 l_{6p} \\
& + 6l_{5p} l_7 + 6l_5 l_{7p} + l_{1pp} l_{7p}^* + 3l_{6p} \text{Tr}(\epsilon_d \epsilon_d^\dagger) + l_{6p} \text{Tr}(\epsilon_e \epsilon_e^\dagger) + 3l_{6p} \text{Tr}(\epsilon_u \epsilon_u^\dagger) + 3l_{4p} \text{Tr}(\epsilon_u Y_u^\dagger) \\
& + 3l_{5p} \text{Tr}(\epsilon_u Y_u^\dagger) + 3l_{4p} \text{Tr}(Y_d \epsilon_d^\dagger) + 3l_{5p} \text{Tr}(Y_d \epsilon_d^\dagger) + 3l_{6p} \text{Tr}(Y_d Y_d^\dagger) + l_{4p} \text{Tr}(Y_e \epsilon_e^\dagger) \\
& + l_{5p} \text{Tr}(Y_e \epsilon_e^\dagger) + l_{6p} \text{Tr}(Y_e Y_e^\dagger) + 3l_{6p} \text{Tr}(Y_u Y_u^\dagger)
\end{aligned} \tag{56}$$

$$\beta_{l_{6p}}^{(2)} = 0 \tag{57}$$

$$\begin{aligned}
\beta_{l_{7p}}^{(1)} = & -\frac{9}{10}g_1^2 l_{7p} - \frac{9}{2}g_2^2 l_{7p} + 4l_{1p}l_{7p} + 4l_{2p}l_{7p} + 2l_{3p}l_{7p} + l_{3pp}l_{7p} + 4l_4l_{7p} + \left(4(l_{4p} + l_{5p}) + l_{2pp}\right)l_{3p}^* + 6l_{6p}l_5^* + 6l_{4p}l_6^* \\
& + l_{1pp}l_{6p}^* + 6l_{5p}l_7^* + 3l_{7p}\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) + 3l_{4p}\text{Tr}\left(\epsilon_dY_d^\dagger\right) + 3l_{5p}\text{Tr}\left(\epsilon_dY_d^\dagger\right) + l_{7p}\text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right) \\
& + l_{4p}\text{Tr}\left(\epsilon_eY_e^\dagger\right) + l_{5p}\text{Tr}\left(\epsilon_eY_e^\dagger\right) + 3l_{7p}\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) + 3l_{7p}\text{Tr}\left(Y_dY_d^\dagger\right) + l_{7p}\text{Tr}\left(Y_eY_e^\dagger\right) \\
& + 3l_{4p}\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 3l_{5p}\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + 3l_{7p}\text{Tr}\left(Y_uY_u^\dagger\right)
\end{aligned} \tag{58}$$

$$\beta_{l_{7p}}^{(2)} = 0 \tag{59}$$

$$\begin{aligned}
\beta_{l_{5p}}^{(1)} = & +l_{2p}l_{2pp} + 4l_3l_{4p} + 2l_4l_{4p} - \frac{9}{10}g_1^2 l_{5p} - \frac{9}{2}g_2^2 l_{5p} + 6l_2l_{5p} + 8l_{2p}l_{5p} + l_{3pp}l_{5p} + 4l_{3p}l_{7p} + 6l_7l_{7p} + 4l_{6p}l_{3p}^* \\
& + l_{1pp}l_{5p}^* + 6l_{6p}l_7^* + 6l_{5p}\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) + 3l_{6p}\text{Tr}\left(\epsilon_dY_d^\dagger\right) + 2l_{5p}\text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right) + l_{6p}\text{Tr}\left(\epsilon_eY_e^\dagger\right) \\
& + 6l_{5p}\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) + 3l_{7p}\text{Tr}\left(\epsilon_uY_u^\dagger\right) + 3l_{7p}\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + l_{7p}\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + 3l_{6p}\text{Tr}\left(Y_u\epsilon_u^\dagger\right)
\end{aligned} \tag{60}$$

$$\beta_{l_{5p}}^{(2)} = 0 \tag{61}$$

$$\beta_{l_{2pp}}^{(1)} = 3\left(3l_{2pp}l_{3pp} + 8l_{1p}l_{4p} + 8l_{2p}l_{5p} + 8l_{3p}l_{7p} + 8l_{6p}l_{3p}^* + l_{1pp}l_{2pp}^*\right) \tag{62}$$

$$\beta_{l_{2pp}}^{(2)} = 0 \tag{63}$$

$$\begin{aligned}
\beta_{l_{3p}}^{(1)} = & -\frac{9}{10}g_1^2 l_{3p} - \frac{9}{2}g_2^2 l_{3p} + 4l_{1p}l_{3p} + 4l_{2p}l_{3p} + 2l_3l_{3p} + 2l_{3p}l_{3pp} + 4l_3l_4 + 6l_{1p}l_6 + 6l_{2p}l_7 + 2l_{6p}l_{2pp}^* + 6l_5l_{3p}^* \\
& + 8l_{6p}l_{4p}^* + 8l_{6p}l_{5p}^* + 2l_{2pp}l_{7p}^* + 8l_{4p}l_{7p}^* + 8l_{5p}l_{7p}^* + 3l_{3p}\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) + l_{3p}\text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right) + 3l_{3p}\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) \\
& + 3l_{1p}\text{Tr}\left(\epsilon_uY_u^\dagger\right) + 3l_{2p}\text{Tr}\left(\epsilon_uY_u^\dagger\right) + 3l_{1p}\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 3l_{2p}\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 3l_{3p}\text{Tr}\left(Y_dY_d^\dagger\right) \\
& + l_{1p}\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + l_{2p}\text{Tr}\left(Y_e\epsilon_e^\dagger\right) + l_{3p}\text{Tr}\left(Y_eY_e^\dagger\right) + 3l_{3p}\text{Tr}\left(Y_uY_u^\dagger\right)
\end{aligned} \tag{64}$$

$$\beta_{l_{3p}}^{(2)} = 0 \tag{65}$$

3.5 Yukawa Couplings

$$\begin{aligned}
\beta_{Y_u}^{(1)} = & +\frac{1}{2}\left(2\epsilon_u\epsilon_u^\dagger Y_u - 3Y_uY_d^\dagger Y_d + 3Y_uY_u^\dagger Y_u - 4\epsilon_uY_d^\dagger\epsilon_d + Y_u\epsilon_d^\dagger\epsilon_d + Y_u\epsilon_u^\dagger\epsilon_u\right) \\
& + \epsilon_u\left(3\text{Tr}\left(\epsilon_dY_d^\dagger\right) + 3\text{Tr}\left(Y_u\epsilon_u^\dagger\right) + \text{Tr}\left(\epsilon_eY_e^\dagger\right)\right) \\
& + Y_u\left(3\text{Tr}\left(Y_dY_d^\dagger\right) + 3\text{Tr}\left(Y_uY_u^\dagger\right) - 8g_3^2 - \frac{17}{20}g_1^2 - \frac{9}{4}g_2^2 + \text{Tr}\left(Y_eY_e^\dagger\right)\right)
\end{aligned} \tag{66}$$

$$\beta_{Y_u}^{(2)} = 0 \tag{67}$$

$$\begin{aligned}
\beta_{\epsilon_u}^{(1)} = & +\epsilon_u\left(3\text{Tr}\left(\epsilon_d\epsilon_d^\dagger\right) + 3\text{Tr}\left(\epsilon_u\epsilon_u^\dagger\right) - 8g_3^2 - \frac{17}{20}g_1^2 - \frac{9}{4}g_2^2 + \text{Tr}\left(\epsilon_e\epsilon_e^\dagger\right)\right) \\
& + \frac{1}{2}\left(-3\epsilon_u\epsilon_d^\dagger\epsilon_d + 3\epsilon_u\epsilon_u^\dagger\epsilon_u + \epsilon_uY_d^\dagger Y_d + \epsilon_uY_u^\dagger Y_u - 4Y_u\epsilon_d^\dagger Y_d + 2Y_uY_u^\dagger\epsilon_u\right. \\
& \left.+ 6Y_u\text{Tr}\left(\epsilon_uY_u^\dagger\right) + 6Y_u\text{Tr}\left(Y_d\epsilon_d^\dagger\right) + 2Y_u\text{Tr}\left(Y_e\epsilon_e^\dagger\right)\right)
\end{aligned} \tag{68}$$

$$\beta_{\epsilon_u}^{(2)} = 0 \tag{69}$$

$$\begin{aligned}\beta_{Y_d}^{(1)} = & +\frac{1}{2}\left(2\epsilon_d\epsilon_d^\dagger Y_d + 3Y_d Y_d^\dagger Y_d - 3Y_d Y_u^\dagger Y_u - 4\epsilon_d Y_u^\dagger \epsilon_u + Y_d \epsilon_d^\dagger \epsilon_d + Y_d \epsilon_u^\dagger \epsilon_u\right) \\ & + \epsilon_d\left(3\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + \text{Tr}\left(Y_e \epsilon_e^\dagger\right)\right) \\ & - \frac{1}{4}Y_d\left(-12\text{Tr}\left(Y_d Y_d^\dagger\right) - 12\text{Tr}\left(Y_u Y_u^\dagger\right) + 32g_3^2 - 4\text{Tr}\left(Y_e Y_e^\dagger\right) + 9g_2^2 + g_1^2\right)\end{aligned}\quad (70)$$

$$\beta_{Y_d}^{(2)} = 0 \quad (71)$$

$$\begin{aligned}\beta_{Y_e}^{(1)} = & +\frac{1}{2}\left(2\epsilon_e\epsilon_e^\dagger Y_e + 3Y_e Y_e^\dagger Y_e + Y_e \epsilon_e^\dagger \epsilon_e\right) + \epsilon_e\left(3\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + \text{Tr}\left(Y_e \epsilon_e^\dagger\right)\right) \\ & + Y_e\left(3\text{Tr}\left(Y_d Y_d^\dagger\right) + 3\text{Tr}\left(Y_u Y_u^\dagger\right) - \frac{9}{4}g_1^2 - \frac{9}{4}g_2^2 + \text{Tr}\left(Y_e Y_e^\dagger\right)\right)\end{aligned}\quad (72)$$

$$\beta_{Y_e}^{(2)} = 0 \quad (73)$$

$$\begin{aligned}\beta_{\epsilon_d}^{(1)} = & +\epsilon_d\left(3\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + 3\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) - 8g_3^2 - \frac{1}{4}g_1^2 - \frac{9}{4}g_2^2 + \text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right)\right) \\ & + \frac{1}{2}\left(3\epsilon_d \epsilon_d^\dagger \epsilon_d - 3\epsilon_d \epsilon_u^\dagger \epsilon_u + \epsilon_d Y_d^\dagger Y_d + \epsilon_d Y_u^\dagger Y_u - 4Y_d \epsilon_u^\dagger Y_u + 2Y_d Y_d^\dagger \epsilon_d\right. \\ & \left.+ 6Y_d \text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 2Y_d \text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 6Y_d \text{Tr}\left(Y_u \epsilon_u^\dagger\right)\right)\end{aligned}\quad (74)$$

$$\beta_{\epsilon_d}^{(2)} = 0 \quad (75)$$

$$\begin{aligned}\beta_{\epsilon_e}^{(1)} = & +\frac{3}{2}\epsilon_e \epsilon_e^\dagger \epsilon_e + \frac{1}{2}\epsilon_e Y_e^\dagger Y_e + Y_e Y_e^\dagger \epsilon_e + 3Y_e \text{Tr}\left(\epsilon_d Y_d^\dagger\right) + Y_e \text{Tr}\left(\epsilon_e Y_e^\dagger\right) \\ & + \epsilon_e\left(3\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + 3\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) - \frac{9}{4}g_1^2 - \frac{9}{4}g_2^2 + \text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right)\right) + 3Y_e \text{Tr}\left(Y_u \epsilon_u^\dagger\right)\end{aligned}\quad (76)$$

$$\beta_{\epsilon_e}^{(2)} = 0 \quad (77)$$

3.6 Trilinear Scalar couplings

$$\beta_{\mu_{s1}}^{(1)} = 3\left(2l_{2pp}\mu_{s2} + 8l_{4p}\mu_{11} + 8l_{5p}\mu_{22} + 8l_{6p}\mu_{21} + 8l_{7p}\mu_{12} + l_{1pp}\mu_{s2}^* + l_{3pp}\mu_{s1}\right) \quad (78)$$

$$\beta_{\mu_{s1}}^{(2)} = 0 \quad (79)$$

$$\begin{aligned}\beta_{\mu_{11}}^{(1)} = & -\frac{9}{10}g_1^2\mu_{11} - \frac{9}{2}g_2^2\mu_{11} + 6l_1\mu_{11} + 4l_{1p}\mu_{11} + 2l_{3p}\mu_{21} + 6l_6\mu_{21} + 4l_3\mu_{22} + 2l_4\mu_{22} + 2l_{1p}\mu_{s2} + 2\mu_{12}l_{3p}^* + 2\mu_{s1}l_{4p}^* \\ & + 6\mu_{12}l_6^* + 8l_{4p}\mu_{11}^* + 4l_{6p}\mu_{12}^* + 4l_{7p}\mu_{21}^* + 2l_{4p}\mu_{s2}^* + 3\mu_{12}\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + \mu_{12}\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 3\mu_{21}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) \\ & + 3\mu_{21}\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + 6\mu_{11}\text{Tr}\left(Y_d Y_d^\dagger\right) + \mu_{21}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) + 2\mu_{11}\text{Tr}\left(Y_e Y_e^\dagger\right) + 3\mu_{12}\text{Tr}\left(Y_u \epsilon_u^\dagger\right) \\ & + 6\mu_{11}\text{Tr}\left(Y_u Y_u^\dagger\right)\end{aligned}\quad (80)$$

$$\beta_{\mu_{11}}^{(2)} = 0 \quad (81)$$

$$\begin{aligned}\beta_{\mu_{12}}^{(1)} = & +2l_{3p}\mu_{11} + 6l_6\mu_{11} - \frac{9}{10}g_1^2\mu_{12} - \frac{9}{2}g_2^2\mu_{12} + 2l_{1p}\mu_{12} + 2l_{2p}\mu_{12} + 2l_3\mu_{12} + 4l_4\mu_{12} + 6l_5\mu_{21} + 2l_{3p}\mu_{22} + 6l_7\mu_{22} \\ & + 2l_{3p}\mu_{s2} + 2\mu_{s1}l_{7p}^* + 4l_{6p}\mu_{11}^* + 4l_{4p}\mu_{21}^* + 4l_{5p}\mu_{21}^* + 4l_{6p}\mu_{22}^* + 2l_{6p}\mu_{s2}^* + 3\mu_{12}\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + \mu_{12}\text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right) \\ & + 3\mu_{12}\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) + 3\mu_{11}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3\mu_{22}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3\mu_{11}\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + 3\mu_{22}\text{Tr}\left(Y_d \epsilon_d^\dagger\right)\end{aligned}$$

$$+ 3\mu_{12}\text{Tr}\left(Y_d Y_d^\dagger\right) + \mu_{11}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) + \mu_{22}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) + \mu_{12}\text{Tr}\left(Y_e Y_e^\dagger\right) + 3\mu_{12}\text{Tr}\left(Y_u Y_u^\dagger\right) \quad (82)$$

$$\beta_{\mu_{12}}^{(2)} = 0 \quad (83)$$

$$\begin{aligned} \beta_{\mu_{21}}^{(1)} = & -\frac{9}{10}g_1^2\mu_{21} - \frac{9}{2}g_2^2\mu_{21} + 2l_{1p}\mu_{21} + 2l_{2p}\mu_{21} + 2l_3\mu_{21} + 4l_4\mu_{21} + 2\left(\mu_{11} + \mu_{22} + \mu_{s2}\right)l_{3p}^* + 6\mu_{12}l_5^* + 6\mu_{11}l_6^* + 2\mu_{s1}l_{6p}^* \\ & + 6\mu_{22}l_7^* + 4l_{7p}\mu_{11}^* + 4l_{4p}\mu_{12}^* + 4l_{5p}\mu_{12}^* + 4l_{7p}\mu_{22}^* + 2l_{7p}\mu_{s2}^* + 3\mu_{21}\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + 3\mu_{11}\text{Tr}\left(\epsilon_d Y_d^\dagger\right) \\ & + 3\mu_{22}\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + \mu_{21}\text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right) + \mu_{11}\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + \mu_{22}\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 3\mu_{21}\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) \\ & + 3\mu_{21}\text{Tr}\left(Y_d Y_d^\dagger\right) + \mu_{21}\text{Tr}\left(Y_e Y_e^\dagger\right) + 3\mu_{11}\text{Tr}\left(Y_u \epsilon_u^\dagger\right) + 3\mu_{22}\text{Tr}\left(Y_u \epsilon_u^\dagger\right) + 3\mu_{21}\text{Tr}\left(Y_u Y_u^\dagger\right) \end{aligned} \quad (84)$$

$$\beta_{\mu_{21}}^{(2)} = 0 \quad (85)$$

$$\begin{aligned} \beta_{\mu_{22}}^{(1)} = & +4l_3\mu_{11} + 2l_4\mu_{11} + 2l_{3p}\mu_{21} + 6l_7\mu_{21} - \frac{9}{10}g_1^2\mu_{22} - \frac{9}{2}g_2^2\mu_{22} + 6l_2\mu_{22} + 4l_{2p}\mu_{22} + 2l_{2p}\mu_{s2} + 2\mu_{12}l_{3p}^* + 2\mu_{s1}l_{5p}^* \\ & + 6\mu_{12}l_7^* + 4l_{6p}\mu_{12}^* + 4l_{7p}\mu_{21}^* + 8l_{5p}\mu_{22}^* + 2l_{5p}\mu_{s2}^* + 6\mu_{22}\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + 3\mu_{12}\text{Tr}\left(\epsilon_d Y_d^\dagger\right) + 2\mu_{22}\text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right) \\ & + \mu_{12}\text{Tr}\left(\epsilon_e Y_e^\dagger\right) + 6\mu_{22}\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) + 3\mu_{21}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) + 3\mu_{21}\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + \mu_{21}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) \\ & + 3\mu_{12}\text{Tr}\left(Y_u \epsilon_u^\dagger\right) \end{aligned} \quad (86)$$

$$\beta_{\mu_{22}}^{(2)} = 0 \quad (87)$$

$$\begin{aligned} \beta_{\mu_{s2}}^{(1)} = & +8l_{1p}\mu_{11} + 8l_{3p}\mu_{21} + 8l_{2p}\mu_{22} + 5l_{3pp}\mu_{s2} + 2\mu_{s1}l_{2pp}^* + 8\mu_{12}l_{3p}^* + 8l_{4p}\mu_{11}^* + 8l_{6p}\mu_{12}^* + 8l_{7p}\mu_{21}^* + 8l_{5p}\mu_{22}^* + l_{1pp}\mu_{s1}^* \\ & + 4l_{2pp}\mu_{s2}^* \end{aligned} \quad (88)$$

$$\beta_{\mu_{s2}}^{(2)} = 0 \quad (89)$$

3.7 Scalar Mass Terms

$$\begin{aligned} \beta_{m_{12}}^{(1)} = & -6l_6m_{11} - \frac{9}{10}g_1^2m_{12} - \frac{9}{2}g_2^2m_{12} + 2l_3m_{12} + 4l_4m_{12} - 6l_7m_{22} - 2l_{3p}m_S - 2m_{Sp}l_{7p}^* + 6l_5m_{12}^* - 2l_{6p}m_{Sp}^* \\ & - 2\mu_{12}\mu_{11}^* - 2\mu_{11}\mu_{21}^* - 2\mu_{22}\mu_{21}^* - 2\mu_{12}\mu_{22}^* + 3m_{12}\text{Tr}\left(\epsilon_d \epsilon_d^\dagger\right) + m_{12}\text{Tr}\left(\epsilon_e \epsilon_e^\dagger\right) + 3m_{12}\text{Tr}\left(\epsilon_u \epsilon_u^\dagger\right) \\ & - 3m_{11}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) - 3m_{22}\text{Tr}\left(\epsilon_u Y_u^\dagger\right) - 3m_{11}\text{Tr}\left(Y_d \epsilon_d^\dagger\right) - 3m_{22}\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + 3m_{12}\text{Tr}\left(Y_d Y_d^\dagger\right) \\ & - m_{11}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) - m_{22}\text{Tr}\left(Y_e \epsilon_e^\dagger\right) + m_{12}\text{Tr}\left(Y_e Y_e^\dagger\right) + 3m_{12}\text{Tr}\left(Y_u Y_u^\dagger\right) \end{aligned} \quad (90)$$

$$\beta_{m_{12}}^{(2)} = 0 \quad (91)$$

$$\begin{aligned} \beta_{m_{11}}^{(1)} = & -\frac{9}{10}g_1^2m_{11} - \frac{9}{2}g_2^2m_{11} + 6l_1m_{11} + 4l_3m_{22} + 2l_4m_{22} + 2l_{1p}m_S + 4|\mu_{11}|^2 + 2|\mu_{12}|^2 + 2|\mu_{21}|^2 + 2m_{Sp}l_{4p}^* \\ & - 6m_{12}l_6^* - 6l_6m_{12}^* + 2l_{4p}m_{Sp}^* - 3m_{12}\text{Tr}\left(\epsilon_d Y_d^\dagger\right) - m_{12}\text{Tr}\left(\epsilon_e Y_e^\dagger\right) - 3m_{12}^*\text{Tr}\left(\epsilon_u Y_u^\dagger\right) \\ & - 3m_{12}^*\text{Tr}\left(Y_d \epsilon_d^\dagger\right) + 6m_{11}\text{Tr}\left(Y_d Y_d^\dagger\right) - m_{12}^*\text{Tr}\left(Y_e \epsilon_e^\dagger\right) + 2m_{11}\text{Tr}\left(Y_e Y_e^\dagger\right) - 3m_{12}\text{Tr}\left(Y_u \epsilon_u^\dagger\right) \\ & + 6m_{11}\text{Tr}\left(Y_u Y_u^\dagger\right) \end{aligned} \quad (92)$$

$$\beta_{m_{11}}^{(2)} = 0 \quad (93)$$

$$\begin{aligned}
\beta_{m_{22}}^{(1)} = & +4l_3m_{11} + 2l_4m_{11} - \frac{9}{10}g_1^2m_{22} - \frac{9}{2}g_2^2m_{22} + 6l_2m_{22} + 2l_{2p}m_S + 2|\mu_{12}|^2 + 2|\mu_{21}|^2 + 4|\mu_{22}|^2 + 2m_{Sp}l_{5p}^* \\
& - 6m_{12}l_7^* - 6l_7m_{12}^* + 2l_{5p}m_{Sp}^* + 6m_{22}\text{Tr}(\epsilon_d\epsilon_d^\dagger) - 3m_{12}\text{Tr}(\epsilon_dY_d^\dagger) + 2m_{22}\text{Tr}(\epsilon_e\epsilon_e^\dagger) \\
& - m_{12}\text{Tr}(\epsilon_eY_e^\dagger) + 6m_{22}\text{Tr}(\epsilon_u\epsilon_u^\dagger) - 3m_{12}^*\text{Tr}(\epsilon_uY_u^\dagger) - 3m_{12}^*\text{Tr}(Y_d\epsilon_d^\dagger) - m_{12}^*\text{Tr}(Y_e\epsilon_e^\dagger) \\
& - 3m_{12}\text{Tr}(Y_u\epsilon_u^\dagger)
\end{aligned} \tag{94}$$

$$\beta_{m_{22}}^{(2)} = 0 \tag{95}$$

$$\begin{aligned}
\beta_{m_S}^{(1)} = & +4l_{1p}m_{11} + 4l_{2p}m_{22} + 2l_{3pp}m_S + 4|\mu_{11}|^2 + 4|\mu_{12}|^2 + 4|\mu_{21}|^2 + 4|\mu_{22}|^2 + |\mu_{s1}|^2 + 3|\mu_{s2}|^2 + m_{Sp}l_{2pp}^* - 4m_{12}l_{3p}^* \\
& - 4l_{3p}m_{12}^* + l_{2pp}m_{Sp}^*
\end{aligned} \tag{96}$$

$$\beta_{m_S}^{(2)} = 0 \tag{97}$$

$$\begin{aligned}
\beta_{m_{Sp}}^{(1)} = & 2l_{2pp}m_S + 2\mu_{s1}\mu_{s2}^* + 2\mu_{s2}^2 + 4\mu_{11}^2 + 4\mu_{22}^2 + 8l_{4p}m_{11} + 8l_{5p}m_{22} - 8l_{6p}m_{12}^* - 8l_{7p}m_{12} + 8\mu_{12}\mu_{21} + l_{1pp}m_{Sp}^* + l_{3pp}m_{Sp} \\
& \tag{98}
\end{aligned}$$

$$\beta_{m_{Sp}}^{(2)} = 0 \tag{99}$$

3.8 Vacuum expectation values

$$\begin{aligned}
\beta_{v_1}^{(1)} = & \frac{1}{20} \left(9g_1^2v_1 + 45g_2^2v_1 + 3g_1^2v_1\text{Xi} + 15g_2^2v_1\text{Xi} - 30v_2\text{Tr}(\epsilon_dY_d^\dagger) - 10v_2\text{Tr}(\epsilon_eY_e^\dagger) \right. \\
& - 30v_2\text{Tr}(\epsilon_uY_u^\dagger) - 30v_2\text{Tr}(Y_d\epsilon_d^\dagger) - 60v_1\text{Tr}(Y_dY_d^\dagger) - 10v_2\text{Tr}(Y_e\epsilon_e^\dagger) - 20v_1\text{Tr}(Y_eY_e^\dagger) \\
& \left. - 30v_2\text{Tr}(Y_u\epsilon_u^\dagger) - 60v_1\text{Tr}(Y_uY_u^\dagger) \right)
\end{aligned} \tag{100}$$

$$\beta_{v_1}^{(2)} = 0 \tag{101}$$

$$\begin{aligned}
\beta_{v_2}^{(1)} = & \frac{1}{20} \left(9g_1^2v_2 + 45g_2^2v_2 + 3g_1^2v_2\text{Xi} + 15g_2^2v_2\text{Xi} - 60v_2\text{Tr}(\epsilon_d\epsilon_d^\dagger) - 30v_1\text{Tr}(\epsilon_dY_d^\dagger) \right. \\
& - 20v_2\text{Tr}(\epsilon_e\epsilon_e^\dagger) - 10v_1\text{Tr}(\epsilon_eY_e^\dagger) - 60v_2\text{Tr}(\epsilon_u\epsilon_u^\dagger) - 30v_1\text{Tr}(\epsilon_uY_u^\dagger) - 30v_1\text{Tr}(Y_d\epsilon_d^\dagger) \\
& \left. - 10v_1\text{Tr}(Y_e\epsilon_e^\dagger) - 30v_1\text{Tr}(Y_u\epsilon_u^\dagger) \right)
\end{aligned} \tag{102}$$

$$\beta_{v_2}^{(2)} = 0 \tag{103}$$

$$\beta_{v_s}^{(1)} = 0 \tag{104}$$

$$\beta_{v_s}^{(2)} = 0 \tag{105}$$

4 Field Rotations

4.1 Rotations in gauge sector for eigenstates 'EWSB'

$$\begin{pmatrix} B_\rho \\ W_{3\rho} \end{pmatrix} = Z^{\gamma Z} \begin{pmatrix} \gamma_\rho \\ Z_\rho \end{pmatrix} \quad (106)$$

$$\begin{pmatrix} W_{1\rho} \\ W_{2\rho} \end{pmatrix} = Z^W \begin{pmatrix} W_\rho^- \\ W_\rho^- \end{pmatrix} \quad (107)$$

$$(108)$$

The mixing matrices are parametrized by

$$Z^{\gamma Z} = \begin{pmatrix} \cos \Theta_W & -\sin \Theta_W \\ \sin \Theta_W & \cos \Theta_W \end{pmatrix} \quad (109)$$

$$Z^W = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -i\frac{1}{\sqrt{2}} & i\frac{1}{\sqrt{2}} \end{pmatrix} \quad (110)$$

$$(111)$$

4.2 Rotations in Mass sector for eigenstates 'EWSB'

4.2.1 Mass Matrices for Scalars

- Mass matrix for Higgs, Basis: $(\phi_1, \phi_2, \phi_S, \sigma_1, \sigma_2, \sigma_S), (\phi_1, \phi_2, \phi_S, \sigma_1, \sigma_2, \sigma_S)$

$$m_h^2 = \begin{pmatrix} m_{\phi_1\phi_1} & m_{\phi_2\phi_1} & m_{\phi_S\phi_1} & m_{\sigma_1\phi_1} & m_{\sigma_2\phi_1} & m_{\sigma_S\phi_1} \\ m_{\phi_1\phi_2} & m_{\phi_2\phi_2} & m_{\phi_S\phi_2} & m_{\sigma_1\phi_2} & m_{\sigma_2\phi_2} & m_{\sigma_S\phi_2} \\ m_{\phi_1\phi_S} & m_{\phi_2\phi_S} & m_{\phi_S\phi_S} & m_{\sigma_1\phi_S} & m_{\sigma_2\phi_S} & m_{\sigma_S\phi_S} \\ m_{\phi_1\sigma_1} & m_{\phi_2\sigma_1} & m_{\phi_S\sigma_1} & m_{\sigma_1\sigma_1} & m_{\sigma_2\sigma_1} & m_{\sigma_S\sigma_1} \\ m_{\phi_1\sigma_2} & m_{\phi_2\sigma_2} & m_{\phi_S\sigma_2} & m_{\sigma_1\sigma_2} & m_{\sigma_2\sigma_2} & m_{\sigma_S\sigma_2} \\ m_{\phi_1\sigma_S} & m_{\phi_2\sigma_S} & m_{\phi_S\sigma_S} & m_{\sigma_1\sigma_S} & m_{\sigma_2\sigma_S} & m_{\sigma_S\sigma_S} \end{pmatrix} + \xi_Z m^2(Z) \quad (112)$$

$$\begin{aligned} m_{\phi_1\phi_1} &= +m_{11} \\ &+ \frac{1}{4} \left(v_2^2 (2(l_3 + l_4) + e^{-2i\eta} l_5 + e^{2i\eta} l_5^*) + 6(l_1 v_1^2 + v_1 v_2 (e^{-i\eta} l_6 + e^{i\eta} l_6^*)) \right. \\ &\left. + 4 \left((e^{2i\zeta} l_{4p} + l_{1p}) v_s^2 + v_s (e^{-2i\zeta} (e^{i\zeta} \mu_{11}^* + v_s l_{4p}^*) + e^{i\zeta} \mu_{11}) \right) \right) \\ m_{\phi_1\phi_2} &= \frac{1}{4} e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left((2l_5 + 4e^{2i\eta} (l_3 + l_4)) v_1 v_2 + 2e^{i(3\eta+\zeta)} v_s (e^{i\zeta} l_{7p} v_s + \mu_{21}) \right. \right. \\ &\left. \left. + e^{i\eta} (-2m_{12} + 2v_s (e^{2i\zeta} l_{6p} + l_{3p}) v_s + e^{i\zeta} \mu_{12}) + 3(l_6 v_1^2 + l_7 v_2^2) \right) \right) \end{aligned} \quad (113)$$

$$\begin{aligned}
& + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(2 \left(e^{i\eta} v_1 v_2 l_5^* + v_s^2 l_{3p}^* \right) - 2m_{12}^* + 3 \left(v_1^2 l_6^* + v_2^2 l_7^* \right) \right) \right. \\
& \left. + 2 \left(e^{i\zeta} v_s \left(e^{2i\eta} \mu_{12}^* + \mu_{21}^* \right) + v_s^2 \left(e^{2i\eta} l_{6p}^* + l_{7p}^* \right) \right) \right) \quad (114)
\end{aligned}$$

$$\begin{aligned}
m_{\phi_2 \phi_2} & = +m_{22} \\
& + \frac{1}{4} \left(v_1^2 \left(2 \left(l_3 + l_4 \right) + e^{-2i\eta} l_5 + e^{2i\eta} l_5^* \right) + 6 \left(l_2 v_2^2 + v_1 v_2 \left(e^{-i\eta} l_7 + e^{i\eta} l_7^* \right) \right) \right. \\
& \left. + 4 \left(\left(e^{2i\zeta} l_{5p} + l_{2p} \right) v_s^2 + v_s \left(e^{-2i\zeta} \left(e^{i\zeta} \mu_{22}^* + v_s l_{5p}^* \right) + e^{i\zeta} \mu_{22} \right) \right) \right) \quad (115)
\end{aligned}$$

$$\begin{aligned}
m_{\phi_1 \phi_S} & = \frac{1}{2} e^{-i(\eta+2\zeta)} \left(2e^{i\eta} v_1 \left(2v_s \left(e^{2i\zeta} l_{1p} + e^{4i\zeta} l_{4p} + l_{4p}^* \right) + e^{3i\zeta} \mu_{11} + e^{i\zeta} \mu_{11}^* \right) \right. \\
& + v_2 \left(e^{3i\zeta} \mu_{12} + 2v_s \left(e^{2i\zeta} l_{3p} + e^{4i\zeta} l_{6p} + l_{7p}^* \right) + e^{2i\eta} \left(2v_s \left(e^{2i\zeta} l_{3p}^* + e^{4i\zeta} l_{7p} + l_{6p}^* \right) + e^{3i\zeta} \mu_{21} + e^{i\zeta} \mu_{12}^* \right) \right. \\
& \left. \left. + e^{i\zeta} \mu_{21}^* \right) \right) \quad (116)
\end{aligned}$$

$$\begin{aligned}
m_{\phi_2 \phi_S} & = \frac{1}{2} e^{-i(\eta+2\zeta)} \left(v_1 \left(e^{3i\zeta} \mu_{12} + 2v_s \left(e^{2i\zeta} l_{3p} + e^{4i\zeta} l_{6p} + l_{7p}^* \right) + e^{2i\eta} \left(2v_s \left(e^{2i\zeta} l_{3p}^* + e^{4i\zeta} l_{7p} + l_{6p}^* \right) + e^{3i\zeta} \mu_{21} + e^{i\zeta} \mu_{12}^* \right) \right. \right. \\
& \left. \left. + e^{i\zeta} \mu_{21}^* \right) \right. \\
& \left. + 2e^{i\eta} v_2 \left(2v_s \left(e^{2i\zeta} l_{2p} + e^{4i\zeta} l_{5p} + l_{5p}^* \right) + e^{3i\zeta} \mu_{22} + e^{i\zeta} \mu_{22}^* \right) \right) \quad (117)
\end{aligned}$$

$$\begin{aligned}
m_{\phi_S \phi_S} & = \frac{1}{2} e^{-i(\eta+4\zeta)} \left(e^{4i\zeta} \left(2 \left(e^{2i(\eta+\zeta)} l_{7p} + e^{2i\zeta} l_{6p} + l_{3p} \right) v_1 v_2 \right. \right. \\
& + e^{i\eta} \left(4m_S + \left(2e^{3i\zeta} \mu_{s1} + 6e^{i\zeta} \mu_{s2} \right) v_s + e^{4i\zeta} l_{1pp} v_s^2 \right. \\
& + 2 \left(3l_{3pp} v_s^2 + e^{2i\zeta} \left(2l_{2pp} v_s^2 + l_{4p} v_1^2 + l_{5p} v_2^2 + m_{Sp} \right) + l_{1p} v_1^2 + l_{2p} v_2^2 \right) \Big) \Big) \\
& + e^{i\eta} v_s^2 l_{1pp}^* \\
& + 2 \left(v_1 v_2 \left(e^{2i(\eta+\zeta)} \left(e^{2i\zeta} l_{3p}^* + l_{6p}^* \right) + e^{2i\zeta} l_{7p}^* \right) \right. \\
& \left. + e^{i(\eta+\zeta)} \left(e^{i\zeta} \left(2v_s^2 l_{2pp}^* + v_1^2 l_{4p}^* + v_2^2 l_{5p}^* + m_{Sp}^* \right) + v_s \left(3e^{2i\zeta} \mu_{s2}^* + \mu_{s1}^* \right) \right) \right) \quad (118)
\end{aligned}$$

$$m_{\phi_1 \sigma_1} = \frac{i}{4} e^{-2i\eta} v_2 \left(v_1 \left(2e^{3i\eta} l_6^* - 2e^{i\eta} l_6 \right) + v_2 \left(e^{4i\eta} l_5^* - l_5 \right) \right) \quad (119)$$

$$\begin{aligned}
m_{\phi_2 \sigma_1} & = \frac{i}{4} e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(-2l_5 v_1 v_2 + 2e^{i(3\eta+\zeta)} v_s \left(e^{i\zeta} l_{7p} v_s + \mu_{21} \right) \right. \right. \\
& - e^{i\eta} \left(-2m_{12} + 2v_s \left(\left(e^{2i\zeta} l_{6p} + l_{3p} \right) v_s + e^{i\zeta} \mu_{12} \right) + 3l_7 v_2^2 + l_6 v_1^2 \right) \Big) \\
& + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(2 \left(e^{i\eta} v_1 v_2 l_5^* + v_s^2 l_{3p}^* \right) - 2m_{12}^* + 3v_2^2 l_7^* + v_1^2 l_6^* \right) \right. \\
& \left. + 2 \left(e^{i\zeta} v_s \left(e^{2i\eta} \mu_{12}^* - \mu_{21}^* \right) + v_s^2 \left(e^{2i\eta} l_{6p}^* - l_{7p}^* \right) \right) \right) \quad (120)
\end{aligned}$$

$$m_{\phi_S \sigma_1} = \frac{1}{2} e^{-i(\eta+2\zeta)} v_2 \left(i e^{2i\eta} \left(2v_s \left(e^{2i\zeta} l_{3p}^* + e^{4i\zeta} l_{7p} + l_{6p}^* \right) + e^{3i\zeta} \mu_{21} + e^{i\zeta} \mu_{12}^* \right) \right. \\ \left. - i \left(2v_s \left(e^{2i\zeta} l_{3p} + e^{4i\zeta} l_{6p} + l_{7p}^* \right) + e^{3i\zeta} \mu_{12} + e^{i\zeta} \mu_{21}^* \right) \right) \quad (121)$$

$$m_{\sigma_1 \sigma_1} = +m_{11} \\ + \frac{1}{4} \left(v_2^2 \left(2(l_3 + l_4) - e^{-2i\eta} l_5 - e^{2i\eta} l_5^* \right) + 2(l_1 v_1^2 + v_1 v_2 (e^{-i\eta} l_6 + e^{i\eta} l_6^*)) \right. \\ \left. + 4 \left((e^{2i\zeta} l_{4p} + l_{1p}) v_s^2 + v_s \left(e^{-2i\zeta} (e^{i\zeta} \mu_{11}^* + v_s l_{4p}^*) + e^{i\zeta} \mu_{11} \right) \right) \right) \quad (122)$$

$$m_{\phi_1 \sigma_2} = -\frac{i}{4} e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(-2l_5 v_1 v_2 + 2e^{i(3\eta+\zeta)} v_s (e^{i\zeta} l_{7p} v_s + \mu_{21}) \right. \right. \\ \left. \left. - e^{i\eta} \left(-2m_{12} + 2v_s \left((e^{2i\zeta} l_{6p} + l_{3p}) v_s + e^{i\zeta} \mu_{12} \right) + 3l_6 v_1^2 + l_7 v_2^2 \right) \right) \right. \\ \left. + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(2(e^{i\eta} v_1 v_2 l_5^* + v_s^2 l_{3p}^*) - 2m_{12}^* + 3v_1^2 l_6^* + v_2^2 l_7^* \right) \right. \right. \\ \left. \left. + 2(e^{i\zeta} v_s (e^{2i\eta} \mu_{12}^* - \mu_{21}^*) + v_s^2 (e^{2i\eta} l_{6p}^* - l_{7p}^*)) \right) \right) \quad (123)$$

$$m_{\phi_2 \sigma_2} = \frac{i}{4} e^{-2i\eta} v_1 \left(v_1 \left(-e^{4i\eta} l_5^* + l_5 \right) + v_2 \left(-2e^{3i\eta} l_7^* + 2e^{i\eta} l_7 \right) \right) \quad (124)$$

$$m_{\phi_S \sigma_2} = \frac{1}{2} e^{-i(\eta+2\zeta)} v_1 \left(-i e^{2i\eta} \left(2v_s \left(e^{2i\zeta} l_{3p}^* + e^{4i\zeta} l_{7p} + l_{6p}^* \right) + e^{3i\zeta} \mu_{21} + e^{i\zeta} \mu_{12}^* \right) \right. \\ \left. + i \left(2v_s \left(e^{2i\zeta} l_{3p} + e^{4i\zeta} l_{6p} + l_{7p}^* \right) + e^{3i\zeta} \mu_{12} + e^{i\zeta} \mu_{21}^* \right) \right) \quad (125)$$

$$m_{\sigma_1 \sigma_2} = \frac{1}{4} e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(e^{i\eta} \left(-2m_{12} + 2v_s \left((e^{2i\zeta} l_{6p} + l_{3p}) v_s + e^{i\zeta} \mu_{12} \right) + l_6 v_1^2 + l_7 v_2^2 \right) \right. \right. \\ \left. \left. + 2 \left(e^{i(3\eta+\zeta)} v_s (e^{i\zeta} l_{7p} v_s + \mu_{21}) + l_5 v_1 v_2 \right) \right) \right. \\ \left. + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(2(e^{i\eta} v_1 v_2 l_5^* + v_s^2 l_{3p}^*) - 2m_{12}^* + v_1^2 l_6^* + v_2^2 l_7^* \right) \right. \right. \\ \left. \left. + 2(e^{i\zeta} v_s (e^{2i\eta} \mu_{12}^* + \mu_{21}^*) + v_s^2 (e^{2i\eta} l_{6p}^* + l_{7p}^*)) \right) \right) \quad (126)$$

$$m_{\sigma_2 \sigma_2} = +m_{22} \\ + \frac{1}{4} \left(2(l_3 v_1^2 + l_4 v_1^2) + 2e^{-i\eta} l_7 v_1 v_2 + 2l_2 v_2^2 + 4e^{i\zeta} \mu_{22} v_s + 4l_{2p} v_s^2 + 4e^{2i\zeta} l_{5p} v_s^2 \right. \\ \left. + v_1^2 \left(-e^{-2i\eta} l_5 - e^{2i\eta} l_5^* \right) + 2e^{i\eta} v_1 v_2 l_7^* + 4e^{-2i\zeta} v_s \left(e^{i\zeta} \mu_{22}^* + v_s l_{5p}^* \right) \right) \quad (127)$$

$$m_{\phi_1 \sigma_S} = \frac{i}{2} e^{-i(\eta+2\zeta)} \left(e^{3i\zeta} \left(2e^{i\eta} \mu_{11} v_1 + (e^{2i\eta} \mu_{21} + \mu_{12}) v_2 \right) \right. \\ \left. + v_s \left(2e^{4i\zeta} \left(2e^{i\eta} l_{4p} v_1 + (e^{2i\eta} l_{7p} + l_{6p}) v_2 \right) - 2v_2 (e^{2i\eta} l_{6p}^* + l_{7p}^*) - 4e^{i\eta} v_1 l_{4p}^* \right) \right. \\ \left. - e^{i\zeta} \left(2e^{i\eta} v_1 \mu_{11}^* + v_2 (e^{2i\eta} \mu_{12}^* + \mu_{21}^*) \right) \right) \quad (128)$$

$$\begin{aligned}
m_{\phi_2\sigma_S} &= \frac{i}{2} e^{-i(\eta+2\zeta)} \left(e^{3i\zeta} \left(2e^{i\eta} \mu_{22} v_2 + (e^{2i\eta} \mu_{21} + \mu_{12}) v_1 \right) \right. \\
&\quad + v_s \left(2e^{4i\zeta} \left(2e^{i\eta} l_{5p} v_2 + (e^{2i\eta} l_{7p} + l_{6p}) v_1 \right) - 2v_1 (e^{2i\eta} l_{6p}^* + l_{7p}^*) - 4e^{i\eta} v_2 l_{5p}^* \right) \\
&\quad \left. - e^{i\zeta} \left(2e^{i\eta} v_2 \mu_{22}^* + v_1 (e^{2i\eta} \mu_{12}^* + \mu_{21}^*) \right) \right) \quad (129)
\end{aligned}$$

$$\begin{aligned}
m_{\phi_S\sigma_S} &= \frac{i}{2} e^{-i(\eta+4\zeta)} \left(e^{i(\eta+8\zeta)} l_{1pp} v_s^2 \right. \\
&\quad + 2 \left(e^{6i\zeta} \left((e^{2i\eta} l_{7p} + l_{6p}) v_1 v_2 + e^{i\eta} (l_{2pp} v_s^2 + l_{4p} v_1^2 + l_{5p} v_2^2 + m_{Sp}) \right) + (e^{i(\eta+5\zeta)} \mu_{s2} + e^{i(\eta+7\zeta)} \mu_{s1}) v_s \right) \\
&\quad + e^{i\eta} \left(-v_s^2 l_{1pp}^* \right. \\
&\quad \left. - 2e^{2i\zeta} \left(v_1^2 l_{4p}^* + v_2 (e^{-i\eta} v_1 (e^{2i\eta} l_{6p}^* + l_{7p}^*) + v_2 l_{5p}^*) + v_s (e^{-i\zeta} \mu_{s1}^* + e^{i\zeta} \mu_{s2}^* + v_s l_{2pp}^*) + m_{Sp}^* \right) \right) \quad (130)
\end{aligned}$$

$$m_{\sigma_1\sigma_S} = \frac{1}{2} e^{-i(\eta+2\zeta)} v_2 \left(e^{2i\eta} (2v_s l_{6p}^* - e^{3i\zeta} (2e^{i\zeta} l_{7p} v_s + \mu_{21}) + e^{i\zeta} \mu_{12}^*) + e^{3i\zeta} \mu_{12} - e^{i\zeta} \mu_{21}^* + v_s (2e^{4i\zeta} l_{6p} - 2l_{7p}^*) \right) \quad (131)$$

$$m_{\sigma_2\sigma_S} = \frac{1}{2} e^{-i(\eta+2\zeta)} v_1 \left(e^{2i\eta} (e^{3i\zeta} \mu_{21} - e^{i\zeta} \mu_{12}^* + v_s (2e^{4i\zeta} l_{7p} - 2l_{6p}^*)) - e^{3i\zeta} \mu_{12} + e^{i\zeta} \mu_{21}^* + v_s (-2e^{4i\zeta} l_{6p} + 2l_{7p}^*) \right) \quad (132)$$

$$\begin{aligned}
m_{\sigma_S\sigma_S} &= \frac{1}{2} e^{-i(\eta+4\zeta)} \left(-2v_1 v_2 \left(e^{2i(\eta+\zeta)} \left(-e^{2i\zeta} l_{3p}^* + e^{4i\zeta} l_{7p} + l_{6p}^* \right) + e^{2i\zeta} \left(-e^{2i\zeta} l_{3p} + e^{4i\zeta} l_{6p} + l_{7p}^* \right) \right) \right. \\
&\quad + e^{i\eta} \left(-e^{8i\zeta} l_{1pp} v_s^2 - 2 \left(e^{6i\zeta} (l_{4p} v_1^2 + l_{5p} v_2^2 + m_{Sp}) + e^{7i\zeta} \mu_{s1} v_s \right) \right. \\
&\quad + 2 \left(e^{4i\zeta} (2m_S + l_{1p} v_1^2 + l_{2p} v_2^2 + l_{3pp} v_s^2) + e^{5i\zeta} \mu_{s2} v_s \right) - 2e^{2i\zeta} (v_1^2 l_{4p}^* + v_2^2 l_{5p}^* + m_{Sp}^*) \\
&\quad \left. \left. - v_s (-2e^{3i\zeta} \mu_{s2}^* + 2e^{i\zeta} \mu_{s1}^* + v_s l_{1pp}^*) \right) \right) \quad (133)
\end{aligned}$$

Gauge fixing contributions:

$$m^2(\xi_Z) = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & m_{\sigma_1\sigma_1} & m_{\sigma_2\sigma_1} & 0 \\ 0 & 0 & 0 & m_{\sigma_1\sigma_2} & m_{\sigma_2\sigma_2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \quad (134)$$

$$m_{\sigma_1\sigma_1} = \frac{1}{4} v_1^2 \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right)^2 \quad (135)$$

$$m_{\sigma_1\sigma_2} = \frac{1}{4} v_1 v_2 \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right)^2 \quad (136)$$

$$m_{\sigma_2\sigma_2} = \frac{1}{4} v_2^2 \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right)^2 \quad (137)$$

This matrix is diagonalized by Z^H :

$$Z^H m_h^2 Z^{H,\dagger} = m_{2,h}^{dia} \quad (138)$$

with

$$\phi_1 = \sum_j Z_{j1}^H h_j, \quad \phi_2 = \sum_j Z_{j2}^H h_j, \quad \phi_S = \sum_j Z_{j3}^H h_j \quad (139)$$

$$\sigma_1 = \sum_j Z_{j4}^H h_j, \quad \sigma_2 = \sum_j Z_{j5}^H h_j, \quad \sigma_S = \sum_j Z_{j6}^H h_j \quad (140)$$

- **Mass matrix for Charged Higgs**, Basis: $(H_1^{+,*}, H_2^{+,*}), (H_1^+, H_2^+)$

$$m_{H^-}^2 = \begin{pmatrix} m_{H_1^{+,*} H_1^+} & m_{H_2^{+,*} H_1^+}^* \\ m_{H_1^{+,*} H_2^+} & m_{H_2^{+,*} H_2^+} \end{pmatrix} + \xi_{W^-} m^2(W^-) \quad (141)$$

$$\begin{aligned} m_{H_1^{+,*} H_1^+} &= +m_{11} \\ &+ \frac{1}{2} \left(l_1 v_1^2 + l_3 v_2^2 + v_1 v_2 \left(e^{-i\eta} l_6 + e^{i\eta} l_6^* \right) \right. \\ &\left. + 2 \left(\left(e^{2i\zeta} l_{4p} + l_{1p} \right) v_s^2 + v_s \left(e^{-2i\zeta} \left(e^{i\zeta} \mu_{11}^* + v_s l_{4p}^* \right) + e^{i\zeta} \mu_{11} \right) \right) \right) \end{aligned} \quad (142)$$

$$\begin{aligned} m_{H_1^{+,*} H_2^+} &= \frac{1}{2} e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(\left(e^{2i\eta} l_4 + l_5 \right) v_1 v_2 + e^{i\eta} \left(-2m_{12} + 2v_s \left(\left(e^{2i\zeta} l_{6p} + l_{3p} \right) v_s + e^{i\zeta} \mu_{12} \right) + l_6 v_1^2 + l_7 v_2^2 \right) \right) \right. \\ &\left. + 2e^{i\eta} v_s \left(e^{i\zeta} \mu_{21}^* + v_s l_{7p}^* \right) \right) \end{aligned} \quad (143)$$

$$\begin{aligned} m_{H_2^{+,*} H_2^+} &= +m_{22} \\ &+ \frac{1}{2} \left(l_3 v_1^2 + l_2 v_2^2 + v_1 v_2 \left(e^{-i\eta} l_7 + e^{i\eta} l_7^* \right) \right. \\ &\left. + 2 \left(\left(e^{2i\zeta} l_{5p} + l_{2p} \right) v_s^2 + v_s \left(e^{-2i\zeta} \left(e^{i\zeta} \mu_{22}^* + v_s l_{5p}^* \right) + e^{i\zeta} \mu_{22} \right) \right) \right) \end{aligned} \quad (144)$$

Gauge fixing contributions:

$$m^2(\xi_{W^-}) = \begin{pmatrix} \frac{1}{4} g_2^2 v_1^2 & \frac{1}{4} g_2^2 v_1 v_2 \\ \frac{1}{4} g_2^2 v_1 v_2 & \frac{1}{4} g_2^2 v_2^2 \end{pmatrix} \quad (145)$$

This matrix is diagonalized by Z^+ :

$$Z^+ m_{H^-}^2 Z^{+,\dagger} = m_{2,H^-}^{dia} \quad (146)$$

with

$$H_1^+ = \sum_j Z_{j1}^+ H_j^+, \quad H_2^+ = \sum_j Z_{j2}^+ H_j^+ \quad (147)$$

4.2.2 Mass Matrices for Fermions

- **Mass matrix for Down-Quarks**, Basis: $(d_{L,\alpha_1}), (d_{R,\beta_1}^*)$

$$m_d = \left(\frac{1}{\sqrt{2}} e^{-i\eta} \delta_{\alpha_1\beta_1} \left(e^{i\eta} v_2 \epsilon_d^T + v_1 Y_d^T \right) \right) \quad (148)$$

This matrix is diagonalized by U_L^d and U_R^d

$$U_L^{d,*} m_d U_R^{d,\dagger} = m_d^{dia} \quad (149)$$

with

$$d_{L,i\alpha} = \sum_{t_2} U_{L,ji}^{d,*} D_{L,j\alpha} \quad (150)$$

$$d_{R,i\alpha} = \sum_{t_2} U_{R,ij}^d D_{R,j\alpha}^* \quad (151)$$

- **Mass matrix for Up-Quarks**, Basis: $(u_{L,\alpha_1}), (u_{R,\beta_1}^*)$

$$m_u = \left(\frac{1}{\sqrt{2}} \delta_{\alpha_1\beta_1} \left(e^{i\eta} v_1 Y_u^T + v_2 \epsilon_u^T \right) \right) \quad (152)$$

This matrix is diagonalized by U_L^u and U_R^u

$$U_L^{u,*} m_u U_R^{u,\dagger} = m_u^{dia} \quad (153)$$

with

$$u_{L,i\alpha} = \sum_{t_2} U_{L,ji}^{u,*} U_{L,j\alpha} \quad (154)$$

$$u_{R,i\alpha} = \sum_{t_2} U_{R,ij}^u U_{R,j\alpha}^* \quad (155)$$

- **Mass matrix for Leptons**, Basis: $(e_L), (e_R^*)$

$$m_e = \left(\frac{1}{\sqrt{2}} \left(e^{-i\eta} v_1 Y_e^T + v_2 \epsilon_e^T \right) \right) \quad (156)$$

This matrix is diagonalized by U_L^e and U_R^e

$$U_L^{e,*} m_e U_R^{e,\dagger} = m_e^{dia} \quad (157)$$

with

$$e_{L,i} = \sum_{t_2} U_{L,ji}^{e,*} E_{L,j} \quad (158)$$

$$e_{R,i} = \sum_{t_2} U_{R,ij}^e E_{R,j}^* \quad (159)$$

5 Vacuum Expectation Values

$$H_1^0 = \frac{1}{\sqrt{2}}\phi_1 + \frac{1}{\sqrt{2}}v_1 + i\frac{1}{\sqrt{2}}\sigma_1 \quad (160)$$

$$H_2^0 = \frac{1}{\sqrt{2}}\phi_2 + \frac{1}{\sqrt{2}}v_2 + i\frac{1}{\sqrt{2}}\sigma_2 \quad (161)$$

$$sR = i\sigma_S + \phi_S + v_s \quad (162)$$

6 Tadpole Equations

$$\begin{aligned} \frac{\partial V}{\partial \phi_1} = & \frac{1}{4}e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(v_2 \left(2e^{i(3\eta+\zeta)} v_s \left(e^{i\zeta} l_{7p} v_s + \mu_{21} \right) + e^{i\eta} \left(-2m_{12} + 2v_s \left(\left(e^{2i\zeta} l_{6p} + l_{3p} \right) v_s + e^{i\zeta} \mu_{12} \right) + 3l_6 v_1^2 + l_7 v_2^2 \right) \right) \right. \right. \\ & + v_1 \left(2e^{2i\eta} \left(2 \left(v_s \left(\left(e^{2i\zeta} l_{4p} + l_{1p} \right) v_s + e^{i\zeta} \mu_{11} \right) + m_{11} \right) + l_1 v_1^2 + \left(l_3 + l_4 \right) v_2^2 \right) + l_5 v_2^2 \right) \\ & + e^{i\eta} \left(e^{2i(\eta+\zeta)} v_2 \left(-2m_{12}^* + 2v_s^2 l_{3p}^* + 3v_1^2 l_6^* + e^{i\eta} v_1 v_2 l_5^* + v_2^2 l_7^* \right) \right. \\ & \left. \left. + 2 \left(e^{i\zeta} v_s \left(2e^{i\eta} v_1 \mu_{11}^* + v_2 \left(e^{2i\eta} \mu_{12}^* + \mu_{21}^* \right) \right) + v_s^2 \left(2e^{i\eta} v_1 l_{4p}^* + v_2 \left(e^{2i\eta} l_{6p}^* + l_{7p}^* \right) \right) \right) \right) \right) \end{aligned} \quad (163)$$

$$\begin{aligned} \frac{\partial V}{\partial \phi_2} = & \frac{1}{4}e^{-2i(\eta+\zeta)} \left(e^{2i\zeta} \left(v_1 \left(2e^{i(3\eta+\zeta)} v_s \left(e^{i\zeta} l_{7p} v_s + \mu_{21} \right) + e^{i\eta} \left(-2m_{12} + 2v_s \left(\left(e^{2i\zeta} l_{6p} + l_{3p} \right) v_s + e^{i\zeta} \mu_{12} \right) + 3l_7 v_2^2 + l_6 v_1^2 \right) \right) \right. \right. \\ & + v_2 \left(2e^{2i\eta} \left(2 \left(v_s \left(\left(e^{2i\zeta} l_{5p} + l_{2p} \right) v_s + e^{i\zeta} \mu_{22} \right) + m_{22} \right) + l_2 v_2^2 + \left(l_3 + l_4 \right) v_1^2 \right) + l_5 v_1^2 \right) \\ & + e^{i\eta} \left(e^{2i(\eta+\zeta)} v_1 \left(-2m_{12}^* + 2v_s^2 l_{3p}^* + 3v_2^2 l_7^* + e^{i\eta} v_1 v_2 l_5^* + v_1^2 l_6^* \right) \right. \\ & \left. \left. + 2 \left(e^{i\zeta} v_s \left(2e^{i\eta} v_2 \mu_{22}^* + v_1 \left(e^{2i\eta} \mu_{12}^* + \mu_{21}^* \right) \right) + v_s^2 \left(2e^{i\eta} v_2 l_{5p}^* + v_1 \left(e^{2i\eta} l_{6p}^* + l_{7p}^* \right) \right) \right) \right) \right) \end{aligned} \quad (164)$$

$$\begin{aligned} \frac{\partial V}{\partial \phi_S} = & \frac{1}{6}e^{-i(\eta+4\zeta)} \left(v_s^3 \left(e^{i(\eta+8\zeta)} l_{1pp} + e^{i\eta} l_{1pp}^* \right) \right. \\ & + v_s \left(6e^{4i\zeta} \left(e^{i\eta} \left(2m_S + l_{1p} v_1^2 + l_{2p} v_2^2 + l_{3pp} v_s^2 \right) + v_1 v_2 \left(e^{2i\eta} l_{3p}^* + l_{3p} \right) \right) \right. \\ & + 2 \left(e^{6i\zeta} \left(3 \left(e^{2i\eta} l_{7p} + l_{6p} \right) v_1 v_2 + e^{i\eta} \left(2l_{2pp} v_s^2 + 3 \left(l_{4p} v_1^2 + l_{5p} v_2^2 + m_{Sp} \right) \right) \right) \right. \\ & \left. + e^{2i\zeta} \left(3v_1 v_2 \left(e^{2i\eta} l_{6p}^* + l_{7p}^* \right) + e^{i\eta} \left(2v_s^2 l_{2pp}^* + 3 \left(v_1^2 l_{4p}^* + v_2^2 l_{5p}^* + m_{Sp}^* \right) \right) \right) \right) \\ & + 3 \left(e^{5i\zeta} \left(\left(e^{2i\eta} \mu_{21} + \mu_{12} \right) v_1 v_2 + e^{i\eta} \left(3\mu_s v_s^2 + \mu_{11} v_1^2 + \mu_{22} v_2^2 \right) \right) + v_s^2 \left(e^{i(\eta+7\zeta)} \mu_{s1} + e^{i(\eta+\zeta)} \mu_{s1}^* \right) \right. \\ & \left. \left. + e^{3i\zeta} \left(e^{i\eta} \left(3v_s^2 \mu_{s2}^* + v_1^2 \mu_{11}^* + v_2^2 \mu_{22}^* \right) + v_1 v_2 \left(e^{2i\eta} \mu_{12}^* + \mu_{21}^* \right) \right) \right) \right) \end{aligned} \quad (165)$$

$$\begin{aligned} \frac{\partial V}{\partial \sigma_1} = & \frac{i}{4}e^{-2i(\eta+\zeta)} v_2 \left(e^{2i\zeta} \left(-l_5 v_1 v_2 + 2e^{i(3\eta+\zeta)} v_s \left(e^{i\zeta} l_{7p} v_s + \mu_{21} \right) \right. \right. \\ & \left. \left. - e^{i\eta} \left(-2m_{12} + 2v_s \left(e^{2i\zeta} l_{6p} v_s + e^{i\zeta} \mu_{12} + l_{3p} v_s \right) + l_6 v_1^2 + l_7 v_2^2 \right) \right) \right) \end{aligned}$$

$$\begin{aligned}
& + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(-2m_{12}^* + 2v_s^2 l_{3p}^* + e^{i\eta} v_1 v_2 l_5^* + v_1^2 l_6^* + v_2^2 l_7^* \right) \right. \\
& \left. + 2 \left(e^{i\zeta} v_s \left(e^{2i\eta} \mu_{12}^* - \mu_{21}^* \right) + v_s^2 \left(e^{2i\eta} l_{6p}^* - l_{7p}^* \right) \right) \right) \quad (166)
\end{aligned}$$

$$\begin{aligned}
\frac{\partial V}{\partial \sigma_2} = & -\frac{i}{4} e^{-2i(\eta+\zeta)} v_1 \left(e^{2i\zeta} \left(-l_5 v_1 v_2 + 2e^{i(3\eta+\zeta)} v_s \left(e^{i\zeta} l_{7p} v_s + \mu_{21} \right) \right) \right. \\
& \left. - e^{i\eta} \left(-2m_{12} + 2v_s \left(e^{2i\zeta} l_{6p} v_s + e^{i\zeta} \mu_{12} + l_{3p} v_s \right) + l_6 v_1^2 + l_7 v_2^2 \right) \right) \\
& + e^{i\eta} \left(e^{2i(\eta+\zeta)} \left(-2m_{12}^* + 2v_s^2 l_{3p}^* + e^{i\eta} v_1 v_2 l_5^* + v_1^2 l_6^* + v_2^2 l_7^* \right) \right. \\
& \left. + 2 \left(e^{i\zeta} v_s \left(e^{2i\eta} \mu_{12}^* - \mu_{21}^* \right) + v_s^2 \left(e^{2i\eta} l_{6p}^* - l_{7p}^* \right) \right) \right) \quad (167)
\end{aligned}$$

$$\begin{aligned}
\frac{\partial V}{\partial \sigma_S} = & \frac{i}{6} e^{-i(\eta+4\zeta)} \left(e^{5i\zeta} \left(3v_1 v_2 \left(2e^{i\zeta} l_{6p} v_s + e^{2i\eta} \left(2e^{i\zeta} l_{7p} v_s + \mu_{21} \right) + \mu_{12} \right) \right. \right. \\
& \left. + e^{i\eta} \left(3 \left(\mu_{11} v_1^2 + \mu_{22} v_2^2 \right) + v_s \left(2e^{i\zeta} \left(3 \left(l_{4p} v_1^2 + l_{5p} v_2^2 + m_{Sp} \right) + l_{2pp} v_s^2 \right) + 3 \left(e^{2i\zeta} \mu_{s1} + \mu_{s2} \right) v_s + e^{3i\zeta} l_{1pp} v_s^2 \right) \right) \right) \\
& - e^{i\eta} v_s^3 l_{1pp}^* + 2e^{2i\zeta} v_s \left(-3v_1 v_2 \left(e^{2i\eta} l_{6p}^* + l_{7p}^* \right) - e^{i\eta} \left(3 \left(v_1^2 l_{4p}^* + v_2^2 l_{5p}^* + m_{Sp}^* \right) + v_s^2 l_{2pp}^* \right) \right) \\
& - 3 \left(e^{3i\zeta} \left(e^{i\eta} \left(v_1^2 \mu_{11}^* + v_2^2 \mu_{22}^* + v_s^2 \mu_{s2}^* \right) + v_1 v_2 \left(e^{2i\eta} \mu_{12}^* + \mu_{21}^* \right) \right) + e^{i(\eta+\zeta)} v_s^2 \mu_{s1}^* \right) \quad (168)
\end{aligned}$$

7 Particle content for eigenstates 'EWSB'

Name	Type	complex/real	Generations	Indices
h	Scalar	real	6	generation, 6
H^-	Scalar	complex	2	generation, 2
ν	Fermion	Dirac	3	generation, 3
d	Fermion	Dirac	3	generation, 3, color, 3
u	Fermion	Dirac	3	generation, 3, color, 3
e	Fermion	Dirac	3	generation, 3
g	Vector	real	1	color, 8, lorentz, 4
γ	Vector	real	1	lorentz, 4
Z	Vector	real	1	lorentz, 4
W^-	Vector	complex	1	lorentz, 4
η^G	Ghost	real	1	color, 8
η^γ	Ghost	real	1	
η^Z	Ghost	real	1	
η^-	Ghost	complex	1	

η^+	Ghost	complex	1
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8 One Loop Self-Energy and One Loop Tadpoles for eigenstates 'EWSB'

8.1 One Loop Self-Energy

- Self-Energy for Higgs (h)

$$\begin{aligned}
16\pi^2 \Pi_{i,j}(p^2) = & +2\left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_Z^2, m_Z^2)\right)\Gamma_{\check{h}_j, Z, Z}^* \Gamma_{\check{h}_i, Z, Z} + 4\left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_{W^-}^2, m_{W^-}^2)\right)\Gamma_{\check{h}_j, W^+, W^-}^* \Gamma_{\check{h}_i, W^+, W^-} \\
& - B_0(p^2, m_{\eta^-}^2, m_{\eta^-}^2)\Gamma_{\check{h}_i, \eta^-, \eta^-} \Gamma_{\check{h}_j, \eta^-, \eta^-} - B_0(p^2, m_{\eta^+}^2, m_{\eta^+}^2)\Gamma_{\check{h}_i, \eta^+, \eta^+} \Gamma_{\check{h}_j, \eta^+, \eta^+} \\
& - B_0(p^2, m_{\eta^Z}^2, m_{\eta^Z}^2)\Gamma_{\check{h}_i, \eta^Z, \eta^Z} \Gamma_{\check{h}_j, \eta^Z, \eta^Z} + 4\Gamma_{\check{h}_i, \check{h}_j, W^+, W^-} \left(-\frac{1}{2}\text{rMS} m_{W^-}^2 + A_0(m_{W^-}^2)\right) \\
& + 2\Gamma_{\check{h}_i, \check{h}_j, Z, Z} \left(-\frac{1}{2}\text{rMS} m_Z^2 + A_0(m_Z^2)\right) - \sum_{a=1}^2 A_0(m_{H_a^-}^2) \Gamma_{\check{h}_i, \check{h}_j, H_a^+, H_a^-} \\
& + \sum_{a=1}^2 \sum_{b=1}^2 B_0(p^2, m_{H_a^-}^2, m_{H_b^-}^2) \Gamma_{\check{h}_j, H_a^+, H_b^-}^* \Gamma_{\check{h}_i, H_a^+, H_b^-} \\
& - 6 \sum_{a=1}^3 m_{d_a} \sum_{b=1}^3 B_0(p^2, m_{d_a}^2, m_{d_b}^2) m_{d_b} \left(\Gamma_{\check{h}_j, \bar{d}_a, d_b}^{L*} \Gamma_{\check{h}_i, \bar{d}_a, d_b}^R + \Gamma_{\check{h}_j, \bar{d}_a, d_b}^{R*} \Gamma_{\check{h}_i, \bar{d}_a, d_b}^L\right) \\
& + 3 \sum_{a=1}^3 \sum_{b=1}^3 G_0(p^2, m_{d_a}^2, m_{d_b}^2) \left(\Gamma_{\check{h}_j, \bar{d}_a, d_b}^{L*} \Gamma_{\check{h}_i, \bar{d}_a, d_b}^L + \Gamma_{\check{h}_j, \bar{d}_a, d_b}^{R*} \Gamma_{\check{h}_i, \bar{d}_a, d_b}^R\right) \\
& - 2 \sum_{a=1}^3 m_{e_a} \sum_{b=1}^3 B_0(p^2, m_{e_a}^2, m_{e_b}^2) m_{e_b} \left(\Gamma_{\check{h}_j, \bar{e}_a, e_b}^{L*} \Gamma_{\check{h}_i, \bar{e}_a, e_b}^R + \Gamma_{\check{h}_j, \bar{e}_a, e_b}^{R*} \Gamma_{\check{h}_i, \bar{e}_a, e_b}^L\right) \\
& + \sum_{a=1}^3 \sum_{b=1}^3 G_0(p^2, m_{e_a}^2, m_{e_b}^2) \left(\Gamma_{\check{h}_j, \bar{e}_a, e_b}^{L*} \Gamma_{\check{h}_i, \bar{e}_a, e_b}^L + \Gamma_{\check{h}_j, \bar{e}_a, e_b}^{R*} \Gamma_{\check{h}_i, \bar{e}_a, e_b}^R\right) \\
& - 6 \sum_{a=1}^3 m_{u_a} \sum_{b=1}^3 B_0(p^2, m_{u_a}^2, m_{u_b}^2) m_{u_b} \left(\Gamma_{\check{h}_j, \bar{u}_a, u_b}^{L*} \Gamma_{\check{h}_i, \bar{u}_a, u_b}^R + \Gamma_{\check{h}_j, \bar{u}_a, u_b}^{R*} \Gamma_{\check{h}_i, \bar{u}_a, u_b}^L\right) \\
& + 3 \sum_{a=1}^3 \sum_{b=1}^3 G_0(p^2, m_{u_a}^2, m_{u_b}^2) \left(\Gamma_{\check{h}_j, \bar{u}_a, u_b}^{L*} \Gamma_{\check{h}_i, \bar{u}_a, u_b}^L + \Gamma_{\check{h}_j, \bar{u}_a, u_b}^{R*} \Gamma_{\check{h}_i, \bar{u}_a, u_b}^R\right) \\
& - \frac{1}{2} \sum_{a=1}^6 A_0(m_{h_a}^2) \Gamma_{\check{h}_i, \check{h}_j, h_a, h_a} + \frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^6 B_0(p^2, m_{h_a}^2, m_{h_b}^2) \Gamma_{\check{h}_j, h_a, h_b}^* \Gamma_{\check{h}_i, h_a, h_b} \\
& + 2 \sum_{b=1}^2 \Gamma_{\check{h}_j, W^+, H_b^-}^* \Gamma_{\check{h}_i, W^+, H_b^-} F_0(p^2, m_{H_b^-}^2, m_{W^-}^2) + \sum_{b=1}^6 \Gamma_{\check{h}_j, Z, h_b}^* \Gamma_{\check{h}_i, Z, h_b} F_0(p^2, m_{h_b}^2, m_Z^2) \quad (169)
\end{aligned}$$

• **Self-Energy for Charged Higgs (H^-)**

$$\begin{aligned}
16\pi^2 \Pi_{i,j}(p^2) = & +4\left(-\frac{1}{2}\text{rMS} + B_0(p^2, 0, m_{W^-}^2)\right)\Gamma_{\tilde{H}_j^+, W^-, \gamma}^* \Gamma_{\tilde{H}_i^+, W^-, \gamma} + 4\left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_{W^-}^2, m_Z^2)\right)\Gamma_{\tilde{H}_j^+, Z, W^-}^* \Gamma_{\tilde{H}_i^+, Z, W^-} \\
& - B_0(p^2, m_{\eta^Z}^2, m_{\eta^+}^2)\Gamma_{\tilde{H}_i^+, \eta^+, \eta^Z} \Gamma_{\tilde{H}_j^-, \eta^+, \eta^Z} - B_0(p^2, m_{\eta^-}^2, m_{\eta^Z}^2)\Gamma_{\tilde{H}_i^+, \eta^Z, \eta^-} \Gamma_{\tilde{H}_j^-, \eta^Z, \eta^-} \\
& + 4\Gamma_{\tilde{H}_i^-, \tilde{H}_j^+, W^+, W^-} \left(-\frac{1}{2}\text{rMS}m_{W^-}^2 + A_0(m_{W^-}^2)\right) + 2\Gamma_{\tilde{H}_i^-, \tilde{H}_j^+, Z, Z} \left(-\frac{1}{2}\text{rMS}m_Z^2 + A_0(m_Z^2)\right) \\
& - \sum_{a=1}^2 A_0(m_{H_a^-}^2)\Gamma_{\tilde{H}_i^-, \tilde{H}_j^+, H_a^+, H_a^-} + \sum_{a=1}^2 \sum_{b=1}^6 B_0(p^2, m_{H_a^-}^2, m_{h_b}^2)\Gamma_{\tilde{H}_j^+, H_a^-, h_b}^* \Gamma_{\tilde{H}_i^+, H_a^-, h_b} \\
& - 6 \sum_{a=1}^3 m_{u_a} \sum_{b=1}^3 B_0(p^2, m_{u_a}^2, m_{d_b}^2) m_{d_b} \left(\Gamma_{\tilde{H}_j^+, \bar{u}_a, d_b}^{L*} \Gamma_{\tilde{H}_i^+, \bar{u}_a, d_b}^R + \Gamma_{\tilde{H}_j^+, \bar{u}_a, d_b}^{R*} \Gamma_{\tilde{H}_i^+, \bar{u}_a, d_b}^L\right) \\
& + 3 \sum_{a=1}^3 \sum_{b=1}^3 G_0(p^2, m_{u_a}^2, m_{d_b}^2) \left(\Gamma_{\tilde{H}_j^+, \bar{u}_a, d_b}^{L*} \Gamma_{\tilde{H}_i^+, \bar{u}_a, d_b}^L + \Gamma_{\tilde{H}_j^+, \bar{u}_a, d_b}^{R*} \Gamma_{\tilde{H}_i^+, \bar{u}_a, d_b}^R\right) \\
& - 2 \sum_{a=1}^3 m_{\nu_a} \sum_{b=1}^3 B_0(p^2, m_{\nu_a}^2, m_{e_b}^2) m_{e_b} \left(\Gamma_{\tilde{H}_j^+, \bar{\nu}_a, e_b}^{L*} \Gamma_{\tilde{H}_i^+, \bar{\nu}_a, e_b}^R + \Gamma_{\tilde{H}_j^+, \bar{\nu}_a, e_b}^{R*} \Gamma_{\tilde{H}_i^+, \bar{\nu}_a, e_b}^L\right) \\
& + \sum_{a=1}^3 \sum_{b=1}^3 G_0(p^2, m_{\nu_a}^2, m_{e_b}^2) \left(\Gamma_{\tilde{H}_j^+, \bar{\nu}_a, e_b}^{L*} \Gamma_{\tilde{H}_i^+, \bar{\nu}_a, e_b}^L + \Gamma_{\tilde{H}_j^+, \bar{\nu}_a, e_b}^{R*} \Gamma_{\tilde{H}_i^+, \bar{\nu}_a, e_b}^R\right) \\
& - \frac{1}{2} \sum_{a=1}^6 A_0(m_{h_a}^2)\Gamma_{\tilde{H}_i^-, \tilde{H}_j^+, h_a, h_a} + \sum_{b=1}^2 \Gamma_{\tilde{H}_j^+, \gamma, H_b^-}^* \Gamma_{\tilde{H}_i^+, \gamma, H_b^-} F_0(p^2, m_{H_b^-}^2, 0) \\
& + \sum_{b=1}^2 \Gamma_{\tilde{H}_j^+, Z, H_b^-}^* \Gamma_{\tilde{H}_i^+, Z, H_b^-} F_0(p^2, m_{H_b^-}^2, m_Z^2) + \sum_{b=1}^6 \Gamma_{\tilde{H}_j^+, W^-, h_b}^* \Gamma_{\tilde{H}_i^+, W^-, h_b} F_0(p^2, m_{h_b}^2, m_{W^-}^2)
\end{aligned} \tag{170}$$

• **Self-Energy for Down-Quarks (d)**

$$\begin{aligned}
16\pi^2 \Sigma_{i,j}^S(p^2) = & + \sum_{a=1}^2 \sum_{b=1}^3 B_0(p^2, m_{u_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{d}_j, H_a^-, u_b}^{L*} m_{u_b} \Gamma_{\tilde{d}_i, H_a^-, u_b}^R \\
& + \sum_{a=1}^6 \sum_{b=1}^3 B_0(p^2, m_{d_b}^2, m_{h_a}^2) \Gamma_{\tilde{d}_j, h_a, d_b}^{L*} m_{d_b} \Gamma_{\tilde{d}_i, h_a, d_b}^R \\
& - \frac{16}{3} \sum_{b=1}^3 \left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_{d_b}^2, 0)\right) \Gamma_{\tilde{d}_j, g, d_b}^{R*} m_{d_b} \Gamma_{\tilde{d}_i, g, d_b}^L - 4 \sum_{b=1}^3 \left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_{d_b}^2, 0)\right) \Gamma_{\tilde{d}_j, \gamma, d_b}^{R*} m_{d_b} \Gamma_{\tilde{d}_i, \gamma, d_b}^L \\
& - 4 \sum_{b=1}^3 \left(-\frac{1}{2}\text{rMS} + B_0(p^2, m_{u_b}^2, m_{W^-}^2)\right) \Gamma_{\tilde{d}_j, W^-, u_b}^{R*} m_{u_b} \Gamma_{\tilde{d}_i, W^-, u_b}^L
\end{aligned}$$

$$-4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{d_b}^2, m_Z^2) \right) \Gamma_{\tilde{d}_j, Z, d_b}^{R*} m_{d_b} \Gamma_{\tilde{d}_i, Z, d_b}^L \quad (171)$$

$$\begin{aligned} 16\pi^2 \Sigma_{i,j}^R(p^2) = & -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{u_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{d}_j, H_a^-, u_b}^{R*} \Gamma_{\tilde{d}_i, H_a^-, u_b}^R \\ & -\frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{d_b}^2, m_{h_a}^2) \Gamma_{\tilde{d}_j, h_a, d_b}^{R*} \Gamma_{\tilde{d}_i, h_a, d_b}^R - \frac{4}{3} \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, 0) \right) \Gamma_{\tilde{d}_j, g, d_b}^{L*} \Gamma_{\tilde{d}_i, g, d_b}^L \\ & - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, 0) \right) \Gamma_{\tilde{d}_j, \gamma, d_b}^{L*} \Gamma_{\tilde{d}_i, \gamma, d_b}^L - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{d}_j, W^-, u_b}^{L*} \Gamma_{\tilde{d}_i, W^-, u_b}^L \\ & - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, m_Z^2) \right) \Gamma_{\tilde{d}_j, Z, d_b}^{L*} \Gamma_{\tilde{d}_i, Z, d_b}^L \quad (172) \end{aligned}$$

$$\begin{aligned} 16\pi^2 \Sigma_{i,j}^L(p^2) = & -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{u_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{d}_j, H_a^-, u_b}^{L*} \Gamma_{\tilde{d}_i, H_a^-, u_b}^L \\ & -\frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{d_b}^2, m_{h_a}^2) \Gamma_{\tilde{d}_j, h_a, d_b}^{L*} \Gamma_{\tilde{d}_i, h_a, d_b}^L - \frac{4}{3} \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, 0) \right) \Gamma_{\tilde{d}_j, g, d_b}^{R*} \Gamma_{\tilde{d}_i, g, d_b}^R \\ & - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, 0) \right) \Gamma_{\tilde{d}_j, \gamma, d_b}^{R*} \Gamma_{\tilde{d}_i, \gamma, d_b}^R - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{d}_j, W^-, u_b}^{R*} \Gamma_{\tilde{d}_i, W^-, u_b}^R \\ & - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, m_Z^2) \right) \Gamma_{\tilde{d}_j, Z, d_b}^{R*} \Gamma_{\tilde{d}_i, Z, d_b}^R \quad (173) \end{aligned}$$

• **Self-Energy for Up-Quarks** (u)

$$\begin{aligned} 16\pi^2 \Sigma_{i,j}^S(p^2) = & + \sum_{a=1}^2 \sum_{b=1}^3 B_0(p^2, m_{d_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{u}_j, H_a^+, d_b}^{L*} m_{d_b} \Gamma_{\tilde{u}_i, H_a^+, d_b}^R \\ & + \sum_{a=1}^6 \sum_{b=1}^3 B_0(p^2, m_{u_b}^2, m_{h_a}^2) \Gamma_{\tilde{u}_j, h_a, u_b}^{L*} m_{u_b} \Gamma_{\tilde{u}_i, h_a, u_b}^R \\ & - \frac{16}{3} \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, g, u_b}^{R*} m_{u_b} \Gamma_{\tilde{u}_i, g, u_b}^L - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, \gamma, u_b}^{R*} m_{u_b} \Gamma_{\tilde{u}_i, \gamma, u_b}^L \\ & - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{u_b}^2, m_Z^2) \right) \Gamma_{\tilde{u}_j, Z, u_b}^{R*} m_{u_b} \Gamma_{\tilde{u}_i, Z, u_b}^L \\ & - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{d_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{u}_j, W^+, d_b}^{R*} m_{d_b} \Gamma_{\tilde{u}_i, W^+, d_b}^L \quad (174) \end{aligned}$$

$$\begin{aligned}
16\pi^2 \Sigma_{i,j}^R(p^2) = & -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{d_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{u}_j, H_a^+, d_b}^{R*} \Gamma_{\tilde{u}_i, H_a^+, d_b}^R \\
& - \frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{u_b}^2, m_{h_a}^2) \Gamma_{\tilde{u}_j, h_a, u_b}^{R*} \Gamma_{\tilde{u}_i, h_a, u_b}^R - \frac{4}{3} \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, g, u_b}^{L*} \Gamma_{\tilde{u}_i, g, u_b}^L \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, \gamma, u_b}^{L*} \Gamma_{\tilde{u}_i, \gamma, u_b}^L - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, m_Z^2) \right) \Gamma_{\tilde{u}_j, Z, u_b}^{L*} \Gamma_{\tilde{u}_i, Z, u_b}^L \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{u}_j, W^+, d_b}^{L*} \Gamma_{\tilde{u}_i, W^+, d_b}^L \tag{175}
\end{aligned}$$

$$\begin{aligned}
16\pi^2 \Sigma_{i,j}^L(p^2) = & -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{d_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{u}_j, H_a^+, d_b}^{L*} \Gamma_{\tilde{u}_i, H_a^+, d_b}^L \\
& - \frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{u_b}^2, m_{h_a}^2) \Gamma_{\tilde{u}_j, h_a, u_b}^{L*} \Gamma_{\tilde{u}_i, h_a, u_b}^L - \frac{4}{3} \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, g, u_b}^{R*} \Gamma_{\tilde{u}_i, g, u_b}^R \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, 0) \right) \Gamma_{\tilde{u}_j, \gamma, u_b}^{R*} \Gamma_{\tilde{u}_i, \gamma, u_b}^R - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{u_b}^2, m_Z^2) \right) \Gamma_{\tilde{u}_j, Z, u_b}^{R*} \Gamma_{\tilde{u}_i, Z, u_b}^R \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{d_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{u}_j, W^+, d_b}^{R*} \Gamma_{\tilde{u}_i, W^+, d_b}^R \tag{176}
\end{aligned}$$

• Self-Energy for Leptons (e)

$$\begin{aligned}
16\pi^2 \Sigma_{i,j}^S(p^2) = & + \sum_{a=1}^2 \sum_{b=1}^3 B_0(p^2, m_{\nu_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{e}_j, H_a^-, \nu_b}^{L*} m_{\nu_b} \Gamma_{\tilde{e}_i, H_a^-, \nu_b}^R \\
& + \sum_{a=1}^6 \sum_{b=1}^3 B_0(p^2, m_{e_b}^2, m_{h_a}^2) \Gamma_{\tilde{e}_j, h_a, e_b}^{L*} m_{e_b} \Gamma_{\tilde{e}_i, h_a, e_b}^R \\
& - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{e_b}^2, 0) \right) \Gamma_{\tilde{e}_j, \gamma, e_b}^{R*} m_{e_b} \Gamma_{\tilde{e}_i, \gamma, e_b}^L \\
& - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{\nu_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{e}_j, W^-, \nu_b}^{R*} m_{\nu_b} \Gamma_{\tilde{e}_i, W^-, \nu_b}^L \\
& - 4 \sum_{b=1}^3 \left(-\frac{1}{2} \text{rMS} + B_0(p^2, m_{e_b}^2, m_Z^2) \right) \Gamma_{\tilde{e}_j, Z, e_b}^{R*} m_{e_b} \Gamma_{\tilde{e}_i, Z, e_b}^L \tag{177}
\end{aligned}$$

$$16\pi^2 \Sigma_{i,j}^R(p^2) = -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{\nu_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{e}_j, H_a^-, \nu_b}^{R*} \Gamma_{\tilde{e}_i, H_a^-, \nu_b}^R$$

$$\begin{aligned}
& -\frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{e_b}^2, m_{h_a}^2) \Gamma_{\tilde{e}_j, h_a, e_b}^{R*} \Gamma_{\tilde{e}_i, h_a, e_b}^R - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{e_b}^2, 0) \right) \Gamma_{\tilde{e}_j, \gamma, e_b}^{L*} \Gamma_{\tilde{e}_i, \gamma, e_b}^L \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{\nu_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{e}_j, W^-, \nu_b}^{L*} \Gamma_{\tilde{e}_i, W^-, \nu_b}^L - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{e_b}^2, m_Z^2) \right) \Gamma_{\tilde{e}_j, Z, e_b}^{L*} \Gamma_{\tilde{e}_i, Z, e_b}^L
\end{aligned} \tag{178}$$

$$\begin{aligned}
16\pi^2 \Sigma_{i,j}^L(p^2) &= -\frac{1}{2} \sum_{a=1}^2 \sum_{b=1}^3 B_1(p^2, m_{\nu_b}^2, m_{H_a^-}^2) \Gamma_{\tilde{e}_j, H_a^-, \nu_b}^{L*} \Gamma_{\tilde{e}_i, H_a^-, \nu_b}^L \\
& - \frac{1}{2} \sum_{a=1}^6 \sum_{b=1}^3 B_1(p^2, m_{e_b}^2, m_{h_a}^2) \Gamma_{\tilde{e}_j, h_a, e_b}^{L*} \Gamma_{\tilde{e}_i, h_a, e_b}^L - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{e_b}^2, 0) \right) \Gamma_{\tilde{e}_j, \gamma, e_b}^{R*} \Gamma_{\tilde{e}_i, \gamma, e_b}^R \\
& - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{\nu_b}^2, m_{W^-}^2) \right) \Gamma_{\tilde{e}_j, W^-, \nu_b}^{R*} \Gamma_{\tilde{e}_i, W^-, \nu_b}^R - \sum_{b=1}^3 \left(\frac{1}{2} \text{rMS} + B_1(p^2, m_{e_b}^2, m_Z^2) \right) \Gamma_{\tilde{e}_j, Z, e_b}^{R*} \Gamma_{\tilde{e}_i, Z, e_b}^R
\end{aligned} \tag{179}$$

• **Self-Energy for Z-Boson** (Z)

$$\begin{aligned}
16\pi^2 \Pi(p^2) &= |\Gamma_{Z, \eta^-, \eta^-}|^2 B_{00}(p^2, m_{\eta^-}^2, m_{\eta^-}^2) + |\Gamma_{Z, \eta^+, \eta^+}|^2 B_{00}(p^2, m_{\eta^+}^2, m_{\eta^+}^2) \\
& + |\Gamma_{Z, W^+, W^-}|^2 \left(-10B_{00}(p^2, m_{W^-}^2, m_{W^-}^2) - 2A_0(m_{W^-}^2) + 2\text{rMS}(2m_{W^-}^2 - \frac{1}{3}p^2) - B_0(p^2, m_{W^-}^2, m_{W^-}^2) \right) (2m_{W^-}^2) \\
& + \sum_{a=1}^2 A_0(m_{H_a^-}^2) \Gamma_{Z, Z, H_a^+, H_a^-} - 4 \sum_{a=1}^2 \sum_{b=1}^2 |\Gamma_{Z, H_a^+, H_b^-}|^2 B_{00}(p^2, m_{H_a^-}^2, m_{H_b^-}^2) \\
& + 3 \sum_{a=1}^3 \sum_{b=1}^3 \left[\left(|\Gamma_{Z, \bar{d}_a, d_b}^L|^2 + |\Gamma_{Z, \bar{d}_a, d_b}^R|^2 \right) H_0(p^2, m_{d_a}^2, m_{d_b}^2) \right. \\
& \left. + 4B_0(p^2, m_{d_a}^2, m_{d_b}^2) m_{d_a} m_{d_b} \Re \left(\Gamma_{Z, \bar{d}_a, d_b}^{L*} \Gamma_{Z, \bar{d}_a, d_b}^R \right) \right] \\
& + \sum_{a=1}^3 \sum_{b=1}^3 \left[\left(|\Gamma_{Z, \bar{e}_a, e_b}^L|^2 + |\Gamma_{Z, \bar{e}_a, e_b}^R|^2 \right) H_0(p^2, m_{e_a}^2, m_{e_b}^2) \right. \\
& \left. + 4B_0(p^2, m_{e_a}^2, m_{e_b}^2) m_{e_a} m_{e_b} \Re \left(\Gamma_{Z, \bar{e}_a, e_b}^{L*} \Gamma_{Z, \bar{e}_a, e_b}^R \right) \right] \\
& + 3 \sum_{a=1}^3 \sum_{b=1}^3 \left[\left(|\Gamma_{Z, \bar{u}_a, u_b}^L|^2 + |\Gamma_{Z, \bar{u}_a, u_b}^R|^2 \right) H_0(p^2, m_{u_a}^2, m_{u_b}^2) \right. \\
& \left. + 4B_0(p^2, m_{u_a}^2, m_{u_b}^2) m_{u_a} m_{u_b} \Re \left(\Gamma_{Z, \bar{u}_a, u_b}^{L*} \Gamma_{Z, \bar{u}_a, u_b}^R \right) \right] \\
& + \sum_{a=1}^3 \sum_{b=1}^3 \left[\left(|\Gamma_{Z, \bar{\nu}_a, \nu_b}^L|^2 + |\Gamma_{Z, \bar{\nu}_a, \nu_b}^R|^2 \right) H_0(p^2, m_{\nu_a}^2, m_{\nu_b}^2) \right. \\
& \left. + 4B_0(p^2, m_{\nu_a}^2, m_{\nu_b}^2) m_{\nu_a} m_{\nu_b} \Re \left(\Gamma_{Z, \bar{\nu}_a, \nu_b}^{L*} \Gamma_{Z, \bar{\nu}_a, \nu_b}^R \right) \right]
\end{aligned}$$

$$\begin{aligned}
& + \frac{1}{2} \sum_{a=1}^6 A_0(m_{h_a}^2) \Gamma_{Z,Z,h_a,h_a} - 2 \sum_{a=1}^6 \sum_{b=1}^6 |\Gamma_{Z,h_a,h_b}|^2 B_{00}(p^2, m_{h_a}^2, m_{h_b}^2) \\
& + 2 \sum_{b=1}^2 |\Gamma_{Z,W^+,H_b^-}|^2 B_0(p^2, m_{W^-}^2, m_{H_b^-}^2) + \sum_{b=1}^6 |\Gamma_{Z,Z,h_b}|^2 B_0(p^2, m_Z^2, m_{h_b}^2) + 2\text{rMS} m_{W^-}^2 \Gamma_{Z,Z,W^+,W^-}^1 \\
& - A_0(m_{W^-}^2) \left(4\Gamma_{Z,Z,W^+,W^-}^1 + \Gamma_{Z,Z,W^+,W^-}^2 + \Gamma_{Z,Z,W^+,W^-}^3 \right) \tag{180}
\end{aligned}$$

• **Self-Energy for W-Boson (W^-)**

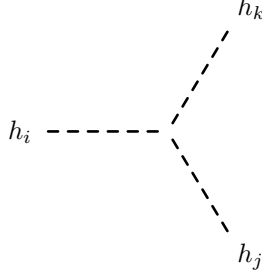
$$\begin{aligned}
16\pi^2 \Pi(p^2) = & 2\text{rMS} m_{W^-}^2 \Gamma_{W^-,W^+,W^+,W^-}^1 + 3 \sum_{a=1}^3 \sum_{b=1}^3 \left[(|\Gamma_{W^+,\bar{u}_a,d_b}^L|^2 + |\Gamma_{W^+,\bar{u}_a,d_b}^R|^2) H_0(p^2, m_{u_a}^2, m_{d_b}^2) \right. \\
& + 4B_0(p^2, m_{u_a}^2, m_{d_b}^2) m_{d_b} m_{u_a} \Re(\Gamma_{W^+,\bar{u}_a,d_b}^{L*} \Gamma_{W^+,\bar{u}_a,d_b}^R) \left. \right] - 4 \sum_{a=1}^2 \sum_{b=1}^6 |\Gamma_{W^+,H_a^-,h_b}|^2 B_{00}(p^2, m_{h_b}^2, m_{H_a^-}^2) - A_0(m_{W^-}^2) \\
& + 4B_0(p^2, m_{\nu_a}^2, m_{e_b}^2) m_{e_b} m_{\nu_a} \Re(\Gamma_{W^+,\bar{\nu}_a,e_b}^{L*} \Gamma_{W^+,\bar{\nu}_a,e_b}^R) \left. \right] + \sum_{b=1}^2 |\Gamma_{W^+,\gamma,H_b^-}|^2 B_0(p^2, 0, m_{H_b^-}^2) + \sum_{b=1}^2 |\Gamma_{W^+,Z,H_b^-}|^2 B_0(p^2, \\
& \tag{181}
\end{aligned}$$

8.2 Tadpoles

$$\begin{aligned}
16\pi^2 \delta t_h^{(1)} = & + A_0(m_{\eta^-}^2) \Gamma_{\tilde{h}_i,\eta^-, \eta^-} + A_0(m_{\eta^+}^2) \Gamma_{\tilde{h}_i,\eta^+, \eta^+} + A_0(m_{\eta^Z}^2) \Gamma_{\tilde{h}_i,\eta^Z, \eta^Z} \\
& + 4\Gamma_{\tilde{h}_i,W^+,W^-} \left(-\frac{1}{2} \text{rMS} m_{W^-}^2 + A_0(m_{W^-}^2) \right) + 2\Gamma_{\tilde{h}_i,Z,Z} \left(-\frac{1}{2} \text{rMS} m_Z^2 + A_0(m_Z^2) \right) - \sum_{a=1}^2 A_0(m_{H_a^-}^2) \Gamma_{\tilde{h}_i,H_a^+,H_a^-} \\
& + 6 \sum_{a=1}^3 A_0(m_{d_a}^2) m_{d_a} \left(\Gamma_{\tilde{h}_i,\bar{d}_a,d_a}^L + \Gamma_{\tilde{h}_i,\bar{d}_a,d_a}^R \right) \\
& + 2 \sum_{a=1}^3 A_0(m_{e_a}^2) m_{e_a} \left(\Gamma_{\tilde{h}_i,\bar{e}_a,e_a}^L + \Gamma_{\tilde{h}_i,\bar{e}_a,e_a}^R \right) \\
& + 6 \sum_{a=1}^3 A_0(m_{u_a}^2) m_{u_a} \left(\Gamma_{\tilde{h}_i,\bar{u}_a,u_a}^L + \Gamma_{\tilde{h}_i,\bar{u}_a,u_a}^R \right) - \frac{1}{2} \sum_{a=1}^6 A_0(m_{h_a}^2) \Gamma_{\tilde{h}_i,h_a,h_a} \tag{182}
\end{aligned}$$

9 Interactions for eigenstates 'EWSB'

9.1 Three Scalar-Interaction



$$\begin{aligned}
& \frac{1}{2} e^{-2i(\eta+2\zeta)} \left(-2ie^{2i\eta+5i\zeta} \mu_{11} Z_{i3}^H Z_{j1}^H Z_{k1}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} v_s Z_{i3}^H Z_{j1}^H Z_{k1}^H \right. \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i3}^H Z_{j1}^H Z_{k1}^H - 4ie^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i3}^H Z_{j1}^H Z_{k1}^H \\
& - 2ie^{2i\eta+3i\zeta} \mu_{11}^* Z_{i3}^H Z_{j1}^H Z_{k1}^H - e^{i(\eta+4\zeta)} l_{6v_2} Z_{i4}^H Z_{j1}^H Z_{k1}^H \\
& + e^{3i\eta+4i\zeta} v_2 l_{6v_2}^* Z_{i4}^H Z_{j1}^H Z_{k1}^H + 3e^{i(\eta+4\zeta)} l_{6v_1} Z_{i5}^H Z_{j1}^H Z_{k1}^H \\
& + e^{4i\zeta} l_5 v_2 Z_{i5}^H Z_{j1}^H Z_{k1}^H - e^{4i(\eta+\zeta)} v_2 l_5^* Z_{i5}^H Z_{j1}^H Z_{k1}^H \\
& - 3e^{3i\eta+4i\zeta} v_1 l_6^* Z_{i5}^H Z_{j1}^H Z_{k1}^H + 2e^{2i\eta+5i\zeta} \mu_{11} Z_{i6}^H Z_{j1}^H Z_{k1}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i6}^H Z_{j1}^H Z_{k1}^H - 4e^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i6}^H Z_{j1}^H Z_{k1}^H \\
& - 2e^{2i\eta+3i\zeta} \mu_{11}^* Z_{i6}^H Z_{j1}^H Z_{k1}^H - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i3}^H Z_{j2}^H Z_{k1}^H \\
& - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j2}^H Z_{k1}^H - 2ie^{i(\eta+4\zeta)} l_{3p} v_s Z_{i3}^H Z_{j2}^H Z_{k1}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i3}^H Z_{j2}^H Z_{k1}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j2}^H Z_{k1}^H \\
& - 2ie^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H \\
& - 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H \\
& - ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H - e^{i(\eta+4\zeta)} l_{6v_1} Z_{i4}^H Z_{j2}^H Z_{k1}^H \\
& - e^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j2}^H Z_{k1}^H + e^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j2}^H Z_{k1}^H \\
& \left. + e^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j2}^H Z_{k1}^H + e^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j2}^H Z_{k1}^H \right)
\end{aligned}$$

$$\begin{aligned}
& + e^{i(\eta+4\zeta)} l_7 v_2 Z_{i5}^H Z_{j2}^H Z_{k1}^H - e^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j2}^H Z_{k1}^H \\
& - e^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j2}^H Z_{k1}^H + e^{i(\eta+5\zeta)} \mu_{12} Z_{i6}^H Z_{j2}^H Z_{k1}^H \\
& + e^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j2}^H Z_{k1}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i6}^H Z_{j2}^H Z_{k1}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j2}^H Z_{k1}^H - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} v_1 Z_{i3}^H Z_{j3}^H Z_{k1}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} v_1 Z_{i3}^H Z_{j3}^H Z_{k1}^H - 2ie^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i3}^H Z_{j3}^H Z_{k1}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i3}^H Z_{j3}^H Z_{k1}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i3}^H Z_{j3}^H Z_{k1}^H \\
& - 2ie^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H - 4ie^{2i(\eta+\zeta)} v_1 l_{4p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H \\
& - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H - 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H \\
& + e^{i(\eta+5\zeta)} \mu_{12} Z_{i5}^H Z_{j3}^H Z_{k1}^H - e^{3i\eta+5i\zeta} \mu_{21} Z_{i5}^H Z_{j3}^H Z_{k1}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i5}^H Z_{j3}^H Z_{k1}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i5}^H Z_{j3}^H Z_{k1}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i5}^H Z_{j3}^H Z_{k1}^H - 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H \\
& - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H + 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H \\
& - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H + e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} v_1 Z_{i6}^H Z_{j3}^H Z_{k1}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i6}^H Z_{j3}^H Z_{k1}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i6}^H Z_{j3}^H Z_{k1}^H - 4e^{2i(\eta+\zeta)} v_1 l_{4p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H \\
& - 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H - 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_1 v_1 Z_{i4}^H Z_{j4}^H Z_{k1}^H - ie^{i(\eta+4\zeta)} l_6 v_2 Z_{i4}^H Z_{j4}^H Z_{k1}^H \\
& - ie^{3i\eta+4i\zeta} v_2 l_6^* Z_{i4}^H Z_{j4}^H Z_{k1}^H - ie^{i(\eta+4\zeta)} l_6 v_1 Z_{i5}^H Z_{j4}^H Z_{k1}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{4i\zeta}l_5v_2Z_{i5}^HZ_{j4}^HZ_{k1}^H - ie^{4i(\eta+\zeta)}v_2l_5^*Z_{i5}^HZ_{j4}^HZ_{k1}^H \\
& -ie^{3i\eta+4i\zeta}v_1l_6^*Z_{i5}^HZ_{j4}^HZ_{k1}^H + e^{i(\eta+5\zeta)}\mu_{12}Z_{i3}^HZ_{j5}^HZ_{k1}^H \\
& -e^{3i\eta+5i\zeta}\mu_{21}Z_{i3}^HZ_{j5}^HZ_{k1}^H + 2e^{i(\eta+4\zeta)}l_{3p}v_sZ_{i3}^HZ_{j5}^HZ_{k1}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}v_sZ_{i3}^HZ_{j5}^HZ_{k1}^H - 2e^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i3}^HZ_{j5}^HZ_{k1}^H \\
& - 2e^{3i\eta+4i\zeta}v_sl_3^*Z_{i3}^HZ_{j5}^HZ_{k1}^H - 2e^{3i\eta+2i\zeta}v_sl_6^*Z_{i3}^HZ_{j5}^HZ_{k1}^H \\
& + 2e^{i(\eta+2\zeta)}v_sl_7^*Z_{i3}^HZ_{j5}^HZ_{k1}^H - e^{3i(\eta+\zeta)}\mu_{12}^*Z_{i3}^HZ_{j5}^HZ_{k1}^H \\
& + e^{i(\eta+3\zeta)}\mu_{21}^*Z_{i3}^HZ_{j5}^HZ_{k1}^H - ie^{i(\eta+4\zeta)}l_6v_1Z_{i4}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{4i\zeta}l_5v_2Z_{i4}^HZ_{j5}^HZ_{k1}^H - ie^{4i(\eta+\zeta)}v_2l_5^*Z_{i4}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{3i\eta+4i\zeta}v_1l_6^*Z_{i4}^HZ_{j5}^HZ_{k1}^H - 2ie^{2i(\eta+2\zeta)}l_3v_1Z_{i5}^HZ_{j5}^HZ_{k1}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_4v_1Z_{i5}^HZ_{j5}^HZ_{k1}^H + ie^{4i\zeta}l_5v_1Z_{i5}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{i(\eta+4\zeta)}l_7v_2Z_{i5}^HZ_{j5}^HZ_{k1}^H + ie^{4i(\eta+\zeta)}v_1l_5^*Z_{i5}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{3i\eta+4i\zeta}v_2l_7^*Z_{i5}^HZ_{j5}^HZ_{k1}^H + ie^{i(\eta+5\zeta)}\mu_{12}Z_{i6}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{3i\eta+5i\zeta}\mu_{21}Z_{i6}^HZ_{j5}^HZ_{k1}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_sZ_{i6}^HZ_{j5}^HZ_{k1}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i6}^HZ_{j5}^HZ_{k1}^H + 2ie^{3i\eta+2i\zeta}v_sl_6^*Z_{i6}^HZ_{j5}^HZ_{k1}^H \\
& - 2ie^{i(\eta+2\zeta)}v_sl_7^*Z_{i6}^HZ_{j5}^HZ_{k1}^H + ie^{3i(\eta+\zeta)}\mu_{12}^*Z_{i6}^HZ_{j5}^HZ_{k1}^H \\
& -ie^{i(\eta+3\zeta)}\mu_{21}^*Z_{i6}^HZ_{j5}^HZ_{k1}^H + 4e^{2i(\eta+3\zeta)}l_{4p}v_1Z_{i3}^HZ_{j6}^HZ_{k1}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}v_2Z_{i3}^HZ_{j6}^HZ_{k1}^H + 2e^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i3}^HZ_{j6}^HZ_{k1}^H \\
& - 4e^{2i(\eta+\zeta)}v_1l_4^*Z_{i3}^HZ_{j6}^HZ_{k1}^H - 2e^{3i\eta+2i\zeta}v_2l_6^*Z_{i3}^HZ_{j6}^HZ_{k1}^H \\
& - 2e^{i(\eta+2\zeta)}v_2l_7^*Z_{i3}^HZ_{j6}^HZ_{k1}^H + ie^{i(\eta+5\zeta)}\mu_{12}Z_{i5}^HZ_{j6}^HZ_{k1}^H \\
& -ie^{3i\eta+5i\zeta}\mu_{21}Z_{i5}^HZ_{j6}^HZ_{k1}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_sZ_{i5}^HZ_{j6}^HZ_{k1}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i5}^HZ_{j6}^HZ_{k1}^H + 2ie^{3i\eta+2i\zeta}v_sl_6^*Z_{i5}^HZ_{j6}^HZ_{k1}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^i(\eta+2\zeta) v_s l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H + ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H \\
& -ie^i(\eta+3\zeta) \mu_{21}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} v_1 Z_{i6}^H Z_{j6}^H Z_{k1}^H \\
& + 4ie^{2i(\eta+3\zeta)} l_{4p} v_1 Z_{i6}^H Z_{j6}^H Z_{k1}^H - 2ie^i(\eta+4\zeta) l_{3p} v_2 Z_{i6}^H Z_{j6}^H Z_{k1}^H \\
& + 2ie^i(\eta+6\zeta) l_{6p} v_2 Z_{i6}^H Z_{j6}^H Z_{k1}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i6}^H Z_{j6}^H Z_{k1}^H \\
& - 2ie^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H + 4ie^{2i(\eta+\zeta)} v_1 l_{4p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H \\
& + 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H + 2ie^i(\eta+2\zeta) v_2 l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H \\
& - ie^i(\eta+5\zeta) \mu_{12} Z_{i3}^H Z_{j1}^H Z_{k2}^H - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j1}^H Z_{k2}^H \\
& - 2ie^i(\eta+4\zeta) l_{3p} v_s Z_{i3}^H Z_{j1}^H Z_{k2}^H - 2ie^i(\eta+6\zeta) l_{6p} v_s Z_{i3}^H Z_{j1}^H Z_{k2}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j1}^H Z_{k2}^H - 2ie^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H \\
& - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H - 2ie^i(\eta+2\zeta) v_s l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H \\
& - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H - ie^i(\eta+3\zeta) \mu_{21}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H \\
& - e^i(\eta+4\zeta) l_6 v_1 Z_{i4}^H Z_{j1}^H Z_{k2}^H - e^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j1}^H Z_{k2}^H \\
& + e^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j1}^H Z_{k2}^H + e^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j1}^H Z_{k2}^H \\
& + e^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j1}^H Z_{k2}^H + e^i(\eta+4\zeta) l_7 v_2 Z_{i5}^H Z_{j1}^H Z_{k2}^H \\
& - e^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j1}^H Z_{k2}^H - e^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j1}^H Z_{k2}^H \\
& + e^i(\eta+5\zeta) \mu_{12} Z_{i6}^H Z_{j1}^H Z_{k2}^H + e^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j1}^H Z_{k2}^H + 2e^i(\eta+6\zeta) l_{6p} v_s Z_{i6}^H Z_{j1}^H Z_{k2}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j1}^H Z_{k2}^H - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H \\
& - 2e^i(\eta+2\zeta) v_s l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H \\
& - e^i(\eta+3\zeta) \mu_{21}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H - 2ie^{2i\eta+5i\zeta} \mu_{22} Z_{i3}^H Z_{j2}^H Z_{k2}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} v_s Z_{i3}^H Z_{j2}^H Z_{k2}^H - 4ie^{2i(\eta+3\zeta)} l_{5p} v_s Z_{i3}^H Z_{j2}^H Z_{k2}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+\zeta)} v_s l_{5p}^* Z_{i3}^H Z_{j2}^H Z_{k2}^H - 2ie^{2i\eta+3i\zeta} \mu_{22}^* Z_{i3}^H Z_{j2}^H Z_{k2}^H \\
& - e^{4i\zeta} l_5 v_1 Z_{i4}^H Z_{j2}^H Z_{k2}^H - 3e^{i(\eta+4\zeta)} l_7 v_2 Z_{i4}^H Z_{j2}^H Z_{k2}^H \\
& + e^{4i(\eta+\zeta)} v_1 l_5^* Z_{i4}^H Z_{j2}^H Z_{k2}^H + 3e^{3i\eta+4i\zeta} v_2 l_7^* Z_{i4}^H Z_{j2}^H Z_{k2}^H \\
& + e^{i(\eta+4\zeta)} l_7 v_1 Z_{i5}^H Z_{j2}^H Z_{k2}^H - e^{3i\eta+4i\zeta} v_1 l_7^* Z_{i5}^H Z_{j2}^H Z_{k2}^H \\
& + 2e^{2i\eta+5i\zeta} \mu_{22} Z_{i6}^H Z_{j2}^H Z_{k2}^H + 4e^{2i(\eta+3\zeta)} l_{5p} v_s Z_{i6}^H Z_{j2}^H Z_{k2}^H \\
& - 4e^{2i(\eta+\zeta)} v_s l_{5p}^* Z_{i6}^H Z_{j2}^H Z_{k2}^H - 2e^{2i\eta+3i\zeta} \mu_{22}^* Z_{i6}^H Z_{j2}^H Z_{k2}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} v_1 Z_{i3}^H Z_{j3}^H Z_{k2}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i3}^H Z_{j3}^H Z_{k2}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i3}^H Z_{j3}^H Z_{k2}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} v_2 Z_{i3}^H Z_{j3}^H Z_{k2}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{5p} v_2 Z_{i3}^H Z_{j3}^H Z_{k2}^H - 2ie^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H \\
& - 4ie^{2i(\eta+\zeta)} v_2 l_{5p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H - 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H \\
& - 2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H - e^{i(\eta+5\zeta)} \mu_{12} Z_{i4}^H Z_{j3}^H Z_{k2}^H \\
& + e^{3i\eta+5i\zeta} \mu_{21} Z_{i4}^H Z_{j3}^H Z_{k2}^H - 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i4}^H Z_{j3}^H Z_{k2}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j3}^H Z_{k2}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i4}^H Z_{j3}^H Z_{k2}^H \\
& + 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H + 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H + e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i6}^H Z_{j3}^H Z_{k2}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i6}^H Z_{j3}^H Z_{k2}^H + 4e^{2i(\eta+3\zeta)} l_{5p} v_2 Z_{i6}^H Z_{j3}^H Z_{k2}^H \\
& - 4e^{2i(\eta+\zeta)} v_2 l_{5p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H - 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H \\
& - 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H - e^{i(\eta+5\zeta)} \mu_{12} Z_{i3}^H Z_{j4}^H Z_{k2}^H \\
& + e^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j4}^H Z_{k2}^H - 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i3}^H Z_{j4}^H Z_{k2}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i3}^H Z_{j4}^H Z_{k2}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j4}^H Z_{k2}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H + 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H + e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H - ie^{i(\eta+4\zeta)} l_6 v_1 Z_{i4}^H Z_{j4}^H Z_{k2}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_3 v_2 Z_{i4}^H Z_{j4}^H Z_{k2}^H - 2ie^{2i(\eta+2\zeta)} l_4 v_2 Z_{i4}^H Z_{j4}^H Z_{k2}^H \\
& + ie^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j4}^H Z_{k2}^H + ie^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j4}^H Z_{k2}^H \\
& - ie^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j4}^H Z_{k2}^H - ie^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j4}^H Z_{k2}^H \\
& - ie^{i(\eta+4\zeta)} l_7 v_2 Z_{i5}^H Z_{j4}^H Z_{k2}^H - ie^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j4}^H Z_{k2}^H \\
& - ie^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j4}^H Z_{k2}^H - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i6}^H Z_{j4}^H Z_{k2}^H \\
& + ie^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j4}^H Z_{k2}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i6}^H Z_{j4}^H Z_{k2}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j4}^H Z_{k2}^H - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H \\
& + 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H \\
& + ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H - ie^{4i\zeta} l_5 v_1 Z_{i4}^H Z_{j5}^H Z_{k2}^H \\
& - ie^{i(\eta+4\zeta)} l_7 v_2 Z_{i4}^H Z_{j5}^H Z_{k2}^H - ie^{4i(\eta+\zeta)} v_1 l_5^* Z_{i4}^H Z_{j5}^H Z_{k2}^H \\
& - ie^{3i\eta+4i\zeta} v_2 l_7^* Z_{i4}^H Z_{j5}^H Z_{k2}^H - ie^{i(\eta+4\zeta)} l_7 v_1 Z_{i5}^H Z_{j5}^H Z_{k2}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_2 v_2 Z_{i5}^H Z_{j5}^H Z_{k2}^H - ie^{3i\eta+4i\zeta} v_1 l_7^* Z_{i5}^H Z_{j5}^H Z_{k2}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i3}^H Z_{j6}^H Z_{k2}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i3}^H Z_{j6}^H Z_{k2}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} v_2 Z_{i3}^H Z_{j6}^H Z_{k2}^H - 4e^{2i(\eta+\zeta)} v_2 l_{5p}^* Z_{i3}^H Z_{j6}^H Z_{k2}^H \\
& - 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k2}^H - 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k2}^H \\
& - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i4}^H Z_{j6}^H Z_{k2}^H + ie^{3i\eta+5i\zeta} \mu_{21} Z_{i4}^H Z_{j6}^H Z_{k2}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j6}^H Z_{k2}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i4}^H Z_{j6}^H Z_{k2}^H \\
& - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k2}^H + 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k2}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{3i(\eta+\zeta)}\mu_{12}^*Z_{i4}^HZ_{j6}^HZ_{k2}^H + ie^{i(\eta+3\zeta)}\mu_{21}^*Z_{i4}^HZ_{j6}^HZ_{k2}^H \\
& - 2ie^{i(\eta+4\zeta)}l_{3p}v_1Z_{i6}^HZ_{j6}^HZ_{k2}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_1Z_{i6}^HZ_{j6}^HZ_{k2}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i6}^HZ_{j6}^HZ_{k2}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}v_2Z_{i6}^HZ_{j6}^HZ_{k2}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{5p}v_2Z_{i6}^HZ_{j6}^HZ_{k2}^H - 2ie^{3i\eta+4i\zeta}v_1l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^H \\
& + 4ie^{2i(\eta+\zeta)}v_2l_{5p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^H + 2ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^H \\
& + 2ie^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^H - 4ie^{2i(\eta+2\zeta)}l_{1p}v_1Z_{i3}^HZ_{j1}^HZ_{k3}^H \\
& - 4ie^{2i(\eta+3\zeta)}l_{4p}v_1Z_{i3}^HZ_{j1}^HZ_{k3}^H - 2ie^{i(\eta+4\zeta)}l_{3p}v_2Z_{i3}^HZ_{j1}^HZ_{k3}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}v_2Z_{i3}^HZ_{j1}^HZ_{k3}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i3}^HZ_{j1}^HZ_{k3}^H \\
& - 2ie^{3i\eta+4i\zeta}v_2l_{3p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^H - 4ie^{2i(\eta+\zeta)}v_1l_{4p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^H \\
& - 2ie^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^H - 2ie^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^H \\
& + e^{i(\eta+5\zeta)}\mu_{12}Z_{i5}^HZ_{j1}^HZ_{k3}^H - e^{3i\eta+5i\zeta}\mu_{21}Z_{i5}^HZ_{j1}^HZ_{k3}^H \\
& + 2e^{i(\eta+4\zeta)}l_{3p}v_sZ_{i5}^HZ_{j1}^HZ_{k3}^H + 2e^{i(\eta+6\zeta)}l_{6p}v_sZ_{i5}^HZ_{j1}^HZ_{k3}^H \\
& - 2e^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i5}^HZ_{j1}^HZ_{k3}^H - 2e^{3i\eta+4i\zeta}v_sl_{3p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^H \\
& - 2e^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^H + 2e^{i(\eta+2\zeta)}v_sl_{7p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^H \\
& - e^{3i(\eta+\zeta)}\mu_{12}^*Z_{i5}^HZ_{j1}^HZ_{k3}^H + e^{i(\eta+3\zeta)}\mu_{21}^*Z_{i5}^HZ_{j1}^HZ_{k3}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{4p}v_1Z_{i6}^HZ_{j1}^HZ_{k3}^H + 2e^{i(\eta+6\zeta)}l_{6p}v_2Z_{i6}^HZ_{j1}^HZ_{k3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i6}^HZ_{j1}^HZ_{k3}^H - 4e^{2i(\eta+\zeta)}v_1l_{4p}^*Z_{i6}^HZ_{j1}^HZ_{k3}^H \\
& - 2e^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i6}^HZ_{j1}^HZ_{k3}^H - 2e^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i6}^HZ_{j1}^HZ_{k3}^H \\
& - 2ie^{i(\eta+4\zeta)}l_{3p}v_1Z_{i3}^HZ_{j2}^HZ_{k3}^H - 2ie^{i(\eta+6\zeta)}l_{6p}v_1Z_{i3}^HZ_{j2}^HZ_{k3}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i3}^HZ_{j2}^HZ_{k3}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}v_2Z_{i3}^HZ_{j2}^HZ_{k3}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+3\zeta)} l_{5p} v_2 Z_{i3}^H Z_{j2}^H Z_{k3}^H - 2ie^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H \\
& -4ie^{2i(\eta+\zeta)} v_2 l_{5p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H - 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H \\
& -2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H - e^{i(\eta+5\zeta)} \mu_{12} Z_{i4}^H Z_{j2}^H Z_{k3}^H \\
& + e^{3i\eta+5i\zeta} \mu_{21} Z_{i4}^H Z_{j2}^H Z_{k3}^H - 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i4}^H Z_{j2}^H Z_{k3}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j2}^H Z_{k3}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i4}^H Z_{j2}^H Z_{k3}^H \\
& + 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H + 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H + e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i6}^H Z_{j2}^H Z_{k3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i6}^H Z_{j2}^H Z_{k3}^H + 4e^{2i(\eta+3\zeta)} l_{5p} v_2 Z_{i6}^H Z_{j2}^H Z_{k3}^H \\
& - 4e^{2i(\eta+\zeta)} v_2 l_{5p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H - 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H \\
& - 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H - 2ie^{2i\eta+7i\zeta} \mu_{s1} Z_{i3}^H Z_{j3}^H Z_{k3}^H \\
& - 6ie^{2i\eta+5i\zeta} \mu_{s2} Z_{i3}^H Z_{j3}^H Z_{k3}^H - 2ie^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i3}^H Z_{j3}^H Z_{k3}^H \\
& - 8ie^{2i(\eta+3\zeta)} l_{2pp} v_s Z_{i3}^H Z_{j3}^H Z_{k3}^H - 12ie^{2i(\eta+2\zeta)} l_{3pp} v_s Z_{i3}^H Z_{j3}^H Z_{k3}^H \\
& - 2ie^{2i\eta} v_s l_{1pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H - 8ie^{2i(\eta+\zeta)} v_s l_{2pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H \\
& - 2ie^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H - 6ie^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i4}^H Z_{j3}^H Z_{k3}^H - 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i4}^H Z_{j3}^H Z_{k3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i4}^H Z_{j3}^H Z_{k3}^H + 2e^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H \\
& + 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H - 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} v_1 Z_{i5}^H Z_{j3}^H Z_{k3}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i5}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i5}^H Z_{j3}^H Z_{k3}^H - 2e^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H + 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{2i\eta+7i\zeta}\mu_{s1}Z_{i6}^H Z_{j3}^H Z_{k3}^H + 2e^{2i\eta+5i\zeta}\mu_{s2}Z_{i6}^H Z_{j3}^H Z_{k3}^H \\
& + 2e^{2i(\eta+4\zeta)}l_{1pp}v_sZ_{i6}^H Z_{j3}^H Z_{k3}^H + 4e^{2i(\eta+3\zeta)}l_{2pp}v_sZ_{i6}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{2i\eta}v_sl_{1pp}^*Z_{i6}^H Z_{j3}^H Z_{k3}^H - 4e^{2i(\eta+\zeta)}v_sl_{2pp}^*Z_{i6}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{i(2\eta+\zeta)}\mu_{s1}^*Z_{i6}^H Z_{j3}^H Z_{k3}^H - 2e^{2i\eta+3i\zeta}\mu_{s2}^*Z_{i6}^H Z_{j3}^H Z_{k3}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}v_2Z_{i3}^H Z_{j4}^H Z_{k3}^H - 2e^{i(\eta+6\zeta)}l_{6p}v_2Z_{i3}^H Z_{j4}^H Z_{k3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i3}^H Z_{j4}^H Z_{k3}^H + 2e^{3i\eta+4i\zeta}v_2l_{3p}^*Z_{i3}^H Z_{j4}^H Z_{k3}^H \\
& + 2e^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i3}^H Z_{j4}^H Z_{k3}^H - 2e^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i3}^H Z_{j4}^H Z_{k3}^H \\
& - 2ie^{2i\eta+5i\zeta}\mu_{11}Z_{i4}^H Z_{j4}^H Z_{k3}^H - 4ie^{2i(\eta+2\zeta)}l_{1p}v_sZ_{i4}^H Z_{j4}^H Z_{k3}^H \\
& - 4ie^{2i(\eta+3\zeta)}l_{4p}v_sZ_{i4}^H Z_{j4}^H Z_{k3}^H - 4ie^{2i(\eta+\zeta)}v_sl_{4p}^*Z_{i4}^H Z_{j4}^H Z_{k3}^H \\
& - 2ie^{2i\eta+3i\zeta}\mu_{11}^*Z_{i4}^H Z_{j4}^H Z_{k3}^H - ie^{i(\eta+5\zeta)}\mu_{12}Z_{i5}^H Z_{j4}^H Z_{k3}^H \\
& - ie^{3i\eta+5i\zeta}\mu_{21}Z_{i5}^H Z_{j4}^H Z_{k3}^H - 2ie^{i(\eta+4\zeta)}l_{3p}v_sZ_{i5}^H Z_{j4}^H Z_{k3}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}v_sZ_{i5}^H Z_{j4}^H Z_{k3}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i5}^H Z_{j4}^H Z_{k3}^H \\
& - 2ie^{3i\eta+4i\zeta}v_sl_{3p}^*Z_{i5}^H Z_{j4}^H Z_{k3}^H - 2ie^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i5}^H Z_{j4}^H Z_{k3}^H \\
& - 2ie^{i(\eta+2\zeta)}v_sl_{7p}^*Z_{i5}^H Z_{j4}^H Z_{k3}^H - ie^{3i(\eta+\zeta)}\mu_{12}^*Z_{i5}^H Z_{j4}^H Z_{k3}^H \\
& - ie^{i(\eta+3\zeta)}\mu_{21}^*Z_{i5}^H Z_{j4}^H Z_{k3}^H - 2ie^{i(\eta+6\zeta)}l_{6p}v_2Z_{i6}^H Z_{j4}^H Z_{k3}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i6}^H Z_{j4}^H Z_{k3}^H - 2ie^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i6}^H Z_{j4}^H Z_{k3}^H \\
& + 2ie^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i6}^H Z_{j4}^H Z_{k3}^H + 2e^{i(\eta+4\zeta)}l_{3p}v_1Z_{i3}^H Z_{j5}^H Z_{k3}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}v_1Z_{i3}^H Z_{j5}^H Z_{k3}^H - 2e^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i3}^H Z_{j5}^H Z_{k3}^H \\
& - 2e^{3i\eta+4i\zeta}v_1l_{3p}^*Z_{i3}^H Z_{j5}^H Z_{k3}^H - 2e^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i3}^H Z_{j5}^H Z_{k3}^H \\
& + 2e^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i3}^H Z_{j5}^H Z_{k3}^H - ie^{i(\eta+5\zeta)}\mu_{12}Z_{i4}^H Z_{j5}^H Z_{k3}^H \\
& - ie^{3i\eta+5i\zeta}\mu_{21}Z_{i4}^H Z_{j5}^H Z_{k3}^H - 2ie^{i(\eta+4\zeta)}l_{3p}v_sZ_{i4}^H Z_{j5}^H Z_{k3}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j5}^H Z_{k3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i4}^H Z_{j5}^H Z_{k3}^H \\
& - 2ie^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H \\
& - 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H \\
& - ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H - 2ie^{2i\eta+5i\zeta} \mu_{22} Z_{i5}^H Z_{j5}^H Z_{k3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} v_s Z_{i5}^H Z_{j5}^H Z_{k3}^H - 4ie^{2i(\eta+3\zeta)} l_{5p} v_s Z_{i5}^H Z_{j5}^H Z_{k3}^H \\
& - 4ie^{2i(\eta+\zeta)} v_s l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k3}^H - 2ie^{2i\eta+3i\zeta} \mu_{22}^* Z_{i5}^H Z_{j5}^H Z_{k3}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i6}^H Z_{j5}^H Z_{k3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i6}^H Z_{j5}^H Z_{k3}^H \\
& + 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H - 2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H \\
& + 2e^{2i\eta+7i\zeta} \mu_{s1} Z_{i3}^H Z_{j6}^H Z_{k3}^H + 2e^{2i\eta+5i\zeta} \mu_{s2} Z_{i3}^H Z_{j6}^H Z_{k3}^H \\
& + 2e^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i3}^H Z_{j6}^H Z_{k3}^H + 4e^{2i(\eta+3\zeta)} l_{2pp} v_s Z_{i3}^H Z_{j6}^H Z_{k3}^H \\
& - 2e^{2i\eta} v_s l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H - 4e^{2i(\eta+\zeta)} v_s l_{2pp}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H \\
& - 2e^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H - 2e^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i4}^H Z_{j6}^H Z_{k3}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i4}^H Z_{j6}^H Z_{k3}^H \\
& - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k3}^H + 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k3}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i5}^H Z_{j6}^H Z_{k3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i5}^H Z_{j6}^H Z_{k3}^H \\
& + 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H - 2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H \\
& + 2ie^{2i\eta+7i\zeta} \mu_{s1} Z_{i6}^H Z_{j6}^H Z_{k3}^H - 2ie^{2i\eta+5i\zeta} \mu_{s2} Z_{i6}^H Z_{j6}^H Z_{k3}^H \\
& + 2ie^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i6}^H Z_{j6}^H Z_{k3}^H - 4ie^{2i(\eta+2\zeta)} l_{3pp} v_s Z_{i6}^H Z_{j6}^H Z_{k3}^H \\
& + 2ie^{2i\eta} v_s l_{1pp}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H + 2ie^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H \\
& - 2ie^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H - 2ie^{2i(\eta+2\zeta)} l_1 v_1 Z_{i4}^H Z_{j1}^H Z_{k4}^H \\
& - ie^{i(\eta+4\zeta)} l_6 v_2 Z_{i4}^H Z_{j1}^H Z_{k4}^H - ie^{3i\eta+4i\zeta} v_2 l_6^* Z_{i4}^H Z_{j1}^H Z_{k4}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{i(\eta+4\zeta)} l_6 v_1 Z_{i5}^H Z_{j1}^H Z_{k4}^H - ie^{4i\zeta} l_5 v_2 Z_{i5}^H Z_{j1}^H Z_{k4}^H \\
& - ie^{4i(\eta+\zeta)} v_2 l_5^* Z_{i5}^H Z_{j1}^H Z_{k4}^H - ie^{3i\eta+4i\zeta} v_1 l_6^* Z_{i5}^H Z_{j1}^H Z_{k4}^H \\
& - e^{i(\eta+5\zeta)} \mu_{12} Z_{i3}^H Z_{j2}^H Z_{k4}^H + e^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j2}^H Z_{k4}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i3}^H Z_{j2}^H Z_{k4}^H - 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i3}^H Z_{j2}^H Z_{k4}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j2}^H Z_{k4}^H + 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H \\
& + 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H \\
& + e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H \\
& - ie^{i(\eta+4\zeta)} l_6 v_1 Z_{i4}^H Z_{j2}^H Z_{k4}^H - 2ie^{2i(\eta+2\zeta)} l_3 v_2 Z_{i4}^H Z_{j2}^H Z_{k4}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_4 v_2 Z_{i4}^H Z_{j2}^H Z_{k4}^H + ie^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j2}^H Z_{k4}^H \\
& + ie^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j2}^H Z_{k4}^H - ie^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j2}^H Z_{k4}^H \\
& - ie^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j2}^H Z_{k4}^H - ie^{i(\eta+4\zeta)} l_7 v_2 Z_{i5}^H Z_{j2}^H Z_{k4}^H \\
& - ie^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j2}^H Z_{k4}^H - ie^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j2}^H Z_{k4}^H \\
& - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i6}^H Z_{j2}^H Z_{k4}^H + ie^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j2}^H Z_{k4}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i6}^H Z_{j2}^H Z_{k4}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j2}^H Z_{k4}^H \\
& - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H + 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H \\
& - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H + ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i3}^H Z_{j3}^H Z_{k4}^H - 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i3}^H Z_{j3}^H Z_{k4}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i3}^H Z_{j3}^H Z_{k4}^H + 2e^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k4}^H \\
& + 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k4}^H - 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k4}^H \\
& - 2ie^{2i\eta+5i\zeta} \mu_{11} Z_{i4}^H Z_{j3}^H Z_{k4}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} v_s Z_{i4}^H Z_{j3}^H Z_{k4}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i4}^H Z_{j3}^H Z_{k4}^H - 4ie^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i4}^H Z_{j3}^H Z_{k4}^H \\
& - 2ie^{2i\eta+3i\zeta} \mu_{11}^* Z_{i4}^H Z_{j3}^H Z_{k4}^H - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i5}^H Z_{j3}^H Z_{k4}^H \\
& - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i5}^H Z_{j3}^H Z_{k4}^H - 2ie^{i(\eta+4\zeta)} l_{3p} v_s Z_{i5}^H Z_{j3}^H Z_{k4}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i5}^H Z_{j3}^H Z_{k4}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i5}^H Z_{j3}^H Z_{k4}^H \\
& - 2ie^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H \\
& - 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H \\
& - ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i6}^H Z_{j3}^H Z_{k4}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i6}^H Z_{j3}^H Z_{k4}^H - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k4}^H \\
& + 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k4}^H - 2ie^{2i\eta+5i\zeta} \mu_{11} Z_{i3}^H Z_{j4}^H Z_{k4}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} v_s Z_{i3}^H Z_{j4}^H Z_{k4}^H - 4ie^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i3}^H Z_{j4}^H Z_{k4}^H \\
& - 4ie^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i3}^H Z_{j4}^H Z_{k4}^H - 2ie^{2i\eta+3i\zeta} \mu_{11}^* Z_{i3}^H Z_{j4}^H Z_{k4}^H \\
& - 3e^{i(\eta+4\zeta)} l_6 v_2 Z_{i4}^H Z_{j4}^H Z_{k4}^H + 3e^{3i\eta+4i\zeta} v_2 l_6^* Z_{i4}^H Z_{j4}^H Z_{k4}^H \\
& + e^{i(\eta+4\zeta)} l_6 v_1 Z_{i5}^H Z_{j4}^H Z_{k4}^H - e^{4i\zeta} l_5 v_2 Z_{i5}^H Z_{j4}^H Z_{k4}^H \\
& + e^{4i(\eta+\zeta)} v_2 l_5^* Z_{i5}^H Z_{j4}^H Z_{k4}^H - e^{3i\eta+4i\zeta} v_1 l_6^* Z_{i5}^H Z_{j4}^H Z_{k4}^H \\
& + 2e^{2i\eta+5i\zeta} \mu_{11} Z_{i6}^H Z_{j4}^H Z_{k4}^H + 4e^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i6}^H Z_{j4}^H Z_{k4}^H \\
& - 4e^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i6}^H Z_{j4}^H Z_{k4}^H - 2e^{2i\eta+3i\zeta} \mu_{11}^* Z_{i6}^H Z_{j4}^H Z_{k4}^H \\
& - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i3}^H Z_{j5}^H Z_{k4}^H - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j5}^H Z_{k4}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} v_s Z_{i3}^H Z_{j5}^H Z_{k4}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i3}^H Z_{j5}^H Z_{k4}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j5}^H Z_{k4}^H - 2ie^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H \\
& - 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H - 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H \\
& - ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H - ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H
\end{aligned}$$

$$\begin{aligned}
& + e^{i(\eta+4\zeta)} l_6 v_1 Z_{i4}^H Z_{j5}^H Z_{k4}^H - e^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j5}^H Z_{k4}^H \\
& + e^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j5}^H Z_{k4}^H - e^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j5}^H Z_{k4}^H \\
& + e^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j5}^H Z_{k4}^H - e^{i(\eta+4\zeta)} l_7 v_2 Z_{i5}^H Z_{j5}^H Z_{k4}^H \\
& - e^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j5}^H Z_{k4}^H + e^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j5}^H Z_{k4}^H \\
& + e^{i(\eta+5\zeta)} \mu_{12} Z_{i6}^H Z_{j5}^H Z_{k4}^H + e^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j5}^H Z_{k4}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i6}^H Z_{j5}^H Z_{k4}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j5}^H Z_{k4}^H - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i3}^H Z_{j6}^H Z_{k4}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i3}^H Z_{j6}^H Z_{k4}^H - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k4}^H \\
& + 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k4}^H + 2e^{2i\eta+5i\zeta} \mu_{11} Z_{i4}^H Z_{j6}^H Z_{k4}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i4}^H Z_{j6}^H Z_{k4}^H - 4e^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i4}^H Z_{j6}^H Z_{k4}^H \\
& - 2e^{2i\eta+3i\zeta} \mu_{11}^* Z_{i4}^H Z_{j6}^H Z_{k4}^H + e^{i(\eta+5\zeta)} \mu_{12} Z_{i5}^H Z_{j6}^H Z_{k4}^H + e^{3i\eta+5i\zeta} \mu_{21} Z_{i5}^H Z_{j6}^H Z_{k4}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i5}^H Z_{j6}^H Z_{k4}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i5}^H Z_{j6}^H Z_{k4}^H \\
& - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H \\
& - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i6}^H Z_{j6}^H Z_{k4}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i6}^H Z_{j6}^H Z_{k4}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i6}^H Z_{j6}^H Z_{k4}^H + 2e^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k4}^H \\
& - 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k4}^H + 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k4}^H \\
& + e^{i(\eta+5\zeta)} \mu_{12} Z_{i3}^H Z_{j1}^H Z_{k5}^H - e^{3i\eta+5i\zeta} \mu_{21} Z_{i3}^H Z_{j1}^H Z_{k5}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} v_s Z_{i3}^H Z_{j1}^H Z_{k5}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i3}^H Z_{j1}^H Z_{k5}^H
\end{aligned}$$

$$\begin{aligned}
& -2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i3}^H Z_{j1}^H Z_{k5}^H - 2e^{3i\eta+4i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H \\
& - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H + 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H \\
& - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H + e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H \\
& - ie^{i(\eta+4\zeta)} l_6 v_1 Z_{i4}^H Z_{j1}^H Z_{k5}^H - ie^{4i\zeta} l_5 v_2 Z_{i4}^H Z_{j1}^H Z_{k5}^H \\
& - ie^{4i(\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j1}^H Z_{k5}^H - ie^{3i\eta+4i\zeta} v_1 l_6^* Z_{i4}^H Z_{j1}^H Z_{k5}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_3 v_1 Z_{i5}^H Z_{j1}^H Z_{k5}^H - 2ie^{2i(\eta+2\zeta)} l_4 v_1 Z_{i5}^H Z_{j1}^H Z_{k5}^H \\
& + ie^{4i\zeta} l_5 v_1 Z_{i5}^H Z_{j1}^H Z_{k5}^H - ie^{i(\eta+4\zeta)} l_7 v_2 Z_{i5}^H Z_{j1}^H Z_{k5}^H \\
& + ie^{4i(\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j1}^H Z_{k5}^H - ie^{3i\eta+4i\zeta} v_2 l_7^* Z_{i5}^H Z_{j1}^H Z_{k5}^H \\
& + ie^{i(\eta+5\zeta)} \mu_{12} Z_{i6}^H Z_{j1}^H Z_{k5}^H - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i6}^H Z_{j1}^H Z_{k5}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i6}^H Z_{j1}^H Z_{k5}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i6}^H Z_{j1}^H Z_{k5}^H \\
& + 2ie^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H - 2ie^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H \\
& + ie^{3i(\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H - ie^{i(\eta+3\zeta)} \mu_{21}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H - ie^{4i\zeta} l_5 v_1 Z_{i4}^H Z_{j2}^H Z_{k5}^H \\
& - ie^{i(\eta+4\zeta)} l_7 v_2 Z_{i4}^H Z_{j2}^H Z_{k5}^H - ie^{4i(\eta+\zeta)} v_1 l_5^* Z_{i4}^H Z_{j2}^H Z_{k5}^H \\
& - ie^{3i\eta+4i\zeta} v_2 l_7^* Z_{i4}^H Z_{j2}^H Z_{k5}^H - ie^{i(\eta+4\zeta)} l_7 v_1 Z_{i5}^H Z_{j2}^H Z_{k5}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_2 v_2 Z_{i5}^H Z_{j2}^H Z_{k5}^H - ie^{3i\eta+4i\zeta} v_1 l_7^* Z_{i5}^H Z_{j2}^H Z_{k5}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} v_1 Z_{i3}^H Z_{j3}^H Z_{k5}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i3}^H Z_{j3}^H Z_{k5}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i3}^H Z_{j3}^H Z_{k5}^H - 2e^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H \\
& - 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H + 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H \\
& - ie^{i(\eta+5\zeta)} \mu_{12} Z_{i4}^H Z_{j3}^H Z_{k5}^H - ie^{3i\eta+5i\zeta} \mu_{21} Z_{i4}^H Z_{j3}^H Z_{k5}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} v_s Z_{i4}^H Z_{j3}^H Z_{k5}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j3}^H Z_{k5}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{3i\left(\eta+2\zeta\right)}l_{7p}v_sZ_{i4}^HZ_{j3}^HZ_{k5}^H-2ie^{3i\eta+4i\zeta}v_sl_{3p}^*Z_{i4}^HZ_{j3}^HZ_{k5}^H \\
& -2ie^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i4}^HZ_{j3}^HZ_{k5}^H-2ie^{i\left(\eta+2\zeta\right)}v_sl_{7p}^*Z_{i4}^HZ_{j3}^HZ_{k5}^H \\
& -ie^{3i\left(\eta+\zeta\right)}\mu_{12}^*Z_{i4}^HZ_{j3}^HZ_{k5}^H-ie^{i\left(\eta+3\zeta\right)}\mu_{21}^*Z_{i4}^HZ_{j3}^HZ_{k5}^H \\
& -2ie^{2i\eta+5i\zeta}\mu_{22}Z_{i5}^HZ_{j3}^HZ_{k5}^H-4ie^{2i\left(\eta+2\zeta\right)}l_{2p}v_sZ_{i5}^HZ_{j3}^HZ_{k5}^H \\
& -4ie^{2i\left(\eta+3\zeta\right)}l_{5p}v_sZ_{i5}^HZ_{j3}^HZ_{k5}^H-4ie^{2i\left(\eta+\zeta\right)}v_sl_{5p}^*Z_{i5}^HZ_{j3}^HZ_{k5}^H \\
& -2ie^{2i\eta+3i\zeta}\mu_{22}^*Z_{i5}^HZ_{j3}^HZ_{k5}^H+2ie^{i\left(\eta+6\zeta\right)}l_{6p}v_1Z_{i6}^HZ_{j3}^HZ_{k5}^H \\
& -2ie^{3i\left(\eta+2\zeta\right)}l_{7p}v_1Z_{i6}^HZ_{j3}^HZ_{k5}^H+2ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k5}^H \\
& -2ie^{i\left(\eta+2\zeta\right)}v_1l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k5}^H-ie^{i\left(\eta+5\zeta\right)}\mu_{12}Z_{i3}^HZ_{j4}^HZ_{k5}^H \\
& -ie^{3i\eta+5i\zeta}\mu_{21}Z_{i3}^HZ_{j4}^HZ_{k5}^H-2ie^{i\left(\eta+4\zeta\right)}l_{3p}v_sZ_{i3}^HZ_{j4}^HZ_{k5}^H \\
& -2ie^{i\left(\eta+6\zeta\right)}l_{6p}v_sZ_{i3}^HZ_{j4}^HZ_{k5}^H-2ie^{3i\left(\eta+2\zeta\right)}l_{7p}v_sZ_{i3}^HZ_{j4}^HZ_{k5}^H \\
& -2ie^{3i\eta+4i\zeta}v_sl_{3p}^*Z_{i3}^HZ_{j4}^HZ_{k5}^H-2ie^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i3}^HZ_{j4}^HZ_{k5}^H \\
& -2ie^{i\left(\eta+2\zeta\right)}v_sl_{7p}^*Z_{i3}^HZ_{j4}^HZ_{k5}^H-ie^{3i\left(\eta+\zeta\right)}\mu_{12}^*Z_{i3}^HZ_{j4}^HZ_{k5}^H \\
& -ie^{i\left(\eta+3\zeta\right)}\mu_{21}^*Z_{i3}^HZ_{j4}^HZ_{k5}^H+e^{i\left(\eta+4\zeta\right)}l_6v_1Z_{i4}^HZ_{j4}^HZ_{k5}^H \\
& -e^{4i\zeta}l_5v_2Z_{i4}^HZ_{j4}^HZ_{k5}^H+e^{4i\left(\eta+\zeta\right)}v_2l_5^*Z_{i4}^HZ_{j4}^HZ_{k5}^H \\
& -e^{3i\eta+4i\zeta}v_1l_6^*Z_{i4}^HZ_{j4}^HZ_{k5}^H+e^{4i\zeta}l_5v_1Z_{i5}^HZ_{j4}^HZ_{k5}^H \\
& -e^{i\left(\eta+4\zeta\right)}l_7v_2Z_{i5}^HZ_{j4}^HZ_{k5}^H-e^{4i\left(\eta+\zeta\right)}v_1l_5^*Z_{i5}^HZ_{j4}^HZ_{k5}^H \\
& +e^{3i\eta+4i\zeta}v_2l_7^*Z_{i5}^HZ_{j4}^HZ_{k5}^H+e^{i\left(\eta+5\zeta\right)}\mu_{12}Z_{i6}^HZ_{j4}^HZ_{k5}^H+e^{3i\eta+5i\zeta}\mu_{21}Z_{i6}^HZ_{j4}^HZ_{k5}^H \\
& +2e^{i\left(\eta+6\zeta\right)}l_{6p}v_sZ_{i6}^HZ_{j4}^HZ_{k5}^H+2e^{3i\left(\eta+2\zeta\right)}l_{7p}v_sZ_{i6}^HZ_{j4}^HZ_{k5}^H \\
& -2e^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i6}^HZ_{j4}^HZ_{k5}^H-2e^{i\left(\eta+2\zeta\right)}v_sl_{7p}^*Z_{i6}^HZ_{j4}^HZ_{k5}^H \\
& -e^{3i\left(\eta+\zeta\right)}\mu_{12}^*Z_{i6}^HZ_{j4}^HZ_{k5}^H-e^{i\left(\eta+3\zeta\right)}\mu_{21}^*Z_{i6}^HZ_{j4}^HZ_{k5}^H \\
& -2ie^{2i\eta+5i\zeta}\mu_{22}Z_{i3}^HZ_{j5}^HZ_{k5}^H-4ie^{2i\left(\eta+2\zeta\right)}l_{2p}v_sZ_{i3}^HZ_{j5}^HZ_{k5}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+3\zeta)}l_{5p}v_sZ_{i3}^HZ_{j5}^HZ_{k5}^H - 4ie^{2i(\eta+\zeta)}v_sl_{5p}^*Z_{i3}^HZ_{j5}^HZ_{k5}^H \\
& - 2ie^{2i\eta+3i\zeta}\mu_{22}^*Z_{i3}^HZ_{j5}^HZ_{k5}^H + e^{4i\zeta}l_5v_1Z_{i4}^HZ_{j5}^HZ_{k5}^H \\
& - e^{i(\eta+4\zeta)}l_7v_2Z_{i4}^HZ_{j5}^HZ_{k5}^H - e^{4i(\eta+\zeta)}v_1l_5^*Z_{i4}^HZ_{j5}^HZ_{k5}^H \\
& + e^{3i\eta+4i\zeta}v_2l_7^*Z_{i4}^HZ_{j5}^HZ_{k5}^H + 3e^{i(\eta+4\zeta)}l_7v_1Z_{i5}^HZ_{j5}^HZ_{k5}^H \\
& - 3e^{3i\eta+4i\zeta}v_1l_7^*Z_{i5}^HZ_{j5}^HZ_{k5}^H + 2e^{2i\eta+5i\zeta}\mu_{22}Z_{i6}^HZ_{j5}^HZ_{k5}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}v_sZ_{i6}^HZ_{j5}^HZ_{k5}^H - 4e^{2i(\eta+\zeta)}v_sl_{5p}^*Z_{i6}^HZ_{j5}^HZ_{k5}^H \\
& - 2e^{2i\eta+3i\zeta}\mu_{22}^*Z_{i6}^HZ_{j5}^HZ_{k5}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_1Z_{i3}^HZ_{j6}^HZ_{k5}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i3}^HZ_{j6}^HZ_{k5}^H + 2ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k5}^H \\
& - 2ie^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k5}^H + e^{i(\eta+5\zeta)}\mu_{12}Z_{i4}^HZ_{j6}^HZ_{k5}^H \\
& + e^{3i\eta+5i\zeta}\mu_{21}Z_{i4}^HZ_{j6}^HZ_{k5}^H + 2e^{i(\eta+6\zeta)}l_{6p}v_sZ_{i4}^HZ_{j6}^HZ_{k5}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i4}^HZ_{j6}^HZ_{k5}^H - 2e^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i4}^HZ_{j6}^HZ_{k5}^H \\
& - 2e^{i(\eta+2\zeta)}v_sl_{7p}^*Z_{i4}^HZ_{j6}^HZ_{k5}^H - e^{3i(\eta+\zeta)}\mu_{12}^*Z_{i4}^HZ_{j6}^HZ_{k5}^H \\
& - e^{i(\eta+3\zeta)}\mu_{21}^*Z_{i4}^HZ_{j6}^HZ_{k5}^H + 2e^{2i\eta+5i\zeta}\mu_{22}Z_{i5}^HZ_{j6}^HZ_{k5}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}v_sZ_{i5}^HZ_{j6}^HZ_{k5}^H - 4e^{2i(\eta+\zeta)}v_sl_{5p}^*Z_{i5}^HZ_{j6}^HZ_{k5}^H \\
& - 2e^{2i\eta+3i\zeta}\mu_{22}^*Z_{i5}^HZ_{j6}^HZ_{k5}^H + 2e^{i(\eta+4\zeta)}l_{3p}v_1Z_{i6}^HZ_{j6}^HZ_{k5}^H \\
& - 2e^{i(\eta+6\zeta)}l_{6p}v_1Z_{i6}^HZ_{j6}^HZ_{k5}^H + 2e^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i6}^HZ_{j6}^HZ_{k5}^H \\
& - 2e^{3i\eta+4i\zeta}v_1l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^H + 2e^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^H \\
& - 2e^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^H + 4e^{2i(\eta+3\zeta)}l_{4p}v_1Z_{i3}^HZ_{j1}^HZ_{k6}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}v_2Z_{i3}^HZ_{j1}^HZ_{k6}^H + 2e^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i3}^HZ_{j1}^HZ_{k6}^H \\
& - 4e^{2i(\eta+\zeta)}v_1l_{4p}^*Z_{i3}^HZ_{j1}^HZ_{k6}^H - 2e^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i3}^HZ_{j1}^HZ_{k6}^H \\
& - 2e^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i3}^HZ_{j1}^HZ_{k6}^H + ie^{i(\eta+5\zeta)}\mu_{12}Z_{i5}^HZ_{j1}^HZ_{k6}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{3i\eta+5i\zeta}\mu_{21}Z_{i5}^HZ_{j1}^HZ_{k6}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_sZ_{i5}^HZ_{j1}^HZ_{k6}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i5}^HZ_{j1}^HZ_{k6}^H + 2ie^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i5}^HZ_{j1}^HZ_{k6}^H \\
& - 2ie^{i(\eta+2\zeta)}v_sl_{7p}^*Z_{i5}^HZ_{j1}^HZ_{k6}^H + ie^{3i(\eta+\zeta)}\mu_{12}^*Z_{i5}^HZ_{j1}^HZ_{k6}^H \\
& - ie^{i(\eta+3\zeta)}\mu_{21}^*Z_{i5}^HZ_{j1}^HZ_{k6}^H - 4ie^{2i(\eta+2\zeta)}l_{1p}v_1Z_{i6}^HZ_{j1}^HZ_{k6}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{4p}v_1Z_{i6}^HZ_{j1}^HZ_{k6}^H - 2ie^{i(\eta+4\zeta)}l_{3p}v_2Z_{i6}^HZ_{j1}^HZ_{k6}^H \\
& + 2ie^{i(\eta+6\zeta)}l_{6p}v_2Z_{i6}^HZ_{j1}^HZ_{k6}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}v_2Z_{i6}^HZ_{j1}^HZ_{k6}^H \\
& - 2ie^{3i\eta+4i\zeta}v_2l_{3p}^*Z_{i6}^HZ_{j1}^HZ_{k6}^H + 4ie^{2i(\eta+\zeta)}v_1l_{4p}^*Z_{i6}^HZ_{j1}^HZ_{k6}^H \\
& + 2ie^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{i6}^HZ_{j1}^HZ_{k6}^H + 2ie^{i(\eta+2\zeta)}v_2l_{7p}^*Z_{i6}^HZ_{j1}^HZ_{k6}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}v_1Z_{i3}^HZ_{j2}^HZ_{k6}^H + 2e^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i3}^HZ_{j2}^HZ_{k6}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}v_2Z_{i3}^HZ_{j2}^HZ_{k6}^H - 4e^{2i(\eta+\zeta)}v_2l_{5p}^*Z_{i3}^HZ_{j2}^HZ_{k6}^H \\
& - 2e^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i3}^HZ_{j2}^HZ_{k6}^H - 2e^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i3}^HZ_{j2}^HZ_{k6}^H \\
& - ie^{i(\eta+5\zeta)}\mu_{12}Z_{i4}^HZ_{j2}^HZ_{k6}^H + ie^{3i\eta+5i\zeta}\mu_{21}Z_{i4}^HZ_{j2}^HZ_{k6}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}v_sZ_{i4}^HZ_{j2}^HZ_{k6}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}v_sZ_{i4}^HZ_{j2}^HZ_{k6}^H \\
& - 2ie^{3i\eta+2i\zeta}v_sl_{6p}^*Z_{i4}^HZ_{j2}^HZ_{k6}^H + 2ie^{i(\eta+2\zeta)}v_sl_{7p}^*Z_{i4}^HZ_{j2}^HZ_{k6}^H \\
& - ie^{3i(\eta+\zeta)}\mu_{12}^*Z_{i4}^HZ_{j2}^HZ_{k6}^H + ie^{i(\eta+3\zeta)}\mu_{21}^*Z_{i4}^HZ_{j2}^HZ_{k6}^H \\
& - 2ie^{i(\eta+4\zeta)}l_{3p}v_1Z_{i6}^HZ_{j2}^HZ_{k6}^H + 2ie^{i(\eta+6\zeta)}l_{6p}v_1Z_{i6}^HZ_{j2}^HZ_{k6}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}v_1Z_{i6}^HZ_{j2}^HZ_{k6}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}v_2Z_{i6}^HZ_{j2}^HZ_{k6}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{5p}v_2Z_{i6}^HZ_{j2}^HZ_{k6}^H - 2ie^{3i\eta+4i\zeta}v_1l_{3p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^H \\
& + 4ie^{2i(\eta+\zeta)}v_2l_{5p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^H + 2ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^H \\
& + 2ie^{i(\eta+2\zeta)}v_1l_{7p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^H + 2e^{2i\eta+7i\zeta}\mu_{s1}Z_{i3}^HZ_{j3}^HZ_{k6}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{2i\eta+5i\zeta} \mu_{s2} Z_{i3}^H Z_{j3}^H Z_{k6}^H + 2e^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i3}^H Z_{j3}^H Z_{k6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{2pp} v_s Z_{i3}^H Z_{j3}^H Z_{k6}^H - 2e^{2i\eta} v_s l_{1pp}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H \\
& - 4e^{2i(\eta+\zeta)} v_s l_{2pp}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H - 2e^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H \\
& - 2e^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i4}^H Z_{j3}^H Z_{k6}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i4}^H Z_{j3}^H Z_{k6}^H - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H \\
& + 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i5}^H Z_{j3}^H Z_{k6}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i5}^H Z_{j3}^H Z_{k6}^H + 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k6}^H \\
& - 2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k6}^H + 2ie^{2i\eta+7i\zeta} \mu_{s1} Z_{i6}^H Z_{j3}^H Z_{k6}^H \\
& - 2ie^{2i\eta+5i\zeta} \mu_{s2} Z_{i6}^H Z_{j3}^H Z_{k6}^H + 2ie^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i6}^H Z_{j3}^H Z_{k6}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{3pp} v_s Z_{i6}^H Z_{j3}^H Z_{k6}^H + 2ie^{2i\eta} v_s l_{1pp}^* Z_{i6}^H Z_{j3}^H Z_{k6}^H \\
& + 2ie^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i6}^H Z_{j3}^H Z_{k6}^H - 2ie^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i6}^H Z_{j3}^H Z_{k6}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i3}^H Z_{j4}^H Z_{k6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i3}^H Z_{j4}^H Z_{k6}^H \\
& - 2ie^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H + 2ie^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H \\
& + 2e^{2i\eta+5i\zeta} \mu_{11} Z_{i4}^H Z_{j4}^H Z_{k6}^H + 4e^{2i(\eta+3\zeta)} l_{4p} v_s Z_{i4}^H Z_{j4}^H Z_{k6}^H \\
& - 4e^{2i(\eta+\zeta)} v_s l_{4p}^* Z_{i4}^H Z_{j4}^H Z_{k6}^H - 2e^{2i\eta+3i\zeta} \mu_{11}^* Z_{i4}^H Z_{j4}^H Z_{k6}^H \\
& + e^{i(\eta+5\zeta)} \mu_{12} Z_{i5}^H Z_{j4}^H Z_{k6}^H + e^{3i\eta+5i\zeta} \mu_{21} Z_{i5}^H Z_{j4}^H Z_{k6}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i5}^H Z_{j4}^H Z_{k6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i5}^H Z_{j4}^H Z_{k6}^H - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H - 2e^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i6}^H Z_{j4}^H Z_{k6}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i6}^H Z_{j4}^H Z_{k6}^H - 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i6}^H Z_{j4}^H Z_{k6}^H \\
& + 2e^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H - 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i3}^H Z_{j5}^H Z_{k6}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i3}^H Z_{j5}^H Z_{k6}^H + 2ie^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k6}^H \\
& - 2ie^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k6}^H + e^{i(\eta+5\zeta)} \mu_{12} Z_{i4}^H Z_{j5}^H Z_{k6}^H \\
& + e^{3i\eta+5i\zeta} \mu_{21} Z_{i4}^H Z_{j5}^H Z_{k6}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_s Z_{i4}^H Z_{j5}^H Z_{k6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_s Z_{i4}^H Z_{j5}^H Z_{k6}^H - 2e^{3i\eta+2i\zeta} v_s l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H \\
& - 2e^{i(\eta+2\zeta)} v_s l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H - e^{3i(\eta+\zeta)} \mu_{12}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H \\
& - e^{i(\eta+3\zeta)} \mu_{21}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H + 2e^{2i\eta+5i\zeta} \mu_{22} Z_{i5}^H Z_{j5}^H Z_{k6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} v_s Z_{i5}^H Z_{j5}^H Z_{k6}^H - 4e^{2i(\eta+\zeta)} v_s l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k6}^H \\
& - 2e^{2i\eta+3i\zeta} \mu_{22}^* Z_{i5}^H Z_{j5}^H Z_{k6}^H + 2e^{i(\eta+4\zeta)} l_{3p} v_1 Z_{i6}^H Z_{j5}^H Z_{k6}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i6}^H Z_{j5}^H Z_{k6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i6}^H Z_{j5}^H Z_{k6}^H \\
& - 2e^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H + 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H \\
& - 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H + 2ie^{2i\eta+7i\zeta} \mu_{s1} Z_{i3}^H Z_{j6}^H Z_{k6}^H \\
& - 2ie^{2i\eta+5i\zeta} \mu_{s2} Z_{i3}^H Z_{j6}^H Z_{k6}^H + 2ie^{2i(\eta+4\zeta)} l_{1pp} v_s Z_{i3}^H Z_{j6}^H Z_{k6}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{3pp} v_s Z_{i3}^H Z_{j6}^H Z_{k6}^H + 2ie^{2i\eta} v_s l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H \\
& + 2ie^{i(2\eta+\zeta)} \mu_{s1}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H - 2ie^{2i\eta+3i\zeta} \mu_{s2}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} v_2 Z_{i4}^H Z_{j6}^H Z_{k6}^H + 2e^{i(\eta+6\zeta)} l_{6p} v_2 Z_{i4}^H Z_{j6}^H Z_{k6}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} v_2 Z_{i4}^H Z_{j6}^H Z_{k6}^H + 2e^{3i\eta+4i\zeta} v_2 l_{3p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H \\
& - 2e^{3i\eta+2i\zeta} v_2 l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H + 2e^{i(\eta+2\zeta)} v_2 l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} v_1 Z_{i5}^H Z_{j6}^H Z_{k6}^H - 2e^{i(\eta+6\zeta)} l_{6p} v_1 Z_{i5}^H Z_{j6}^H Z_{k6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} v_1 Z_{i5}^H Z_{j6}^H Z_{k6}^H - 2e^{3i\eta+4i\zeta} v_1 l_{3p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H \\
& + 2e^{3i\eta+2i\zeta} v_1 l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H - 2e^{i(\eta+2\zeta)} v_1 l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H
\end{aligned}$$

$$\begin{aligned}
& -2e^{2i\eta+7i\zeta}\mu_{s1}Z_{i6}^HZ_{j6}^HZ_{k6}^H+6e^{2i\eta+5i\zeta}\mu_{s2}Z_{i6}^HZ_{j6}^HZ_{k6}^H \\
& -2e^{2i\left(\eta+4\zeta\right)}l_{1pp}v_sZ_{i6}^HZ_{j6}^HZ_{k6}^H+4e^{2i\left(\eta+3\zeta\right)}l_{2pp}v_sZ_{i6}^HZ_{j6}^HZ_{k6}^H \\
& +2e^{2i\eta}v_sl_{1pp}^*Z_{i6}^HZ_{j6}^HZ_{k6}^H-4e^{2i\left(\eta+\zeta\right)}v_sl_{2pp}^*Z_{i6}^HZ_{j6}^HZ_{k6}^H \\
& +2e^{i\left(2\eta+\zeta\right)}\mu_{s1}^*Z_{i6}^HZ_{j6}^HZ_{k6}^H-6e^{2i\eta+3i\zeta}\mu_{s2}^*Z_{i6}^HZ_{j6}^HZ_{k6}^H \\
& +e^{2i\zeta}Z_{i1}^H\left(-2ie^{2i\eta+3i\zeta}\mu_{11}Z_{j3}^HZ_{k1}^H-4ie^{2i\left(\eta+\zeta\right)}l_{1p}v_sZ_{j3}^HZ_{k1}^H-4ie^{2i\left(\eta+2\zeta\right)}l_{4p}v_sZ_{j3}^HZ_{k1}^H\right. \\
& -4ie^{2i\eta}v_sl_{4p}^*Z_{j3}^HZ_{k1}^H-2ie^{i\left(2\eta+\zeta\right)}\mu_{11}^*Z_{j3}^HZ_{k1}^H-e^{i\left(\eta+2\zeta\right)}l_6v_2Z_{j4}^HZ_{k1}^H \\
& +e^{3i\eta+2i\zeta}v_2l_6^*Z_{j4}^HZ_{k1}^H+3e^{i\left(\eta+2\zeta\right)}l_6v_1Z_{j5}^HZ_{k1}^H+e^{2i\zeta}l_5v_2Z_{j5}^HZ_{k1}^H \\
& -e^{2i\left(2\eta+\zeta\right)}v_2l_5^*Z_{j5}^HZ_{k1}^H-3e^{3i\eta+2i\zeta}v_1l_6^*Z_{j5}^HZ_{k1}^H+2e^{2i\eta+3i\zeta}\mu_{11}Z_{j6}^HZ_{k1}^H \\
& +4e^{2i\left(\eta+2\zeta\right)}l_{4p}v_sZ_{j6}^HZ_{k1}^H-4e^{2i\eta}v_sl_{4p}^*Z_{j6}^HZ_{k1}^H-2e^{i\left(2\eta+\zeta\right)}\mu_{11}^*Z_{j6}^HZ_{k1}^H \\
& -ie^{i\left(\eta+3\zeta\right)}\mu_{12}Z_{j3}^HZ_{k2}^H-ie^{3i\left(\eta+\zeta\right)}\mu_{21}Z_{j3}^HZ_{k2}^H-2ie^{i\left(\eta+2\zeta\right)}l_{3p}v_sZ_{j3}^HZ_{k2}^H \\
& -2ie^{i\left(\eta+4\zeta\right)}l_{6p}v_sZ_{j3}^HZ_{k2}^H-2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j3}^HZ_{k2}^H-2ie^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{j3}^HZ_{k2}^H \\
& -2ie^{3i\eta}v_sl_{6p}^*Z_{j3}^HZ_{k2}^H-2ie^{i\eta}v_sl_{7p}^*Z_{j3}^HZ_{k2}^H-ie^{i\left(3\eta+\zeta\right)}\mu_{12}^*Z_{j3}^HZ_{k2}^H \\
& -ie^{i\left(\eta+\zeta\right)}\mu_{21}^*Z_{j3}^HZ_{k2}^H-e^{i\left(\eta+2\zeta\right)}l_6v_1Z_{j4}^HZ_{k2}^H-e^{2i\zeta}l_5v_2Z_{j4}^HZ_{k2}^H \\
& +e^{2i\left(2\eta+\zeta\right)}v_2l_5^*Z_{j4}^HZ_{k2}^H+e^{3i\eta+2i\zeta}v_1l_6^*Z_{j4}^HZ_{k2}^H+e^{2i\zeta}l_5v_1Z_{j5}^HZ_{k2}^H \\
& +e^{i\left(\eta+2\zeta\right)}l_7v_2Z_{j5}^HZ_{k2}^H-e^{2i\left(2\eta+\zeta\right)}v_1l_5^*Z_{j5}^HZ_{k2}^H-e^{3i\eta+2i\zeta}v_2l_7^*Z_{j5}^HZ_{k2}^H \\
& +e^{i\left(\eta+3\zeta\right)}\mu_{12}Z_{j6}^HZ_{k2}^H+e^{3i\left(\eta+\zeta\right)}\mu_{21}Z_{j6}^HZ_{k2}^H+2e^{i\left(\eta+4\zeta\right)}l_{6p}v_sZ_{j6}^HZ_{k2}^H \\
& +2e^{3i\eta+4i\zeta}l_{7p}v_sZ_{j6}^HZ_{k2}^H-2e^{3i\eta}v_sl_{6p}^*Z_{j6}^HZ_{k2}^H-2e^{i\eta}v_sl_{7p}^*Z_{j6}^HZ_{k2}^H \\
& -e^{i\left(3\eta+\zeta\right)}\mu_{12}^*Z_{j6}^HZ_{k2}^H-e^{i\left(\eta+\zeta\right)}\mu_{21}^*Z_{j6}^HZ_{k2}^H-4ie^{2i\left(\eta+\zeta\right)}l_{1p}v_1Z_{j3}^HZ_{k3}^H \\
& -4ie^{2i\left(\eta+2\zeta\right)}l_{4p}v_1Z_{j3}^HZ_{k3}^H-2ie^{i\left(\eta+2\zeta\right)}l_{3p}v_2Z_{j3}^HZ_{k3}^H-2ie^{i\left(\eta+4\zeta\right)}l_{6p}v_2Z_{j3}^HZ_{k3}^H \\
& -2ie^{3i\eta+4i\zeta}l_{7p}v_2Z_{j3}^HZ_{k3}^H-2ie^{3i\eta+2i\zeta}v_2l_{3p}^*Z_{j3}^HZ_{k3}^H-4ie^{2i\eta}v_1l_{4p}^*Z_{j3}^HZ_{k3}^H \\
& -2ie^{3i\eta}v_2l_{6p}^*Z_{j3}^HZ_{k3}^H-2ie^{i\eta}v_2l_{7p}^*Z_{j3}^HZ_{k3}^H+e^{i\left(\eta+3\zeta\right)}\mu_{12}Z_{j5}^HZ_{k3}^H
\end{aligned}$$

$$\begin{aligned}
& -e^{3i(\eta+\zeta)}\mu_{21}Z_{j5}^HZ_{k3}^H + 2e^{i(\eta+2\zeta)}l_{3p}v_sZ_{j5}^HZ_{k3}^H + 2e^{i(\eta+4\zeta)}l_{6p}v_sZ_{j5}^HZ_{k3}^H \\
& - 2e^{3i\eta+4i\zeta}l_{7p}v_sZ_{j5}^HZ_{k3}^H - 2e^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{j5}^HZ_{k3}^H - 2e^{3i\eta}v_sl_{6p}^*Z_{j5}^HZ_{k3}^H \\
& + 2e^{i\eta}v_sl_{7p}^*Z_{j5}^HZ_{k3}^H - e^{i(3\eta+\zeta)}\mu_{12}^*Z_{j5}^HZ_{k3}^H + e^{i(\eta+\zeta)}\mu_{21}^*Z_{j5}^HZ_{k3}^H \\
& + 4e^{2i(\eta+2\zeta)}l_{4p}v_1Z_{j6}^HZ_{k3}^H + 2e^{i(\eta+4\zeta)}l_{6p}v_2Z_{j6}^HZ_{k3}^H + 2e^{3i\eta+4i\zeta}l_{7p}v_2Z_{j6}^HZ_{k3}^H \\
& - 4e^{2i\eta}v_1l_{4p}^*Z_{j6}^HZ_{k3}^H - 2e^{3i\eta}v_2l_{6p}^*Z_{j6}^HZ_{k3}^H - 2e^{i\eta}v_2l_{7p}^*Z_{j6}^HZ_{k3}^H \\
& - 2ie^{2i(\eta+\zeta)}l_{1p}v_1Z_{j4}^HZ_{k4}^H - ie^{i(\eta+2\zeta)}l_{6p}v_2Z_{j4}^HZ_{k4}^H - ie^{3i\eta+2i\zeta}v_2l_{6p}^*Z_{j4}^HZ_{k4}^H \\
& - ie^{i(\eta+2\zeta)}l_{6p}v_1Z_{j5}^HZ_{k4}^H - ie^{2i\zeta}l_{5p}v_2Z_{j5}^HZ_{k4}^H - ie^{2i(2\eta+\zeta)}v_2l_{5p}^*Z_{j5}^HZ_{k4}^H \\
& - ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{j5}^HZ_{k4}^H + e^{i(\eta+3\zeta)}\mu_{12}Z_{j3}^HZ_{k5}^H - e^{3i(\eta+\zeta)}\mu_{21}Z_{j3}^HZ_{k5}^H \\
& + 2e^{i(\eta+2\zeta)}l_{3p}v_sZ_{j3}^HZ_{k5}^H + 2e^{i(\eta+4\zeta)}l_{6p}v_sZ_{j3}^HZ_{k5}^H - 2e^{3i\eta+4i\zeta}l_{7p}v_sZ_{j3}^HZ_{k5}^H \\
& - 2e^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{j3}^HZ_{k5}^H - 2e^{3i\eta}v_sl_{6p}^*Z_{j3}^HZ_{k5}^H + 2e^{i\eta}v_sl_{7p}^*Z_{j3}^HZ_{k5}^H \\
& - e^{i(3\eta+\zeta)}\mu_{12}^*Z_{j3}^HZ_{k5}^H + e^{i(\eta+\zeta)}\mu_{21}^*Z_{j3}^HZ_{k5}^H - ie^{i(\eta+2\zeta)}l_{6p}v_1Z_{j4}^HZ_{k5}^H \\
& - ie^{2i\zeta}l_{5p}v_2Z_{j4}^HZ_{k5}^H - ie^{2i(2\eta+\zeta)}v_2l_{5p}^*Z_{j4}^HZ_{k5}^H - ie^{3i\eta+2i\zeta}v_1l_{6p}^*Z_{j4}^HZ_{k5}^H \\
& - 2ie^{2i(\eta+\zeta)}l_{3p}v_1Z_{j5}^HZ_{k5}^H - 2ie^{2i(\eta+\zeta)}l_{4p}v_1Z_{j5}^HZ_{k5}^H + ie^{2i\zeta}l_{5p}v_1Z_{j5}^HZ_{k5}^H \\
& - ie^{i(\eta+2\zeta)}l_{7p}v_2Z_{j5}^HZ_{k5}^H + ie^{2i(2\eta+\zeta)}v_1l_{5p}^*Z_{j5}^HZ_{k5}^H - ie^{3i\eta+2i\zeta}v_2l_{7p}^*Z_{j5}^HZ_{k5}^H \\
& + ie^{i(\eta+3\zeta)}\mu_{12}Z_{j6}^HZ_{k5}^H - ie^{3i(\eta+\zeta)}\mu_{21}Z_{j6}^HZ_{k5}^H + 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{j6}^HZ_{k5}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j6}^HZ_{k5}^H + 2ie^{3i\eta}v_sl_{6p}^*Z_{j6}^HZ_{k5}^H - 2ie^{i\eta}v_sl_{7p}^*Z_{j6}^HZ_{k5}^H \\
& + ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{j6}^HZ_{k5}^H - ie^{i(\eta+\zeta)}\mu_{21}^*Z_{j6}^HZ_{k5}^H + 4e^{2i(\eta+2\zeta)}l_{4p}v_1Z_{j3}^HZ_{k6}^H \\
& + 2e^{i(\eta+4\zeta)}l_{6p}v_2Z_{j3}^HZ_{k6}^H + 2e^{3i\eta+4i\zeta}l_{7p}v_2Z_{j3}^HZ_{k6}^H - 4e^{2i\eta}v_1l_{4p}^*Z_{j3}^HZ_{k6}^H \\
& - 2e^{3i\eta}v_2l_{6p}^*Z_{j3}^HZ_{k6}^H - 2e^{i\eta}v_2l_{7p}^*Z_{j3}^HZ_{k6}^H + ie^{i(\eta+3\zeta)}\mu_{12}Z_{j5}^HZ_{k6}^H \\
& - ie^{3i(\eta+\zeta)}\mu_{21}Z_{j5}^HZ_{k6}^H + 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{j5}^HZ_{k6}^H - 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j5}^HZ_{k6}^H \\
& + 2ie^{3i\eta}v_sl_{6p}^*Z_{j5}^HZ_{k6}^H - 2ie^{i\eta}v_sl_{7p}^*Z_{j5}^HZ_{k6}^H + ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{j5}^HZ_{k6}^H \\
& - ie^{i(\eta+\zeta)}\mu_{21}^*Z_{j5}^HZ_{k6}^H - 4ie^{2i(\eta+\zeta)}l_{1p}v_1Z_{j6}^HZ_{k6}^H + 4ie^{2i(\eta+2\zeta)}l_{4p}v_1Z_{j6}^HZ_{k6}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+2\zeta)}l_{3p}v_2Z_{j6}^HZ_{k6}^H + 2ie^{i(\eta+4\zeta)}l_{6p}v_2Z_{j6}^HZ_{k6}^H + 2ie^{3i\eta+4i\zeta}l_{7p}v_2Z_{j6}^HZ_{k6}^H \\
& -2ie^{3i\eta+2i\zeta}v_2l_{3p}^*Z_{j6}^HZ_{k6}^H + 4ie^{2i\eta}v_1l_{4p}^*Z_{j6}^HZ_{k6}^H + 2ie^{3i\eta}v_2l_{6p}^*Z_{j6}^HZ_{k6}^H \\
& + 2ie^{i\eta}v_2l_{7p}^*Z_{j6}^HZ_{k6}^H \\
& + Z_{j1}^H\left(-3ie^{i(\eta+2\zeta)}\left(2e^{i\eta}l_1v_1 + e^{2i\eta}v_2l_6^* + l_6v_2\right)Z_{k1}^H\right. \\
& - ie^{2i\zeta}\left(2e^{2i\eta}l_3v_2 + 2e^{2i\eta}l_4v_2 + 3e^{3i\eta}v_1l_6^* + 3e^{i\eta}l_6v_1 + e^{4i\eta}v_2l_5^* + l_5v_2\right)Z_{k2}^H \\
& - 2ie^{2i\eta+3i\zeta}\mu_{11}Z_{k3}^H - 4ie^{2i(\eta+\zeta)}l_{1p}v_sZ_{k3}^H - 4ie^{2i(\eta+2\zeta)}l_{4p}v_sZ_{k3}^H - 4ie^{2i\eta}v_sl_{4p}^*Z_{k3}^H \\
& - 2ie^{i(2\eta+\zeta)}\mu_{11}^*Z_{k3}^H - e^{i(\eta+2\zeta)}l_6v_2Z_{k4}^H + e^{3i\eta+2i\zeta}v_2l_6^*Z_{k4}^H \\
& + 3e^{i(\eta+2\zeta)}l_6v_1Z_{k5}^H + e^{2i\zeta}l_5v_2Z_{k5}^H - e^{2i(2\eta+\zeta)}v_2l_5^*Z_{k5}^H - 3e^{3i\eta+2i\zeta}v_1l_6^*Z_{k5}^H \\
& + 2e^{2i\eta+3i\zeta}\mu_{11}Z_{k6}^H + 4e^{2i(\eta+2\zeta)}l_{4p}v_sZ_{k6}^H - 4e^{2i\eta}v_sl_{4p}^*Z_{k6}^H - 2e^{i(2\eta+\zeta)}\mu_{11}^*Z_{k6}^H \\
& + Z_{j2}^H\left(-ie^{2i\zeta}\left(2e^{2i\eta}l_3v_2 + 2e^{2i\eta}l_4v_2 + 3e^{3i\eta}v_1l_6^* + 3e^{i\eta}l_6v_1 + e^{4i\eta}v_2l_5^* + l_5v_2\right)Z_{k1}^H\right. \\
& - ie^{2i\zeta}\left(2e^{2i\eta}l_3v_1 + 2e^{2i\eta}l_4v_1 + 3e^{3i\eta}v_2l_7^* + 3e^{i\eta}l_7v_2 + e^{4i\eta}v_1l_5^* + l_5v_1\right)Z_{k2}^H \\
& - ie^{i(\eta+3\zeta)}\mu_{12}Z_{k3}^H - ie^{3i(\eta+\zeta)}\mu_{21}Z_{k3}^H - 2ie^{i(\eta+2\zeta)}l_{3p}v_sZ_{k3}^H - 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{k3}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{k3}^H - 2ie^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{k3}^H - 2ie^{3i\eta}v_sl_{6p}^*Z_{k3}^H - 2ie^{i\eta}v_sl_{7p}^*Z_{k3}^H \\
& - ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{k3}^H - ie^{i(\eta+\zeta)}\mu_{21}^*Z_{k3}^H - e^{i(\eta+2\zeta)}l_6v_1Z_{k4}^H - e^{2i\zeta}l_5v_2Z_{k4}^H \\
& + e^{2i(2\eta+\zeta)}v_2l_5^*Z_{k4}^H + e^{3i\eta+2i\zeta}v_1l_6^*Z_{k4}^H + e^{2i\zeta}l_5v_1Z_{k5}^H + e^{i(\eta+2\zeta)}l_7v_2Z_{k5}^H \\
& - e^{2i(2\eta+\zeta)}v_1l_5^*Z_{k5}^H - e^{3i\eta+2i\zeta}v_2l_7^*Z_{k5}^H + e^{i(\eta+3\zeta)}\mu_{12}Z_{k6}^H + e^{3i(\eta+\zeta)}\mu_{21}Z_{k6}^H \\
& + 2e^{i(\eta+4\zeta)}l_{6p}v_sZ_{k6}^H + 2e^{3i\eta+4i\zeta}l_{7p}v_sZ_{k6}^H - 2e^{3i\eta}v_sl_{6p}^*Z_{k6}^H - 2e^{i\eta}v_sl_{7p}^*Z_{k6}^H \\
& - e^{i(3\eta+\zeta)}\mu_{12}^*Z_{k6}^H - e^{i(\eta+\zeta)}\mu_{21}^*Z_{k6}^H) \\
& + e^{2i\zeta}Z_{i2}^H\left(-ie^{i(\eta+3\zeta)}\mu_{12}Z_{j3}^HZ_{k1}^H - ie^{3i(\eta+\zeta)}\mu_{21}Z_{j3}^HZ_{k1}^H - 2ie^{i(\eta+2\zeta)}l_{3p}v_sZ_{j3}^HZ_{k1}^H\right. \\
& - 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{j3}^HZ_{k1}^H - 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j3}^HZ_{k1}^H - 2ie^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{j3}^HZ_{k1}^H \\
& - 2ie^{3i\eta}v_sl_{6p}^*Z_{j3}^HZ_{k1}^H - 2ie^{i\eta}v_sl_{7p}^*Z_{j3}^HZ_{k1}^H - ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{j3}^HZ_{k1}^H \\
& \left.- ie^{i(\eta+\zeta)}\mu_{21}^*Z_{j3}^HZ_{k1}^H - e^{i(\eta+2\zeta)}l_6v_1Z_{j4}^HZ_{k1}^H - e^{2i\zeta}l_5v_2Z_{j4}^HZ_{k1}^H\right)
\end{aligned}$$

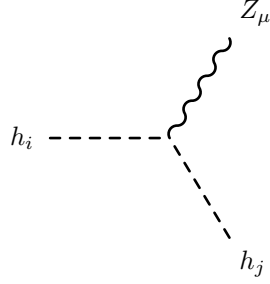
$$\begin{aligned}
& + e^{2i(2\eta+\zeta)} v_2 l_5^* Z_{j4}^H Z_{k1}^H + e^{3i\eta+2i\zeta} v_1 l_6^* Z_{j4}^H Z_{k1}^H + e^{2i\zeta} l_5 v_1 Z_{j5}^H Z_{k1}^H \\
& + e^{i(\eta+2\zeta)} l_7 v_2 Z_{j5}^H Z_{k1}^H - e^{2i(2\eta+\zeta)} v_1 l_5^* Z_{j5}^H Z_{k1}^H - e^{3i\eta+2i\zeta} v_2 l_7^* Z_{j5}^H Z_{k1}^H \\
& + e^{i(\eta+3\zeta)} \mu_{12} Z_{j6}^H Z_{k1}^H + e^{3i(\eta+\zeta)} \mu_{21} Z_{j6}^H Z_{k1}^H + 2e^{i(\eta+4\zeta)} l_{6p} v_s Z_{j6}^H Z_{k1}^H \\
& + 2e^{3i\eta+4i\zeta} l_{7p} v_s Z_{j6}^H Z_{k1}^H - 2e^{3i\eta} v_s l_{6p}^* Z_{j6}^H Z_{k1}^H - 2e^{i\eta} v_s l_{7p}^* Z_{j6}^H Z_{k1}^H \\
& - e^{i(3\eta+\zeta)} \mu_{12}^* Z_{j6}^H Z_{k1}^H - e^{i(\eta+\zeta)} \mu_{21}^* Z_{j6}^H Z_{k1}^H - 2ie^{2i\eta+3i\zeta} \mu_{22} Z_{j3}^H Z_{k2}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{2p} v_s Z_{j3}^H Z_{k2}^H - 4ie^{2i(\eta+2\zeta)} l_{5p} v_s Z_{j3}^H Z_{k2}^H - 4ie^{2i\eta} v_s l_{5p}^* Z_{j3}^H Z_{k2}^H \\
& - 2ie^{i(2\eta+\zeta)} \mu_{22}^* Z_{j3}^H Z_{k2}^H - e^{2i\zeta} l_5 v_1 Z_{j4}^H Z_{k2}^H - 3e^{i(\eta+2\zeta)} l_7 v_2 Z_{j4}^H Z_{k2}^H \\
& + e^{2i(2\eta+\zeta)} v_1 l_5^* Z_{j4}^H Z_{k2}^H + 3e^{3i\eta+2i\zeta} v_2 l_7^* Z_{j4}^H Z_{k2}^H + e^{i(\eta+2\zeta)} l_7 v_1 Z_{j5}^H Z_{k2}^H \\
& - e^{3i\eta+2i\zeta} v_1 l_7^* Z_{j5}^H Z_{k2}^H + 2e^{2i\eta+3i\zeta} \mu_{22} Z_{j6}^H Z_{k2}^H + 4e^{2i(\eta+2\zeta)} l_{5p} v_s Z_{j6}^H Z_{k2}^H \\
& - 4e^{2i\eta} v_s l_{5p}^* Z_{j6}^H Z_{k2}^H - 2e^{i(2\eta+\zeta)} \mu_{22}^* Z_{j6}^H Z_{k2}^H - 2ie^{i(\eta+2\zeta)} l_{3p} v_1 Z_{j3}^H Z_{k3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{6p} v_1 Z_{j3}^H Z_{k3}^H - 2ie^{3i\eta+4i\zeta} l_{7p} v_1 Z_{j3}^H Z_{k3}^H - 4ie^{2i(\eta+\zeta)} l_{2p} v_2 Z_{j3}^H Z_{k3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{5p} v_2 Z_{j3}^H Z_{k3}^H - 2ie^{3i\eta+2i\zeta} v_1 l_{3p}^* Z_{j3}^H Z_{k3}^H - 4ie^{2i\eta} v_2 l_{5p}^* Z_{j3}^H Z_{k3}^H \\
& - 2ie^{3i\eta} v_1 l_{6p}^* Z_{j3}^H Z_{k3}^H - 2ie^{i\eta} v_1 l_{7p}^* Z_{j3}^H Z_{k3}^H - e^{i(\eta+3\zeta)} \mu_{12} Z_{j4}^H Z_{k3}^H \\
& + e^{3i(\eta+\zeta)} \mu_{21} Z_{j4}^H Z_{k3}^H - 2e^{i(\eta+2\zeta)} l_{3p} v_s Z_{j4}^H Z_{k3}^H - 2e^{i(\eta+4\zeta)} l_{6p} v_s Z_{j4}^H Z_{k3}^H \\
& + 2e^{3i\eta+4i\zeta} l_{7p} v_s Z_{j4}^H Z_{k3}^H + 2e^{3i\eta+2i\zeta} v_s l_{3p}^* Z_{j4}^H Z_{k3}^H + 2e^{3i\eta} v_s l_{6p}^* Z_{j4}^H Z_{k3}^H \\
& - 2e^{i\eta} v_s l_{7p}^* Z_{j4}^H Z_{k3}^H + e^{i(3\eta+\zeta)} \mu_{12}^* Z_{j4}^H Z_{k3}^H - e^{i(\eta+\zeta)} \mu_{21}^* Z_{j4}^H Z_{k3}^H \\
& + 2e^{i(\eta+4\zeta)} l_{6p} v_1 Z_{j6}^H Z_{k3}^H + 2e^{3i\eta+4i\zeta} l_{7p} v_1 Z_{j6}^H Z_{k3}^H + 4e^{2i(\eta+2\zeta)} l_{5p} v_2 Z_{j6}^H Z_{k3}^H \\
& - 4e^{2i\eta} v_2 l_{5p}^* Z_{j6}^H Z_{k3}^H - 2e^{3i\eta} v_1 l_{6p}^* Z_{j6}^H Z_{k3}^H - 2e^{i\eta} v_1 l_{7p}^* Z_{j6}^H Z_{k3}^H \\
& - e^{i(\eta+3\zeta)} \mu_{12} Z_{j3}^H Z_{k4}^H + e^{3i(\eta+\zeta)} \mu_{21} Z_{j3}^H Z_{k4}^H - 2e^{i(\eta+2\zeta)} l_{3p} v_s Z_{j3}^H Z_{k4}^H \\
& - 2e^{i(\eta+4\zeta)} l_{6p} v_s Z_{j3}^H Z_{k4}^H + 2e^{3i\eta+4i\zeta} l_{7p} v_s Z_{j3}^H Z_{k4}^H + 2e^{3i\eta+2i\zeta} v_s l_{3p}^* Z_{j3}^H Z_{k4}^H \\
& + 2e^{3i\eta} v_s l_{6p}^* Z_{j3}^H Z_{k4}^H - 2e^{i\eta} v_s l_{7p}^* Z_{j3}^H Z_{k4}^H + e^{i(3\eta+\zeta)} \mu_{12}^* Z_{j3}^H Z_{k4}^H
\end{aligned}$$

$$\begin{aligned}
& -e^{i(\eta+\zeta)}\mu_{21}^*Z_{j3}^HZ_{k4}^H - ie^{i(\eta+2\zeta)}l_6v_1Z_{j4}^HZ_{k4}^H - 2ie^{2i(\eta+\zeta)}l_3v_2Z_{j4}^HZ_{k4}^H \\
& - 2ie^{2i(\eta+\zeta)}l_4v_2Z_{j4}^HZ_{k4}^H + ie^{2i\zeta}l_5v_2Z_{j4}^HZ_{k4}^H + ie^{2i(2\eta+\zeta)}v_2l_5^*Z_{j4}^HZ_{k4}^H \\
& - ie^{3i\eta+2i\zeta}v_1l_6^*Z_{j4}^HZ_{k4}^H - ie^{2i\zeta}l_5v_1Z_{j5}^HZ_{k4}^H - ie^{i(\eta+2\zeta)}l_7v_2Z_{j5}^HZ_{k4}^H \\
& - ie^{2i(2\eta+\zeta)}v_1l_5^*Z_{j5}^HZ_{k4}^H - ie^{3i\eta+2i\zeta}v_2l_7^*Z_{j5}^HZ_{k4}^H - ie^{i(\eta+3\zeta)}\mu_{12}Z_{j6}^HZ_{k4}^H \\
& + ie^{3i(\eta+\zeta)}\mu_{21}Z_{j6}^HZ_{k4}^H - 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{j6}^HZ_{k4}^H + 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j6}^HZ_{k4}^H \\
& - 2ie^{3i\eta}v_sl_{6p}^*Z_{j6}^HZ_{k4}^H + 2ie^{i\eta}v_sl_{7p}^*Z_{j6}^HZ_{k4}^H - ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{j6}^HZ_{k4}^H \\
& + ie^{i(\eta+\zeta)}\mu_{21}^*Z_{j6}^HZ_{k4}^H - ie^{2i\zeta}l_5v_1Z_{j4}^HZ_{k5}^H - ie^{i(\eta+2\zeta)}l_7v_2Z_{j4}^HZ_{k5}^H \\
& - ie^{2i(2\eta+\zeta)}v_1l_5^*Z_{j4}^HZ_{k5}^H - ie^{3i\eta+2i\zeta}v_2l_7^*Z_{j4}^HZ_{k5}^H - ie^{i(\eta+2\zeta)}l_7v_1Z_{j5}^HZ_{k5}^H \\
& - 2ie^{2i(\eta+\zeta)}l_2v_2Z_{j5}^HZ_{k5}^H - ie^{3i\eta+2i\zeta}v_1l_7^*Z_{j5}^HZ_{k5}^H + 2e^{i(\eta+4\zeta)}l_{6p}v_1Z_{j3}^HZ_{k6}^H \\
& + 2e^{3i\eta+4i\zeta}l_{7p}v_1Z_{j3}^HZ_{k6}^H + 4e^{2i(\eta+2\zeta)}l_{5p}v_2Z_{j3}^HZ_{k6}^H - 4e^{2i\eta}v_2l_{5p}^*Z_{j3}^HZ_{k6}^H \\
& - 2e^{3i\eta}v_1l_{6p}^*Z_{j3}^HZ_{k6}^H - 2e^{i\eta}v_1l_{7p}^*Z_{j3}^HZ_{k6}^H - ie^{i(\eta+3\zeta)}\mu_{12}Z_{j4}^HZ_{k6}^H \\
& + ie^{3i(\eta+\zeta)}\mu_{21}Z_{j4}^HZ_{k6}^H - 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{j4}^HZ_{k6}^H + 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{j4}^HZ_{k6}^H \\
& - 2ie^{3i\eta}v_sl_{6p}^*Z_{j4}^HZ_{k6}^H + 2ie^{i\eta}v_sl_{7p}^*Z_{j4}^HZ_{k6}^H - ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{j4}^HZ_{k6}^H \\
& + ie^{i(\eta+\zeta)}\mu_{21}^*Z_{j4}^HZ_{k6}^H - 2ie^{i(\eta+2\zeta)}l_{3p}v_1Z_{j6}^HZ_{k6}^H + 2ie^{i(\eta+4\zeta)}l_{6p}v_1Z_{j6}^HZ_{k6}^H \\
& + 2ie^{3i\eta+4i\zeta}l_{7p}v_1Z_{j6}^HZ_{k6}^H - 4ie^{2i(\eta+\zeta)}l_{2p}v_2Z_{j6}^HZ_{k6}^H + 4ie^{2i(\eta+2\zeta)}l_{5p}v_2Z_{j6}^HZ_{k6}^H \\
& - 2ie^{3i\eta+2i\zeta}v_1l_{3p}^*Z_{j6}^HZ_{k6}^H + 4ie^{2i\eta}v_2l_{5p}^*Z_{j6}^HZ_{k6}^H + 2ie^{3i\eta}v_1l_{6p}^*Z_{j6}^HZ_{k6}^H \\
& + 2ie^{i\eta}v_1l_{7p}^*Z_{j6}^HZ_{k6}^H \\
& + Z_{j1}^H \left(-ie^{2i\zeta} \left(2e^{2i\eta}l_3v_2 + 2e^{2i\eta}l_4v_2 + 3e^{3i\eta}v_1l_6^* + 3e^{i\eta}l_6v_1 + e^{4i\eta}v_2l_5^* + l_5v_2 \right) Z_{k1}^H \right. \\
& - ie^{2i\zeta} \left(2e^{2i\eta}l_3v_1 + 2e^{2i\eta}l_4v_1 + 3e^{3i\eta}v_2l_7^* + 3e^{i\eta}l_7v_2 + e^{4i\eta}v_1l_5^* + l_5v_1 \right) Z_{k2}^H \\
& - ie^{i(\eta+3\zeta)}\mu_{12}Z_{k3}^H - ie^{3i(\eta+\zeta)}\mu_{21}Z_{k3}^H - 2ie^{i(\eta+2\zeta)}l_{3p}v_sZ_{k3}^H - 2ie^{i(\eta+4\zeta)}l_{6p}v_sZ_{k3}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{7p}v_sZ_{k3}^H - 2ie^{3i\eta+2i\zeta}v_sl_{3p}^*Z_{k3}^H - 2ie^{3i\eta}v_sl_{6p}^*Z_{k3}^H - 2ie^{i\eta}v_sl_{7p}^*Z_{k3}^H \\
& \left. - ie^{i(3\eta+\zeta)}\mu_{12}^*Z_{k3}^H - ie^{i(\eta+\zeta)}\mu_{21}^*Z_{k3}^H - e^{i(\eta+2\zeta)}l_6v_1Z_{k4}^H - e^{2i\zeta}l_5v_2Z_{k4}^H \right)
\end{aligned}$$

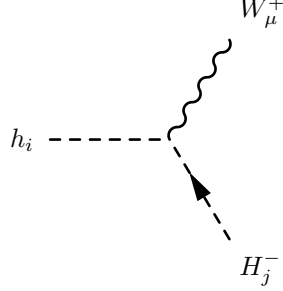
$$\begin{aligned}
& + 4e^{2i(\eta+2\zeta)} l_{4p} v_s Z_{i6}^H Z_{j1}^+ Z_{k1}^+ - 4e^{2i\eta} v_s l_{4p}^* Z_{i6}^H Z_{j1}^+ Z_{k1}^+ \\
& - 2e^{i(2\eta+\zeta)} \mu_{11}^* Z_{i6}^H Z_{j1}^+ Z_{k1}^+ - 2ie^{3i(\eta+\zeta)} \mu_{21} Z_{i3}^H Z_{j2}^+ Z_{k1}^+ \\
& - 4ie^{3i\eta+4i\zeta} l_{7p} v_s Z_{i3}^H Z_{j2}^+ Z_{k1}^+ - 4ie^{3i\eta+2i\zeta} v_s l_{3p}^* Z_{i3}^H Z_{j2}^+ Z_{k1}^+ \\
& - 4ie^{3i\eta} v_s l_{6p}^* Z_{i3}^H Z_{j2}^+ Z_{k1}^+ - 2ie^{i(3\eta+\zeta)} \mu_{12}^* Z_{i3}^H Z_{j2}^+ Z_{k1}^+ \\
& - e^{2i(\eta+\zeta)} l_4 v_2 Z_{i4}^H Z_{j2}^+ Z_{k1}^+ + e^{2i(2\eta+\zeta)} v_2 l_5^* Z_{i4}^H Z_{j2}^+ Z_{k1}^+ \\
& + e^{2i(\eta+\zeta)} l_4 v_1 Z_{i5}^H Z_{j2}^+ Z_{k1}^+ - e^{2i(2\eta+\zeta)} v_1 l_5^* Z_{i5}^H Z_{j2}^+ Z_{k1}^+ \\
& + 2e^{3i(\eta+\zeta)} \mu_{21} Z_{i6}^H Z_{j2}^+ Z_{k1}^+ + 4e^{3i\eta+4i\zeta} l_{7p} v_s Z_{i6}^H Z_{j2}^+ Z_{k1}^+ \\
& - 4e^{3i\eta} v_s l_{6p}^* Z_{i6}^H Z_{j2}^+ Z_{k1}^+ - 2e^{i(3\eta+\zeta)} \mu_{12}^* Z_{i6}^H Z_{j2}^+ Z_{k1}^+ \\
& - 2ie^{i(\eta+3\zeta)} \mu_{12} Z_{i3}^H Z_{j1}^+ Z_{k2}^+ - 4ie^{i(\eta+2\zeta)} l_{3p} v_s Z_{i3}^H Z_{j1}^+ Z_{k2}^+ \\
& - 4ie^{i(\eta+4\zeta)} l_{6p} v_s Z_{i3}^H Z_{j1}^+ Z_{k2}^+ - 4ie^{i\eta} v_s l_{7p}^* Z_{i3}^H Z_{j1}^+ Z_{k2}^+ \\
& - 2ie^{i(\eta+\zeta)} \mu_{21}^* Z_{i3}^H Z_{j1}^+ Z_{k2}^+ + e^{2i(\eta+\zeta)} l_4 v_2 Z_{i4}^H Z_{j1}^+ Z_{k2}^+ - e^{2i\zeta} l_5 v_2 Z_{i4}^H Z_{j1}^+ Z_{k2}^+ \\
& - e^{2i(\eta+\zeta)} l_4 v_1 Z_{i5}^H Z_{j1}^+ Z_{k2}^+ + e^{2i\zeta} l_5 v_1 Z_{i5}^H Z_{j1}^+ Z_{k2}^+ + 2e^{i(\eta+3\zeta)} \mu_{12} Z_{i6}^H Z_{j1}^+ Z_{k2}^+ \\
& + 4e^{i(\eta+4\zeta)} l_{6p} v_s Z_{i6}^H Z_{j1}^+ Z_{k2}^+ - 4e^{i\eta} v_s l_{7p}^* Z_{i6}^H Z_{j1}^+ Z_{k2}^+ \\
& - 2e^{i(\eta+\zeta)} \mu_{21}^* Z_{i6}^H Z_{j1}^+ Z_{k2}^+ - 2ie^{2i\eta+3i\zeta} \mu_{22} Z_{i3}^H Z_{j2}^+ Z_{k2}^+ \\
& - 4ie^{2i(\eta+\zeta)} l_{2p} v_s Z_{i3}^H Z_{j2}^+ Z_{k2}^+ - 4ie^{2i(\eta+2\zeta)} l_{5p} v_s Z_{i3}^H Z_{j2}^+ Z_{k2}^+ \\
& - 4ie^{2i\eta} v_s l_{5p}^* Z_{i3}^H Z_{j2}^+ Z_{k2}^+ - 2ie^{i(2\eta+\zeta)} \mu_{22}^* Z_{i3}^H Z_{j2}^+ Z_{k2}^+ \\
& - e^{i(\eta+2\zeta)} l_7 v_2 Z_{i4}^H Z_{j2}^+ Z_{k2}^+ + e^{3i\eta+2i\zeta} v_2 l_7^* Z_{i4}^H Z_{j2}^+ Z_{k2}^+ \\
& + e^{i(\eta+2\zeta)} l_7 v_1 Z_{i5}^H Z_{j2}^+ Z_{k2}^+ - e^{3i\eta+2i\zeta} v_1 l_7^* Z_{i5}^H Z_{j2}^+ Z_{k2}^+ \\
& + 2e^{2i\eta+3i\zeta} \mu_{22} Z_{i6}^H Z_{j2}^+ Z_{k2}^+ + 4e^{2i(\eta+2\zeta)} l_{5p} v_s Z_{i6}^H Z_{j2}^+ Z_{k2}^+ \\
& - 4e^{2i\eta} v_s l_{5p}^* Z_{i6}^H Z_{j2}^+ Z_{k2}^+ - 2e^{i(2\eta+\zeta)} \mu_{22}^* Z_{i6}^H Z_{j2}^+ Z_{k2}^+ \\
& - ie^{2i\zeta} Z_{i2}^H \left(Z_{j1}^+ \left((2e^{i\eta} l_7 v_2 + e^{2i\eta} l_4 v_1 + l_5 v_1) Z_{k2}^+ + e^{i\eta} (2e^{i\eta} l_3 v_2 + e^{2i\eta} v_1 l_6^* + l_6 v_1) Z_{k1}^+ \right) \right)
\end{aligned}$$

$$\begin{aligned}
& + e^{i\eta} Z_{j2}^+ \left(\left(2e^{i\eta} l_2 v_2 + e^{2i\eta} v_1 l_7^* + l_7 v_1 \right) Z_{k2}^+ + e^{i\eta} \left(2e^{i\eta} v_2 l_7^* + e^{2i\eta} v_1 l_5^* + l_4 v_1 \right) Z_{k1}^+ \right) \\
& - ie^{2i\zeta} Z_{i1}^H \left(Z_{j1}^+ \left(\left(2e^{i\eta} l_6 v_1 + e^{2i\eta} l_4 v_2 + l_5 v_2 \right) Z_{k2}^+ + e^{i\eta} \left(2e^{i\eta} l_1 v_1 + e^{2i\eta} v_2 l_6^* + l_6 v_2 \right) Z_{k1}^+ \right) \right. \\
& \left. + e^{i\eta} Z_{j2}^+ \left(\left(2e^{i\eta} l_3 v_1 + e^{2i\eta} v_2 l_7^* + l_7 v_2 \right) Z_{k2}^+ + e^{i\eta} \left(2e^{i\eta} v_1 l_6^* + e^{2i\eta} v_2 l_5^* + l_4 v_2 \right) Z_{k1}^+ \right) \right) \quad (184)
\end{aligned}$$

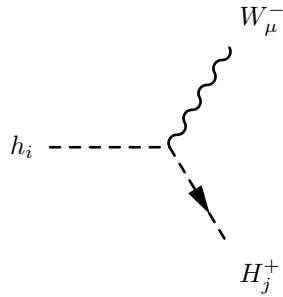
9.2 Two Scalar-One Vector Boson-Interaction



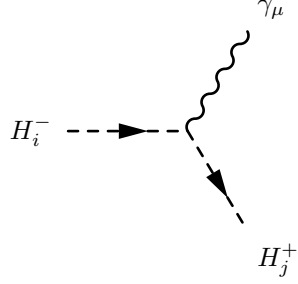
$$-\frac{1}{2} \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right) \left(-Z_{i1}^H Z_{j4}^H - Z_{i2}^H Z_{j5}^H + Z_{i4}^H Z_{j1}^H + Z_{i5}^H Z_{j2}^H \right) \left(-p_\mu^{h_j} + p_\mu^{h_i} \right) \quad (185)$$



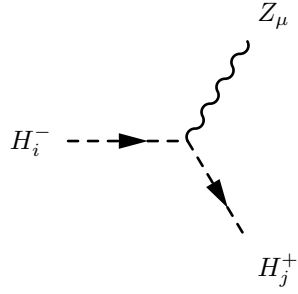
$$\frac{1}{2} g_2 \left(-i Z_{i1}^H Z_{j1}^+ + \left(-i Z_{i2}^H + Z_{i5}^H \right) Z_{j2}^+ + Z_{i4}^H Z_{j1}^+ \right) \left(-p_\mu^{H_j^-} + p_\mu^{h_i} \right) \quad (186)$$



$$\frac{1}{2}g_2\left(iZ_{i1}^H Z_{j1}^+ + \left(iZ_{i2}^H + Z_{i5}^H\right)Z_{j2}^+ + Z_{i4}^H Z_{j1}^+\right)\left(-p_\mu^{H_j^+} + p_\mu^{h_i}\right) \quad (187)$$

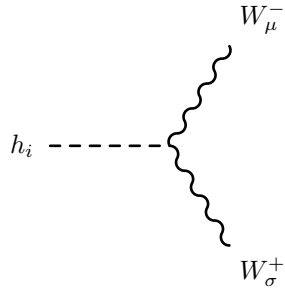


$$\frac{i}{2}\left(g_1 \cos \Theta_W + g_2 \sin \Theta_W\right)\left(Z_{i1}^+ Z_{j1}^+ + Z_{i2}^+ Z_{j2}^+\right)\left(-p_\mu^{H_j^+} + p_\mu^{H_i^-}\right) \quad (188)$$

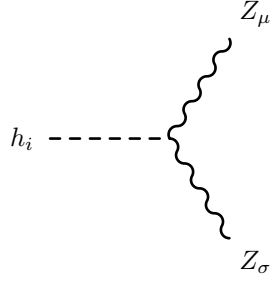


$$\frac{i}{2}\left(-g_1 \sin \Theta_W + g_2 \cos \Theta_W\right)\left(Z_{i1}^+ Z_{j1}^+ + Z_{i2}^+ Z_{j2}^+\right)\left(-p_\mu^{H_j^+} + p_\mu^{H_i^-}\right) \quad (189)$$

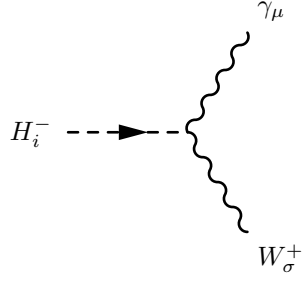
9.3 One Scalar-Two Vector Boson-Interaction



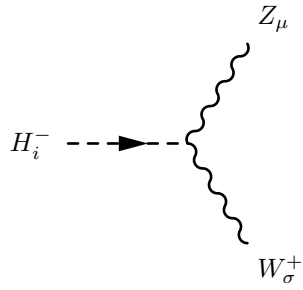
$$\frac{i}{2}g_2^2\left(v_1 Z_{i1}^H + v_2 Z_{i2}^H\right)\left(g_{\sigma\mu}\right) \quad (190)$$



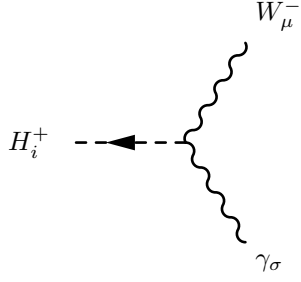
$$\frac{i}{2} \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right)^2 \left(v_1 Z_{i1}^H + v_2 Z_{i2}^H \right) \left(g_{\sigma\mu} \right) \quad (191)$$



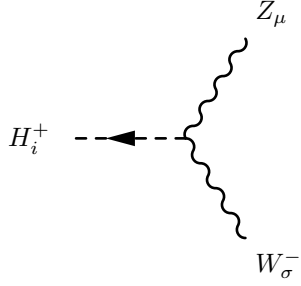
$$\frac{i}{2} g_1 g_2 \cos \Theta_W \left(v_1 Z_{i1}^+ + v_2 Z_{i2}^+ \right) \left(g_{\sigma\mu} \right) \quad (192)$$



$$- \frac{i}{2} g_1 g_2 \sin \Theta_W \left(v_1 Z_{i1}^+ + v_2 Z_{i2}^+ \right) \left(g_{\sigma\mu} \right) \quad (193)$$

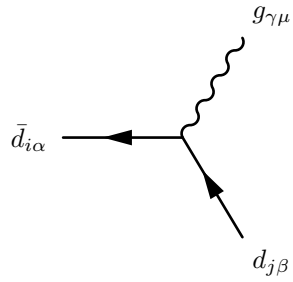


$$\frac{i}{2} g_1 g_2 \cos \Theta_W \left(v_1 Z_{i1}^+ + v_2 Z_{i2}^+ \right) \left(g_{\sigma\mu} \right) \quad (194)$$



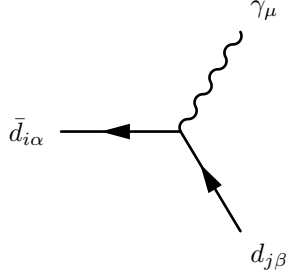
$$- \frac{i}{2} g_1 g_2 \sin \Theta_W \left(v_1 Z_{i1}^+ + v_2 Z_{i2}^+ \right) \left(g_{\sigma\mu} \right) \quad (195)$$

9.4 Two Fermion-One Vector Boson-Interaction



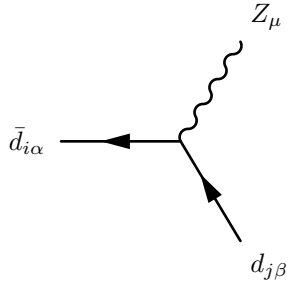
$$- \frac{i}{2} g_3 \delta_{ij} \lambda_{\alpha,\beta}^\gamma \left(\gamma_\mu \cdot \frac{1 - \gamma_5}{2} \right) \quad (196)$$

$$+ - \frac{i}{2} g_3 \delta_{ij} \lambda_{\alpha,\beta}^\gamma \left(\gamma_\mu \cdot \frac{1 + \gamma_5}{2} \right) \quad (197)$$



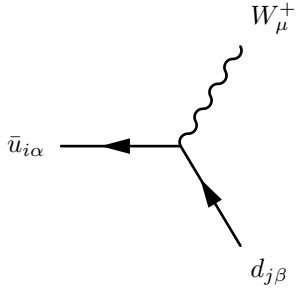
$$-\frac{i}{6}\delta_{\alpha\beta}\delta_{ij}\left(-3g_2\sin\Theta_W+g_1\cos\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (198)$$

$$+\frac{i}{3}g_1\cos\Theta_W\delta_{\alpha\beta}\delta_{ij}\left(\gamma_\mu\cdot\frac{1+\gamma_5}{2}\right) \quad (199)$$

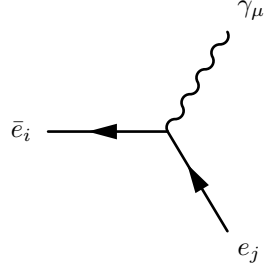


$$\frac{i}{6}\delta_{\alpha\beta}\delta_{ij}\left(3g_2\cos\Theta_W+g_1\sin\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (200)$$

$$+\frac{i}{3}g_1\delta_{\alpha\beta}\delta_{ij}\sin\Theta_W\left(\gamma_\mu\cdot\frac{1+\gamma_5}{2}\right) \quad (201)$$

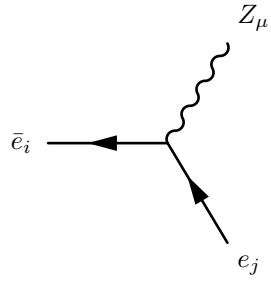


$$-i\frac{1}{\sqrt{2}}g_2\delta_{\alpha\beta}\sum_{a=1}^3U_{L,ja}^{d,*}U_{L,ia}^u\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (202)$$



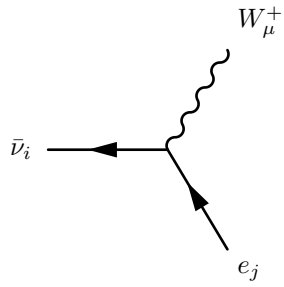
$$\frac{i}{2}\delta_{ij}\left(g_1\cos\Theta_W+g_2\sin\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (203)$$

$$+ig_1\cos\Theta_W\delta_{ij}\left(\gamma_\mu\cdot\frac{1+\gamma_5}{2}\right) \quad (204)$$

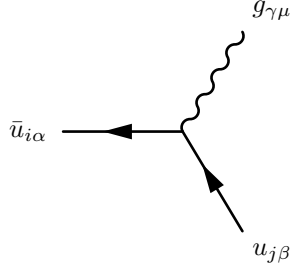


$$\frac{i}{2}\delta_{ij}\left(-g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (205)$$

$$+ -ig_1\delta_{ij}\sin\Theta_W\left(\gamma_\mu\cdot\frac{1+\gamma_5}{2}\right) \quad (206)$$

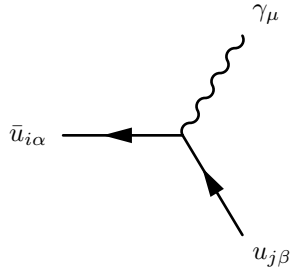


$$-i\frac{1}{\sqrt{2}}g_2U_{L,ji}^{e,*}\Theta_{i,3}\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (207)$$



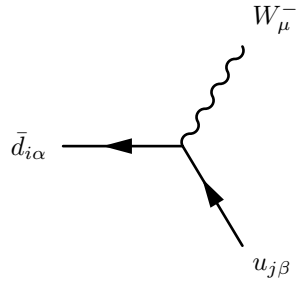
$$- \frac{i}{2} g_3 \delta_{ij} \lambda_{\alpha,\beta}^\gamma \left(\gamma_\mu \cdot \frac{1 - \gamma_5}{2} \right) \quad (208)$$

$$+ - \frac{i}{2} g_3 \delta_{ij} \lambda_{\alpha,\beta}^\gamma \left(\gamma_\mu \cdot \frac{1 + \gamma_5}{2} \right) \quad (209)$$

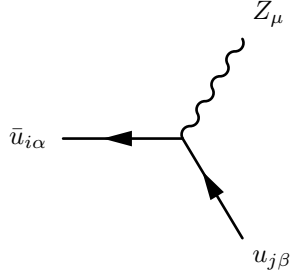


$$- \frac{i}{6} \delta_{\alpha\beta} \delta_{ij} \left(3g_2 \sin \Theta_W + g_1 \cos \Theta_W \right) \left(\gamma_\mu \cdot \frac{1 - \gamma_5}{2} \right) \quad (210)$$

$$+ - \frac{2i}{3} g_1 \cos \Theta_W \delta_{\alpha\beta} \delta_{ij} \left(\gamma_\mu \cdot \frac{1 + \gamma_5}{2} \right) \quad (211)$$

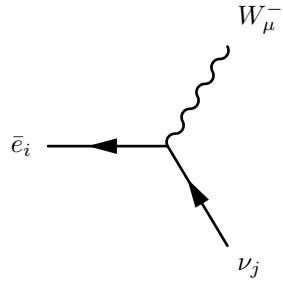


$$- i \frac{1}{\sqrt{2}} g_2 \delta_{\alpha\beta} \sum_{a=1}^3 U_{L,ja}^{u,*} U_{L,ia}^d \left(\gamma_\mu \cdot \frac{1 - \gamma_5}{2} \right) \quad (212)$$

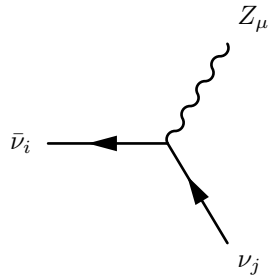


$$-\frac{i}{6}\delta_{\alpha\beta}\delta_{ij}\left(3g_2\cos\Theta_W-g_1\sin\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (213)$$

$$+\frac{2i}{3}g_1\delta_{\alpha\beta}\delta_{ij}\sin\Theta_W\left(\gamma_\mu\cdot\frac{1+\gamma_5}{2}\right) \quad (214)$$

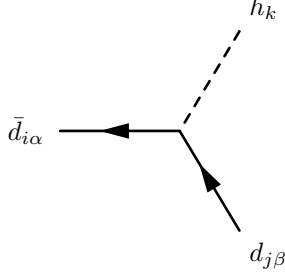


$$-i\frac{1}{\sqrt{2}}g_2\Theta_{j,3}U_{L,ij}^e\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (215)$$



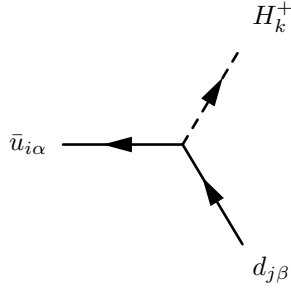
$$-\frac{i}{2}\delta_{ij}\left(g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(\gamma_\mu\cdot\frac{1-\gamma_5}{2}\right) \quad (216)$$

9.5 Two Fermion-One Scalar Boson-Interaction



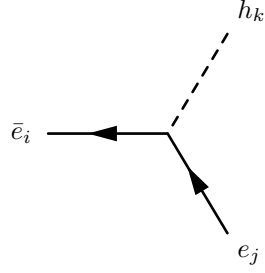
$$-i \frac{1}{\sqrt{2}} e^{-i\eta} \delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 U_{L,jb}^{d,*} \sum_{a=1}^3 U_{R,ia}^d \epsilon_{d,ab} \left(-iZ_{k5}^H + Z_{k2}^H \right) + \sum_{b=1}^3 U_{L,jb}^{d,*} \sum_{a=1}^3 U_{R,ia}^d Y_{d,ab} \left(-iZ_{k4}^H + Z_{k1}^H \right) \right) \left(\frac{1-\gamma_5}{2} \right) \quad (217)$$

$$+ \frac{1}{\sqrt{2}} \delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 \sum_{a=1}^3 Y_{d,ab}^* U_{R,ja}^d U_{L,ib}^d \left(-iZ_{k1}^H + Z_{k4}^H \right) + \sum_{b=1}^3 \sum_{a=1}^3 \epsilon_{d,ab}^* U_{R,ja}^d U_{L,ib}^d \left(-iZ_{k2}^H + Z_{k5}^H \right) \right) \left(\frac{1+\gamma_5}{2} \right) \quad (218)$$



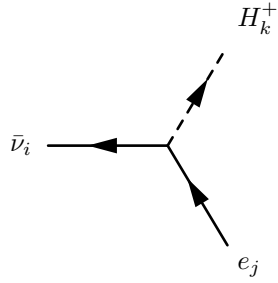
$$i\delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 U_{L,jb}^{d,*} \sum_{a=1}^3 U_{R,ia}^u Y_{u,ab} Z_{k1}^+ + \sum_{b=1}^3 U_{L,jb}^{d,*} \sum_{a=1}^3 U_{R,ia}^u \epsilon_{u,ab} Z_{k2}^+ \right) \left(\frac{1-\gamma_5}{2} \right) \quad (219)$$

$$+ -i\delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 \sum_{a=1}^3 Y_{d,ab}^* U_{R,ja}^d U_{L,ib}^u Z_{k1}^+ + \sum_{b=1}^3 \sum_{a=1}^3 \epsilon_{d,ab}^* U_{R,ja}^d U_{L,ib}^u Z_{k2}^+ \right) \left(\frac{1+\gamma_5}{2} \right) \quad (220)$$



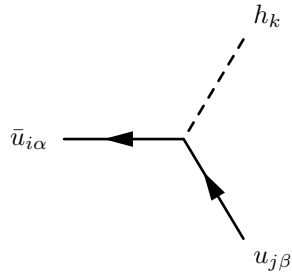
$$\frac{1}{\sqrt{2}} \left(-ie^{-i\eta} \sum_{b=1}^3 U_{L,jb}^{e,*} \sum_{a=1}^3 U_{R,ia}^{e,*} Y_{e,ab} \left(-iZ_{k4}^H + Z_{k1}^H \right) + \sum_{b=1}^3 U_{L,jb}^{e,*} \sum_{a=1}^3 U_{R,ia}^{e,*} \epsilon_{e,ab} \left(-iZ_{k2}^H - Z_{k5}^H \right) \right) \left(\frac{1-\gamma_5}{2} \right) \quad (221)$$

$$+ \frac{1}{\sqrt{2}} \left(e^{i\eta} \sum_{b=1}^3 \sum_{a=1}^3 Y_{e,ab}^* U_{R,ja}^e U_{L,ib}^e \left(-iZ_{k1}^H + Z_{k4}^H \right) + \sum_{b=1}^3 \sum_{a=1}^3 \epsilon_{e,ab}^* U_{R,ja}^e U_{L,ib}^e \left(-iZ_{k2}^H + Z_{k5}^H \right) \right) \left(\frac{1+\gamma_5}{2} \right) \quad (222)$$

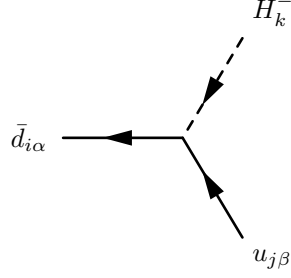


$$(223)$$

$$+ -i \left(e^{i\eta} \sum_{a=1}^3 Y_{e,ai}^* U_{R,ja}^e Z_{k1}^+ + \sum_{a=1}^3 \epsilon_{e,ai}^* U_{R,ja}^e Z_{k2}^+ \right) \left(\frac{1+\gamma_5}{2} \right) \quad (224)$$

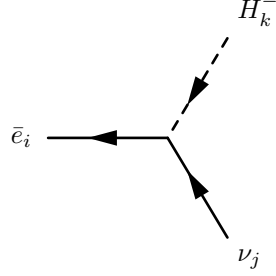


$$\begin{aligned}
& \frac{1}{\sqrt{2}} \delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 U_{L,jb}^{u,*} \sum_{a=1}^3 U_{R,ia}^{u,*} Y_{u,ab} \left(-iZ_{k1}^H + Z_{k4}^H \right) + \sum_{b=1}^3 U_{L,jb}^{u,*} \sum_{a=1}^3 U_{R,ia}^{u,*} \epsilon_{u,ab} \left(-iZ_{k2}^H + Z_{k5}^H \right) \right) \left(\frac{1-\gamma_5}{2} \right) \quad (225) \\
& + -i \frac{1}{\sqrt{2}} e^{-i\eta} \delta_{\alpha\beta} \left(e^{i\eta} \sum_{b=1}^3 \sum_{a=1}^3 \epsilon_{u,ab}^* U_{R,ja}^u U_{L,ib}^u \left(-iZ_{k5}^H + Z_{k2}^H \right) + \sum_{b=1}^3 \sum_{a=1}^3 Y_{u,ab}^* U_{R,ja}^u U_{L,ib}^u \left(-iZ_{k4}^H + Z_{k1}^H \right) \right) \left(\frac{1+\gamma_5}{2} \right) \quad (226)
\end{aligned}$$



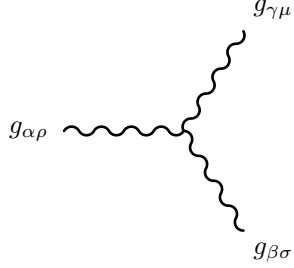
$$-i \delta_{\alpha\beta} \left(e^{-i\eta} \sum_{b=1}^3 U_{L,jb}^{u,*} \sum_{a=1}^3 U_{R,ia}^{d,*} Y_{d,ab} Z_{k1}^+ + \sum_{b=1}^3 U_{L,jb}^{u,*} \sum_{a=1}^3 U_{R,ia}^{d,*} \epsilon_{d,ab} Z_{k2}^+ \right) \left(\frac{1-\gamma_5}{2} \right) \quad (227)$$

$$+ i \delta_{\alpha\beta} \left(e^{-i\eta} \sum_{b=1}^3 \sum_{a=1}^3 Y_{u,ab}^* U_{R,ja}^u U_{L,ib}^d Z_{k1}^+ + \sum_{b=1}^3 \sum_{a=1}^3 \epsilon_{u,ab}^* U_{R,ja}^u U_{L,ib}^d Z_{k2}^+ \right) \left(\frac{1+\gamma_5}{2} \right) \quad (228)$$

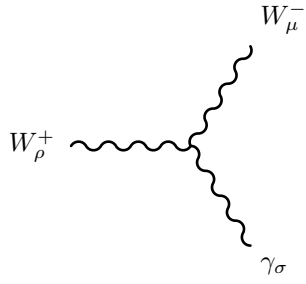


$$-i \left(e^{-i\eta} \sum_{a=1}^3 U_{R,ia}^{e,*} Y_{e,aj} Z_{k1}^+ + \sum_{a=1}^3 U_{R,ia}^{e,*} \epsilon_{e,aj} Z_{k2}^+ \right) \left(\frac{1-\gamma_5}{2} \right) \quad (229)$$

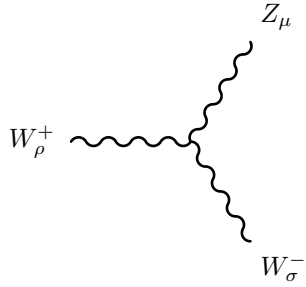
9.6 Three Vector Boson-Interaction



$$g_3 f_{\alpha,\beta,\gamma} \left(g_{\rho\mu} \left(-p_{\sigma}^{g_{\gamma\mu}} + p_{\sigma}^{g_{\alpha\rho}} \right) + g_{\rho\sigma} \left(-p_{\mu}^{g_{\alpha\rho}} + p_{\mu}^{g_{\beta\sigma}} \right) + g_{\sigma\mu} \left(-p_{\rho}^{g_{\beta\sigma}} + p_{\rho}^{g_{\gamma\mu}} \right) \right) \quad (230)$$

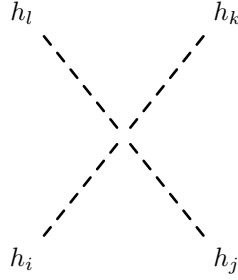


$$ig_2 \sin \Theta_W \left(g_{\rho\mu} \left(-p_{\sigma}^{W_{\mu}^{-}} + p_{\sigma}^{W_{\rho}^{+}} \right) + g_{\rho\sigma} \left(-p_{\mu}^{W_{\rho}^{+}} + p_{\mu}^{\gamma_{\sigma}} \right) + g_{\sigma\mu} \left(-p_{\rho}^{\gamma_{\sigma}} + p_{\rho}^{W_{\mu}^{-}} \right) \right) \quad (231)$$



$$-ig_2 \cos \Theta_W \left(g_{\rho\mu} \left(-p_{\sigma}^{Z_{\mu}} + p_{\sigma}^{W_{\rho}^{+}} \right) + g_{\rho\sigma} \left(-p_{\mu}^{W_{\rho}^{+}} + p_{\mu}^{W_{\sigma}^{-}} \right) + g_{\sigma\mu} \left(-p_{\rho}^{W_{\sigma}^{-}} + p_{\rho}^{Z_{\mu}} \right) \right) \quad (232)$$

9.7 Four Scalar-Interaction



$$\begin{aligned}
& \frac{1}{2} e^{-2i(\eta+2\zeta)} \left(3e^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l1}^H - 3e^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l1}^H \right. \\
& - e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l1}^H + e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l1}^H \\
& + e^{4i\zeta} l_5 Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l1}^H - e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l1}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l1}^H - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l1}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l1}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l1}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l1}^H - 2ie^{2i(\eta+2\zeta)} l_1 Z_{i4}^H Z_{j4}^H Z_{k1}^H Z_{l1}^H \\
& - ie^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l1}^H - ie^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l1}^H \\
& - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_3 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H - 2ie^{2i(\eta+2\zeta)} l_4 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H \\
& + ie^{4i\zeta} l_5 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H + ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l1}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l1}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l1}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l1}^H + 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l1}^H \\
& + 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l1}^H - e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l1}^H \\
& + e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l1}^H + e^{4i\zeta} l_5 Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l1}^H \\
& \left. - e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l1}^H - e^{4i\zeta} l_5 Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l1}^H \right)
\end{aligned}$$

$$\begin{aligned}
& + e^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l1}^H + e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j2}^H Z_{k2}^H Z_{l1}^H \\
& - e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j2}^H Z_{k2}^H Z_{l1}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l1}^H - ie^{4i\zeta} l_5 Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l1}^H \\
& - ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l1}^H - ie^{4i\zeta} l_5 Z_{i4}^H Z_{j5}^H Z_{k2}^H Z_{l1}^H \\
& - ie^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j5}^H Z_{k2}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j5}^H Z_{k2}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j5}^H Z_{k2}^H Z_{l1}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H \\
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k2}^H Z_{l1}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l1}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l1}^H - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l1}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l1}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l1}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H Z_{l1}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l1}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l1}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l1}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l1}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l1}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_1 Z_{i4}^H Z_{j1}^H Z_{k4}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j1}^H Z_{k4}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j1}^H Z_{k4}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j2}^H Z_{k4}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j2}^H Z_{k4}^H Z_{l1}^H - ie^{4i\zeta} l_5 Z_{i5}^H Z_{j2}^H Z_{k4}^H Z_{l1}^H \\
& - ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j2}^H Z_{k4}^H Z_{l1}^H + e^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j4}^H Z_{k4}^H Z_{l1}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j4}^H Z_{k4}^H Z_{l1}^H + e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j5}^H Z_{k4}^H Z_{l1}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j5}^H Z_{k4}^H Z_{l1}^H + e^{4i\zeta} l_5 Z_{i5}^H Z_{j5}^H Z_{k4}^H Z_{l1}^H \\
& - e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j5}^H Z_{k4}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H - 2ie^{2i(\eta+2\zeta)} l_3 Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_4 Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H + ie^{4i\zeta} l_5 Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H
\end{aligned}$$

$$\begin{aligned}
& + ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l1}^H - ie^{4i\zeta} l_5 Z_{i4}^H Z_{j2}^H Z_{k5}^H Z_{l1}^H \\
& - ie^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j2}^H Z_{k5}^H Z_{l1}^H - ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j2}^H Z_{k5}^H Z_{l1}^H \\
& - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j2}^H Z_{k5}^H Z_{l1}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H \\
& - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H \\
& + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k5}^H Z_{l1}^H + e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j4}^H Z_{k5}^H Z_{l1}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j4}^H Z_{k5}^H Z_{l1}^H + e^{4i\zeta} l_5 Z_{i5}^H Z_{j4}^H Z_{k5}^H Z_{l1}^H \\
& - e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j4}^H Z_{k5}^H Z_{l1}^H + e^{4i\zeta} l_5 Z_{i4}^H Z_{j5}^H Z_{k5}^H Z_{l1}^H \\
& - e^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j5}^H Z_{k5}^H Z_{l1}^H + 3e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j5}^H Z_{k5}^H Z_{l1}^H \\
& - 3e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j5}^H Z_{k5}^H Z_{l1}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H \\
& - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l1}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l1}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l1}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l1}^H \\
& + 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l1}^H + 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l1}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l1}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l1}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l1}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l1}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+4\zeta)}l_{3p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H + 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l1}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l1}^H - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{i(\eta+4\zeta)}l_{3p}Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H - 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{i(\eta+4\zeta)}l_{3p}Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H - 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i5}^HZ_{j6}^HZ_{k6}^HZ_{l1}^H \\
& - e^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j1}^HZ_{k1}^HZ_{l2}^H + e^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j1}^HZ_{k1}^HZ_{l2}^H \\
& + e^{4i\zeta}l_5Z_{i5}^HZ_{j1}^HZ_{k1}^HZ_{l2}^H - e^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j1}^HZ_{k1}^HZ_{l2}^H \\
& - e^{4i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k1}^HZ_{l2}^H + e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j2}^HZ_{k1}^HZ_{l2}^H \\
& + e^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j2}^HZ_{k1}^HZ_{l2}^H - e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j2}^HZ_{k1}^HZ_{l2}^H \\
& - 2ie^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k1}^HZ_{l2}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l2}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l2}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l2}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l2}^H \\
& - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j4}^H Z_{k1}^H Z_{l2}^H - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j4}^H Z_{k1}^H Z_{l2}^H \\
& - ie^{4i\zeta} l_5 Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l2}^H - ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l2}^H \\
& - ie^{4i\zeta} l_5 Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l2}^H - ie^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l2}^H \\
& - ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l2}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l2}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l2}^H \\
& - e^{4i\zeta} l_5 Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l2}^H + e^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l2}^H \\
& + e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l2}^H - e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l2}^H \\
& - 3e^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l2}^H + 3e^{3i\eta+4i\zeta} l_7^* Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l2}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l2}^H - 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l2}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j3}^H Z_{k2}^H Z_{l2}^H + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l2}^H \\
& - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j3}^H Z_{k2}^H Z_{l2}^H - 2ie^{2i(\eta+2\zeta)} l_3 Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_4 Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H + ie^{4i\zeta} l_5 Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H \\
& + ie^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H - ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H \\
& - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l2}^H - ie^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j5}^H Z_{k2}^H Z_{l2}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{3i\eta+4i\zeta}l_7^*Z_{i4}^HZ_{j5}^HZ_{k2}^HZ_{l2}^H - 2ie^{2i(\eta+2\zeta)}l_2Z_{i5}^HZ_{j5}^HZ_{k2}^HZ_{l2}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l2}^H - 4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l2}^H \\
& - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l2}^H + 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l2}^H \\
& + 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l2}^H - 2ie^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H \\
& - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j1}^HZ_{k3}^HZ_{l2}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l2}^H \\
& - 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l2}^H - 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l2}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j2}^HZ_{k3}^HZ_{l2}^H - 4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j2}^HZ_{k3}^HZ_{l2}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j3}^HZ_{k3}^HZ_{l2}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l2}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l2}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l2}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j1}^HZ_{k4}^HZ_{l2}^H - ie^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j1}^HZ_{k4}^HZ_{l2}^H \\
& - ie^{4i\zeta}l_5Z_{i5}^HZ_{j1}^HZ_{k4}^HZ_{l2}^H - ie^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j1}^HZ_{k4}^HZ_{l2}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_3Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H - 2ie^{2i(\eta+2\zeta)}l_4Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H \\
& + ie^{4i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H + ie^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H \\
& - ie^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H - ie^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j2}^HZ_{k4}^HZ_{l2}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l2}^H \\
& - 3e^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j4}^HZ_{k4}^HZ_{l2}^H + 3e^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j4}^HZ_{k4}^HZ_{l2}^H \\
& - e^{4i\zeta}l_5Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l2}^H + e^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l2}^H \\
& - e^{4i\zeta}l_5Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l2}^H + e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l2}^H \\
& - e^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l2}^H + e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l2}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H \\
& - 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H + 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l2}^H \\
& - ie^{4i\zeta}l_5Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l2}^H - ie^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l2}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l2}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j1}^H Z_{k5}^H Z_{l2}^H \\
& -ie^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j2}^H Z_{k5}^H Z_{l2}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i4}^H Z_{j2}^H Z_{k5}^H Z_{l2}^H \\
& -2ie^{2i(\eta+2\zeta)} l_2 Z_{i5}^H Z_{j2}^H Z_{k5}^H Z_{l2}^H - e^{4i\zeta} l_5 Z_{i4}^H Z_{j4}^H Z_{k5}^H Z_{l2}^H \\
& +e^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j4}^H Z_{k5}^H Z_{l2}^H - e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j4}^H Z_{k5}^H Z_{l2}^H \\
& +e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j4}^H Z_{k5}^H Z_{l2}^H - e^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j5}^H Z_{k5}^H Z_{l2}^H \\
& +e^{3i\eta+4i\zeta} l_7^* Z_{i4}^H Z_{j5}^H Z_{k5}^H Z_{l2}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H \\
& +2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H \\
& +2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H \\
& -2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H \\
& +2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l2}^H + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l2}^H \\
& -4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j2}^H Z_{k6}^H Z_{l2}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i6}^H Z_{j2}^H Z_{k6}^H Z_{l2}^H \\
& +4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j2}^H Z_{k6}^H Z_{l2}^H + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j2}^H Z_{k6}^H Z_{l2}^H \\
& -2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l2}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l2}^H \\
& -2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l2}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l2}^H \\
& -2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H \\
& -2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H
\end{aligned}$$

$$\begin{aligned}
& -2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H \\
& -2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l2}^H \\
& -4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j1}^H Z_{k1}^H Z_{l3}^H - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j1}^H Z_{k1}^H Z_{l3}^H \\
& -4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j1}^H Z_{k1}^H Z_{l3}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j1}^H Z_{k1}^H Z_{l3}^H \\
& -4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j1}^H Z_{k1}^H Z_{l3}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H \\
& -2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l3}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H \\
& -2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H \\
& + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l3}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H \\
& -2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H \\
& + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l3}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l3}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l3}^H \\
& -2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l3}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l3}^H \\
& -2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H \\
& - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H \\
& - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j1}^HZ_{k2}^HZ_{l3}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i3}^HZ_{j2}^HZ_{k2}^HZ_{l3}^H \\
& - 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j2}^HZ_{k2}^HZ_{l3}^H - 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j2}^HZ_{k2}^HZ_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j2}^HZ_{k2}^HZ_{l3}^H - 4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j2}^HZ_{k2}^HZ_{l3}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j3}^HZ_{k2}^HZ_{l3}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j4}^HZ_{k2}^HZ_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j6}^HZ_{k2}^HZ_{l3}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j6}^HZ_{k2}^HZ_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j6}^HZ_{k2}^HZ_{l3}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j6}^HZ_{k2}^HZ_{l3}^H \\
& + 2e^{i(\eta+4\zeta)}l_{3p}Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H \\
& - 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H - 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H + 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i5}^HZ_{j1}^HZ_{k3}^HZ_{l3}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i4}^HZ_{j2}^HZ_{k3}^HZ_{l3}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j2}^HZ_{k3}^HZ_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j2}^HZ_{k3}^HZ_{l3}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i4}^HZ_{j2}^HZ_{k3}^HZ_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l3}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H - 8ie^{2i(\eta+3\zeta)} l_{2pp} Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H \\
& - 12ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H - 2ie^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H \\
& - 8ie^{2i(\eta+\zeta)} l_{2pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H + 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H - 2e^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H \\
& - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l3}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i4}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i5}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H - 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k3}^H Z_{l3}^H + 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H - 2e^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H \\
& - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H + 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H + 2ie^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l3}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i4}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l3}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j4}^H Z_{k4}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j4}^H Z_{k4}^H Z_{l3}^H - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j4}^H Z_{k4}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j4}^H Z_{k4}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j4}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l3}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i5}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H - 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j3}^H Z_{k5}^H Z_{l3}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k5}^H Z_{l3}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i3}^H Z_{j5}^H Z_{k5}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i3}^H Z_{j5}^H Z_{k5}^H Z_{l3}^H - 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j5}^H Z_{k5}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j5}^H Z_{k5}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j5}^H Z_{k5}^H Z_{l3}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j6}^H Z_{k5}^H Z_{l3}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j1}^H Z_{k6}^H Z_{l3}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j1}^H Z_{k6}^H Z_{l3}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j1}^H Z_{k6}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j1}^H Z_{k6}^H Z_{l3}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j2}^H Z_{k6}^H Z_{l3}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j2}^H Z_{k6}^H Z_{l3}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j2}^H Z_{k6}^H Z_{l3}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j2}^H Z_{k6}^H Z_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& + 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i3}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H \\
& - 2e^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i3}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H \\
& + 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H - 4ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i6}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H \\
& + 2ie^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j3}^H Z_{k6}^H Z_{l3}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l3}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H \\
& - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k6}^H Z_{l3}^H + 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H + 2ie^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H \\
& - 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H \\
& + 2e^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l3}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_1 Z_{i4}^H Z_{j1}^H Z_{k1}^H Z_{l4}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l4}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l4}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l4}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l4}^H - ie^{4i\zeta} l_5 Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l4}^H \\
& - ie^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l4}^H + e^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l4}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l4}^H + e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l4}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l4}^H + e^{4i\zeta} l_5 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l4}^H \\
& - e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l4}^H - ie^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l4}^H \\
& - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l4}^H - ie^{4i\zeta} l_5 Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l4}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j1}^HZ_{k2}^HZ_{l4}^H - 2ie^{2i(\eta+2\zeta)}l_3Z_{i4}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_4Z_{i4}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H + ie^{4i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H \\
& + ie^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H - ie^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H \\
& - ie^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j2}^HZ_{k2}^HZ_{l4}^H - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H \\
& - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H \\
& + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H \\
& - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H \\
& + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k2}^HZ_{l4}^H - 3e^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j4}^HZ_{k2}^HZ_{l4}^H \\
& + 3e^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j4}^HZ_{k2}^HZ_{l4}^H - e^{4i\zeta}l_5Z_{i5}^HZ_{j4}^HZ_{k2}^HZ_{l4}^H \\
& + e^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j4}^HZ_{k2}^HZ_{l4}^H - e^{4i\zeta}l_5Z_{i4}^HZ_{j5}^HZ_{k2}^HZ_{l4}^H \\
& + e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j5}^HZ_{k2}^HZ_{l4}^H - e^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j5}^HZ_{k2}^HZ_{l4}^H \\
& + e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j5}^HZ_{k2}^HZ_{l4}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H \\
& + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H - 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H \\
& + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H \\
& + 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^HZ_{l4}^H - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H \\
& - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H \\
& + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H \\
& - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j2}^HZ_{k3}^HZ_{l4}^H
\end{aligned}$$

$$\begin{aligned}
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k3}^H Z_{l4}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l4}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j4}^H Z_{k3}^H Z_{l4}^H - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j4}^H Z_{k3}^H Z_{l4}^H \\
& - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j4}^H Z_{k3}^H Z_{l4}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j4}^H Z_{k3}^H Z_{l4}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j4}^H Z_{k3}^H Z_{l4}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k3}^H Z_{l4}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k3}^H Z_{l4}^H + e^{i(\eta+4\zeta)} l_6 Z_{i5}^H Z_{j1}^H Z_{k4}^H Z_{l4}^H \\
& - e^{3i\eta+4i\zeta} l_6^* Z_{i5}^H Z_{j1}^H Z_{k4}^H Z_{l4}^H - 3e^{i(\eta+4\zeta)} l_6 Z_{i4}^H Z_{j2}^H Z_{k4}^H Z_{l4}^H \\
& + 3e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j2}^H Z_{k4}^H Z_{l4}^H - e^{4i\zeta} l_5 Z_{i5}^H Z_{j2}^H Z_{k4}^H Z_{l4}^H \\
& + e^{4i(\eta+\zeta)} l_5^* Z_{i5}^H Z_{j2}^H Z_{k4}^H Z_{l4}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i3}^H Z_{j3}^H Z_{k4}^H Z_{l4}^H \\
& - 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j3}^H Z_{k4}^H Z_{l4}^H - 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j3}^H Z_{k4}^H Z_{l4}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j3}^H Z_{k4}^H Z_{l4}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j3}^H Z_{k4}^H Z_{l4}^H
\end{aligned}$$

$$\begin{aligned}
& -6ie^{2i(\eta+2\zeta)}l_1Z_{i4}^HZ_{j4}^HZ_{k4}^HZ_{l4}^H - 3ie^{i(\eta+4\zeta)}l_6Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l4}^H \\
& - 3ie^{3i\eta+4i\zeta}l_6^*Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l4}^H - 3ie^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H \\
& - 3ie^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H - 2ie^{2i(\eta+2\zeta)}l_3Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_4Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H - ie^{4i\zeta}l_5Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H \\
& - ie^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l4}^H + 4e^{2i(\eta+3\zeta)}l_{4p}Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l4}^H \\
& - 4e^{2i(\eta+\zeta)}l_{4p}^*Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l4}^H - 4ie^{2i(\eta+2\zeta)}l_{1p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l4}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{4p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l4}^H + 4ie^{2i(\eta+\zeta)}l_{4p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l4}^H \\
& + e^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l4}^H - e^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l4}^H \\
& + e^{4i\zeta}l_5Z_{i5}^HZ_{j1}^HZ_{k5}^HZ_{l4}^H - e^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j1}^HZ_{k5}^HZ_{l4}^H \\
& - e^{4i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k5}^HZ_{l4}^H + e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j2}^HZ_{k5}^HZ_{l4}^H \\
& - e^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j2}^HZ_{k5}^HZ_{l4}^H + e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j2}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H \\
& + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l4}^H \\
& - 3ie^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H - 3ie^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_3Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H - 2ie^{2i(\eta+2\zeta)}l_4Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H \\
& - ie^{4i\zeta}l_5Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H - ie^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_3Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H - 2ie^{2i(\eta+2\zeta)}l_4Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H
\end{aligned}$$

$$\begin{aligned}
& -ie^{4i\zeta}l_5Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H - ie^{4i\left(\eta+\zeta\right)}l_5^*Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H \\
& - 3ie^{i\left(\eta+4\zeta\right)}l_7Z_{i5}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H - 3ie^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j5}^HZ_{k5}^HZ_{l4}^H \\
& + 2e^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i3}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H + 2e^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i3}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H - 2e^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{i\left(\eta+4\zeta\right)}l_{3p}Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H + 2ie^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H \\
& + 2ie^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H \\
& + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H + 2ie^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k5}^HZ_{l4}^H \\
& - 2ie^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i3}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H + 2ie^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i3}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H + 2ie^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i3}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{i\left(\eta+4\zeta\right)}l_{3p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H + 2e^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H + 2e^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i6}^HZ_{j2}^HZ_{k6}^HZ_{l4}^H \\
& + 4e^{2i\left(\eta+3\zeta\right)}l_{4p}Z_{i4}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H - 4e^{2i\left(\eta+\zeta\right)}l_{4p}^*Z_{i4}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H \\
& + 2e^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H + 2e^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H - 2e^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i5}^HZ_{j3}^HZ_{k6}^HZ_{l4}^H \\
& + 4e^{2i\left(\eta+3\zeta\right)}l_{4p}Z_{i3}^HZ_{j4}^HZ_{k6}^HZ_{l4}^H - 4e^{2i\left(\eta+\zeta\right)}l_{4p}^*Z_{i3}^HZ_{j4}^HZ_{k6}^HZ_{l4}^H \\
& - 4ie^{2i\left(\eta+2\zeta\right)}l_{1p}Z_{i6}^HZ_{j4}^HZ_{k6}^HZ_{l4}^H + 4ie^{2i\left(\eta+3\zeta\right)}l_{4p}Z_{i6}^HZ_{j4}^HZ_{k6}^HZ_{l4}^H \\
& + 4ie^{2i\left(\eta+\zeta\right)}l_{4p}^*Z_{i6}^HZ_{j4}^HZ_{k6}^HZ_{l4}^H + 2e^{i\left(\eta+6\zeta\right)}l_{6p}Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l4}^H \\
& + 2e^{3i\left(\eta+2\zeta\right)}l_{7p}Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l4}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{i\left(\eta+2\zeta\right)}l_{7p}^*Z_{i3}^HZ_{j5}^HZ_{k6}^HZ_{l4}^H - 2ie^{i\left(\eta+4\zeta\right)}l_{3p}Z_{i6}^HZ_{j5}^HZ_{k6}^HZ_{l4}^H
\end{aligned}$$

$$\begin{aligned}
& + 2ie^i(\eta+6\zeta) l_{6p} Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l4}^H + 2ie^{3i}(\eta+2\zeta) l_{7p} Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l4}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l4}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l4}^H \\
& + 2ie^i(\eta+2\zeta) l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l4}^H - 4ie^{2i}(\eta+2\zeta) l_{1p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H \\
& + 4ie^{2i}(\eta+3\zeta) l_{4p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H + 4ie^{2i}(\eta+\zeta) l_{4p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H \\
& - 2ie^i(\eta+4\zeta) l_{3p} Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H + 2ie^i(\eta+6\zeta) l_{6p} Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H \\
& + 2ie^{3i}(\eta+2\zeta) l_{7p} Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H + 2ie^i(\eta+2\zeta) l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l4}^H \\
& - ie^i(\eta+4\zeta) l_6 Z_{i4}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H - ie^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H \\
& - 2ie^{2i}(\eta+2\zeta) l_3 Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H - 2ie^{2i}(\eta+2\zeta) l_4 Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H \\
& + ie^{4i\zeta} l_5 Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H + ie^{4i}(\eta+\zeta) l_5^* Z_{i5}^H Z_{j1}^H Z_{k1}^H Z_{l5}^H \\
& - ie^{4i\zeta} l_5 Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l5}^H - ie^{4i}(\eta+\zeta) l_5^* Z_{i4}^H Z_{j2}^H Z_{k1}^H Z_{l5}^H \\
& - ie^i(\eta+4\zeta) l_7 Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l5}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j2}^H Z_{k1}^H Z_{l5}^H \\
& + 2e^i(\eta+4\zeta) l_{3p} Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H + 2e^i(\eta+6\zeta) l_{6p} Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H \\
& - 2e^{3i}(\eta+2\zeta) l_{7p} Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H + 2e^i(\eta+2\zeta) l_{7p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H \\
& + 2ie^i(\eta+6\zeta) l_{6p} Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H - 2ie^{3i}(\eta+2\zeta) l_{7p} Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H - 2ie^i(\eta+2\zeta) l_{7p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^H Z_{l5}^H \\
& + e^i(\eta+4\zeta) l_6 Z_{i4}^H Z_{j4}^H Z_{k1}^H Z_{l5}^H - e^{3i\eta+4i\zeta} l_6^* Z_{i4}^H Z_{j4}^H Z_{k1}^H Z_{l5}^H \\
& + e^{4i\zeta} l_5 Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l5}^H - e^{4i}(\eta+\zeta) l_5^* Z_{i5}^H Z_{j4}^H Z_{k1}^H Z_{l5}^H \\
& + e^{4i\zeta} l_5 Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l5}^H - e^{4i}(\eta+\zeta) l_5^* Z_{i4}^H Z_{j5}^H Z_{k1}^H Z_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& + 3e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l5}^H - 3e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j5}^H Z_{k1}^H Z_{l5}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H \\
& + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^H Z_{l5}^H \\
& - ie^{4i\zeta} l_5 Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l5}^H - ie^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j1}^H Z_{k2}^H Z_{l5}^H \\
& - ie^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l5}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j1}^H Z_{k2}^H Z_{l5}^H \\
& - ie^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l5}^H - ie^{3i\eta+4i\zeta} l_7^* Z_{i4}^H Z_{j2}^H Z_{k2}^H Z_{l5}^H \\
& - 2ie^{2i(\eta+2\zeta)} l_2 Z_{i5}^H Z_{j2}^H Z_{k2}^H Z_{l5}^H - e^{4i\zeta} l_5 Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l5}^H \\
& + e^{4i(\eta+\zeta)} l_5^* Z_{i4}^H Z_{j4}^H Z_{k2}^H Z_{l5}^H - e^{i(\eta+4\zeta)} l_7 Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l5}^H \\
& + e^{3i\eta+4i\zeta} l_7^* Z_{i5}^H Z_{j4}^H Z_{k2}^H Z_{l5}^H - e^{i(\eta+4\zeta)} l_7 Z_{i4}^H Z_{j5}^H Z_{k2}^H Z_{l5}^H \\
& + e^{3i\eta+4i\zeta} l_7^* Z_{i4}^H Z_{j5}^H Z_{k2}^H Z_{l5}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H \\
& - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H \\
& + 2e^{i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k3}^H Z_{l5}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i5}^H Z_{j3}^H Z_{k3}^H Z_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i5}^HZ_{j3}^HZ_{k3}^HZ_{l5}^H - 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i5}^HZ_{j3}^HZ_{k3}^HZ_{l5}^H \\
& -2ie^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H - 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H \\
& -2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H \\
& -2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H - 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H \\
& +2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H \\
& -2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j4}^HZ_{k3}^HZ_{l5}^H \\
& -4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i3}^HZ_{j5}^HZ_{k3}^HZ_{l5}^H - 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j5}^HZ_{k3}^HZ_{l5}^H \\
& -4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j5}^HZ_{k3}^HZ_{l5}^H + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j5}^HZ_{k3}^HZ_{l5}^H \\
& -4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j5}^HZ_{k3}^HZ_{l5}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H \\
& +2e^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H \\
& -2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i5}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H \\
& -4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i5}^HZ_{j6}^HZ_{k3}^HZ_{l5}^H + e^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j1}^HZ_{k4}^HZ_{l5}^H \\
& -e^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j1}^HZ_{k4}^HZ_{l5}^H + e^{4i\zeta}l_5Z_{i5}^HZ_{j1}^HZ_{k4}^HZ_{l5}^H \\
& -e^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j1}^HZ_{k4}^HZ_{l5}^H - e^{4i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l5}^H \\
& +e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j2}^HZ_{k4}^HZ_{l5}^H - e^{i(\eta+4\zeta)}l_7Z_{i5}^HZ_{j2}^HZ_{k4}^HZ_{l5}^H \\
& +e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j2}^HZ_{k4}^HZ_{l5}^H - 2ie^{i(\eta+4\zeta)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H \\
& -2ie^{i(\eta+6\zeta)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H - 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H \\
& -2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H - 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H \\
& -2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H \\
& +2e^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H \\
& -2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k4}^HZ_{l5}^H - 3ie^{i(\eta+4\zeta)}l_6Z_{i4}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& -3ie^{3i\eta+4i\zeta}l_6^*Z_{i4}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H - 2ie^{2i(\eta+2\zeta)}l_3Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_4Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H - ie^{4i\zeta}l_5Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H \\
& - ie^{4i(\eta+\zeta)}l_5^*Z_{i5}^HZ_{j4}^HZ_{k4}^HZ_{l5}^H - 2ie^{2i(\eta+2\zeta)}l_3Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_4Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H - ie^{4i\zeta}l_5Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H \\
& - ie^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H - 3ie^i(\eta+4\zeta)l_7Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H \\
& - 3ie^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j5}^HZ_{k4}^HZ_{l5}^H + 2e^i(\eta+6\zeta)l_{6p}Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H \\
& - 2e^i(\eta+2\zeta)l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H - 2ie^i(\eta+4\zeta)l_{3p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H \\
& + 2ie^i(\eta+6\zeta)l_{6p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H \\
& + 2ie^i(\eta+2\zeta)l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k4}^HZ_{l5}^H + e^{4i\zeta}l_5Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l5}^H \\
& - e^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j1}^HZ_{k5}^HZ_{l5}^H + 3e^i(\eta+4\zeta)l_7Z_{i5}^HZ_{j1}^HZ_{k5}^HZ_{l5}^H \\
& - 3e^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j1}^HZ_{k5}^HZ_{l5}^H - e^i(\eta+4\zeta)l_7Z_{i4}^HZ_{j2}^HZ_{k5}^HZ_{l5}^H \\
& + e^{3i\eta+4i\zeta}l_7^*Z_{i4}^HZ_{j2}^HZ_{k5}^HZ_{l5}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l5}^H \\
& - 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l5}^H - 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j3}^HZ_{k5}^HZ_{l5}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l5}^H - 4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j3}^HZ_{k5}^HZ_{l5}^H \\
& - 2ie^{2i(\eta+2\zeta)}l_3Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H - 2ie^{2i(\eta+2\zeta)}l_4Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H \\
& - ie^{4i\zeta}l_5Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H - ie^{4i(\eta+\zeta)}l_5^*Z_{i4}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H \\
& - 3ie^i(\eta+4\zeta)l_7Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H - 3ie^{3i\eta+4i\zeta}l_7^*Z_{i5}^HZ_{j4}^HZ_{k5}^HZ_{l5}^H \\
& - 3ie^i(\eta+4\zeta)l_7Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l5}^H - 3ie^{3i\eta+4i\zeta}l_7^*Z_{i4}^HZ_{j5}^HZ_{k5}^HZ_{l5}^H \\
& - 6ie^{2i(\eta+2\zeta)}l_2Z_{i5}^HZ_{j5}^HZ_{k5}^HZ_{l5}^H + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j6}^HZ_{k5}^HZ_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& -4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j6}^H Z_{k5}^H Z_{l5}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l5}^H \\
& + 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l5}^H + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j6}^H Z_{k5}^H Z_{l5}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H \\
& + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k6}^H Z_{l5}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j3}^H Z_{k6}^H Z_{l5}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k6}^H Z_{l5}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i3}^H Z_{j5}^H Z_{k6}^H Z_{l5}^H - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j5}^H Z_{k6}^H Z_{l5}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l5}^H + 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l5}^H \\
& + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j5}^H Z_{k6}^H Z_{l5}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H \\
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& + 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j6}^H Z_{k6}^H Z_{l5}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j1}^H Z_{k1}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j1}^H Z_{k1}^H Z_{l6}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i6}^H Z_{j1}^H Z_{k1}^H Z_{l6}^H + 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j1}^H Z_{k1}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j1}^H Z_{k1}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H \\
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k1}^H Z_{l6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l6}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l6}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k1}^H Z_{l6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H \\
& - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H \\
& - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k1}^H Z_{l6}^H + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H \\
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k2}^H Z_{l6}^H + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i3}^H Z_{j2}^H Z_{k2}^H Z_{l6}^H \\
& - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i3}^H Z_{j2}^H Z_{k2}^H Z_{l6}^H - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i6}^H Z_{j2}^H Z_{k2}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i6}^H Z_{j2}^H Z_{k2}^H Z_{l6}^H + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i6}^H Z_{j2}^H Z_{k2}^H Z_{l6}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k2}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k2}^H Z_{l6}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k2}^H Z_{l6}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j4}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j6}^H Z_{k2}^H Z_{l6}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j1}^H Z_{k3}^H Z_{l6}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j1}^H Z_{k3}^H Z_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j1}^H Z_{k3}^H Z_{l6}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j1}^H Z_{k3}^H Z_{l6}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l6}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j2}^H Z_{k3}^H Z_{l6}^H \\
& + 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H \\
& - 2e^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i3}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& + 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H - 4ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H \\
& + 2ie^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j3}^H Z_{k3}^H Z_{l6}^H + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H \\
& - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j4}^H Z_{k3}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H \\
& - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k3}^H Z_{l6}^H + 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H + 2ie^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H \\
& - 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H \\
& + 2e^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i6}^H Z_{j6}^H Z_{k3}^H Z_{l6}^H \\
& - 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H + 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H + 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j2}^H Z_{k4}^H Z_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j3}^H Z_{k4}^H Z_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{4p} Z_{i3}^H Z_{j4}^H Z_{k4}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{4p}^* Z_{i3}^H Z_{j4}^H Z_{k4}^H Z_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& -4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i6}^H Z_{j4}^H Z_{k4}^H Z_{l6}^H + 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i6}^H Z_{j4}^H Z_{k4}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i6}^H Z_{j4}^H Z_{k4}^H Z_{l6}^H + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j5}^H Z_{k4}^H Z_{l6}^H - 4ie^{2i(\eta+2\zeta)} l_{1p} Z_{i4}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+3\zeta)} l_{4p} Z_{i4}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H + 4ie^{2i(\eta+\zeta)} l_{4p}^* Z_{i4}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H - 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H - 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H \\
& + 2e^{i(\eta+4\zeta)} l_{3p} Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H - 2e^{i(\eta+6\zeta)} l_{6p} Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H - 2e^{3i\eta+4i\zeta} l_{3p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H \\
& + 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i6}^H Z_{j1}^H Z_{k5}^H Z_{l6}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H - 4e^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j3}^H Z_{k5}^H Z_{l6}^H \\
& + 2e^{i(\eta+6\zeta)} l_{6p} Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l6}^H + 2e^{3i(\eta+2\zeta)} l_{7p} Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l6}^H \\
& - 2e^{3i\eta+2i\zeta} l_{6p}^* Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{7p}^* Z_{i3}^H Z_{j4}^H Z_{k5}^H Z_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+4\zeta)}l_{3p}Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H + 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H \\
& + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i6}^HZ_{j4}^HZ_{k5}^HZ_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{5p}Z_{i3}^HZ_{j5}^HZ_{k5}^HZ_{l6}^H - 4e^{2i(\eta+\zeta)}l_{5p}^*Z_{i3}^HZ_{j5}^HZ_{k5}^HZ_{l6}^H \\
& - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i6}^HZ_{j5}^HZ_{k5}^HZ_{l6}^H + 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i6}^HZ_{j5}^HZ_{k5}^HZ_{l6}^H \\
& + 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i6}^HZ_{j5}^HZ_{k5}^HZ_{l6}^H - 2ie^{i(\eta+4\zeta)}l_{3p}Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H \\
& + 2ie^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H + 2ie^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{3p}^*Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H + 2ie^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H \\
& + 2ie^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H - 4ie^{2i(\eta+2\zeta)}l_{2p}Z_{i5}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{5p}Z_{i5}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H + 4ie^{2i(\eta+\zeta)}l_{5p}^*Z_{i5}^HZ_{j6}^HZ_{k5}^HZ_{l6}^H \\
& + 2e^{i(\eta+4\zeta)}l_{3p}Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H - 2e^{i(\eta+6\zeta)}l_{6p}Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H \\
& + 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H - 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H \\
& + 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H - 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i5}^HZ_{j1}^HZ_{k6}^HZ_{l6}^H \\
& - 2e^{i(\eta+4\zeta)}l_{3p}Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H + 2e^{i(\eta+6\zeta)}l_{6p}Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H \\
& - 2e^{3i(\eta+2\zeta)}l_{7p}Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H + 2e^{3i\eta+4i\zeta}l_{3p}^*Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H \\
& - 2e^{3i\eta+2i\zeta}l_{6p}^*Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H + 2e^{i(\eta+2\zeta)}l_{7p}^*Z_{i4}^HZ_{j2}^HZ_{k6}^HZ_{l6}^H \\
& + 2ie^{2i(\eta+4\zeta)}l_{1pp}Z_{i3}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H - 4ie^{2i(\eta+2\zeta)}l_{3pp}Z_{i3}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H \\
& + 2ie^{2i\eta}l_{1pp}^*Z_{i3}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H - 2e^{2i(\eta+4\zeta)}l_{1pp}Z_{i6}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)}l_{2pp}Z_{i6}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H + 2e^{2i\eta}l_{1pp}^*Z_{i6}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H \\
& - 4e^{2i(\eta+\zeta)}l_{2pp}^*Z_{i6}^HZ_{j3}^HZ_{k6}^HZ_{l6}^H - 4ie^{2i(\eta+2\zeta)}l_{1p}Z_{i4}^HZ_{j4}^HZ_{k6}^HZ_{l6}^H \\
& + 4ie^{2i(\eta+3\zeta)}l_{4p}Z_{i4}^HZ_{j4}^HZ_{k6}^HZ_{l6}^H + 4ie^{2i(\eta+\zeta)}l_{4p}^*Z_{i4}^HZ_{j4}^HZ_{k6}^HZ_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+4\zeta)} l_{3p} Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i5}^H Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{3p} Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+6\zeta)} l_{6p} Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i(\eta+2\zeta)} l_{7p} Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H - 2ie^{3i\eta+4i\zeta} l_{3p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i\eta+2i\zeta} l_{6p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+2\zeta)} l_{7p}^* Z_{i4}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{2p} Z_{i5}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H + 4ie^{2i(\eta+3\zeta)} l_{5p} Z_{i5}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+\zeta)} l_{5p}^* Z_{i5}^H Z_{j5}^H Z_{k6}^H Z_{l6}^H - 2e^{2i(\eta+4\zeta)} l_{1pp} Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H \\
& + 4e^{2i(\eta+3\zeta)} l_{2pp} Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H + 2e^{2i\eta} l_{1pp}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H \\
& - 4e^{2i(\eta+\zeta)} l_{2pp}^* Z_{i3}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H - 2ie^{2i(\eta+4\zeta)} l_{1pp} Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H \\
& + 8ie^{2i(\eta+3\zeta)} l_{2pp} Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H - 12ie^{2i(\eta+2\zeta)} l_{3pp} Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H \\
& - 2ie^{2i\eta} l_{1pp}^* Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H + 8ie^{2i(\eta+\zeta)} l_{2pp}^* Z_{i6}^H Z_{j6}^H Z_{k6}^H Z_{l6}^H \\
& + e^{2i\zeta} Z_{i2}^H \left(-e^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k1}^H Z_{l1}^H + e^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k1}^H Z_{l1}^H + e^{2i\zeta} l_5 Z_{j5}^H Z_{k1}^H Z_{l1}^H \right. \\
& - e^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k1}^H Z_{l1}^H - e^{2i\zeta} l_5 Z_{j4}^H Z_{k2}^H Z_{l1}^H + e^{2i(2\eta+\zeta)} l_5^* Z_{j4}^H Z_{k2}^H Z_{l1}^H \\
& \left. + e^{i(\eta+2\zeta)} l_7 Z_{j5}^H Z_{k2}^H Z_{l1}^H - e^{3i\eta+2i\zeta} l_7^* Z_{j5}^H Z_{k2}^H Z_{l1}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{j3}^H Z_{k3}^H Z_{l1}^H \right. \\
& - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j3}^H Z_{k3}^H Z_{l1}^H - 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{j3}^H Z_{k3}^H Z_{l1}^H - 2ie^{3i\eta} l_{6p}^* Z_{j3}^H Z_{k3}^H Z_{l1}^H - 2ie^{i\eta} l_{7p}^* Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& \left. + 2e^{i(\eta+4\zeta)} l_{6p} Z_{j6}^H Z_{k3}^H Z_{l1}^H + 2e^{3i\eta+4i\zeta} l_{7p} Z_{j6}^H Z_{k3}^H Z_{l1}^H - 2e^{3i\eta} l_{6p}^* Z_{j6}^H Z_{k3}^H Z_{l1}^H \right. \\
& - 2e^{i\eta} l_{7p}^* Z_{j6}^H Z_{k3}^H Z_{l1}^H - ie^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k4}^H Z_{l1}^H - ie^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k4}^H Z_{l1}^H \\
& \left. - ie^{2i\zeta} l_5 Z_{j5}^H Z_{k4}^H Z_{l1}^H - ie^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k4}^H Z_{l1}^H - ie^{2i\zeta} l_5 Z_{j4}^H Z_{k5}^H Z_{l1}^H \right)
\end{aligned}$$

$$\begin{aligned}
& -ie^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k5}^HZ_{l1}^H - ie^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k5}^HZ_{l1}^H \\
& -ie^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k5}^HZ_{l1}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k6}^HZ_{l1}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k6}^HZ_{l1}^H \\
& - 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k6}^HZ_{l1}^H - 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k6}^HZ_{l1}^H - 2ie^{i(\eta+2\zeta)}l_{3p}Z_{j6}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k6}^HZ_{l1}^H + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k6}^HZ_{l1}^H - 2ie^{3i\eta+2i\zeta}l_{3p}^*Z_{j6}^HZ_{k6}^HZ_{l1}^H \\
& + 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k6}^HZ_{l1}^H + 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k6}^HZ_{l1}^H - e^{2i\zeta}l_5Z_{j4}^HZ_{k1}^HZ_{l2}^H \\
& + e^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k1}^HZ_{l2}^H + e^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k1}^HZ_{l2}^H - e^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k1}^HZ_{l2}^H \\
& - 3e^{i(\eta+2\zeta)}l_7Z_{j4}^HZ_{k2}^HZ_{l2}^H + 3e^{3i\eta+2i\zeta}l_7^*Z_{j4}^HZ_{k2}^HZ_{l2}^H - 4ie^{2i(\eta+\zeta)}l_{2p}Z_{j3}^HZ_{k3}^HZ_{l2}^H \\
& - 4ie^{2i(\eta+2\zeta)}l_{5p}Z_{j3}^HZ_{k3}^HZ_{l2}^H - 4ie^{2i\eta}l_{5p}^*Z_{j3}^HZ_{k3}^HZ_{l2}^H + 4e^{2i(\eta+2\zeta)}l_{5p}Z_{j6}^HZ_{k3}^HZ_{l2}^H \\
& - 4e^{2i\eta}l_{5p}^*Z_{j6}^HZ_{k3}^HZ_{l2}^H - 2ie^{2i(\eta+\zeta)}l_3Z_{j4}^HZ_{k4}^HZ_{l2}^H - 2ie^{2i(\eta+\zeta)}l_4Z_{j4}^HZ_{k4}^HZ_{l2}^H \\
& + ie^{2i\zeta}l_5Z_{j4}^HZ_{k4}^HZ_{l2}^H + ie^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k4}^HZ_{l2}^H - ie^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k4}^HZ_{l2}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k4}^HZ_{l2}^H - ie^{i(\eta+2\zeta)}l_7Z_{j4}^HZ_{k5}^HZ_{l2}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j4}^HZ_{k5}^HZ_{l2}^H - 2ie^{2i(\eta+\zeta)}l_2Z_{j5}^HZ_{k5}^HZ_{l2}^H + 4e^{2i(\eta+2\zeta)}l_{5p}Z_{j3}^HZ_{k6}^HZ_{l2}^H \\
& - 4e^{2i\eta}l_{5p}^*Z_{j3}^HZ_{k6}^HZ_{l2}^H - 4ie^{2i(\eta+\zeta)}l_{2p}Z_{j6}^HZ_{k6}^HZ_{l2}^H + 4ie^{2i(\eta+2\zeta)}l_{5p}Z_{j6}^HZ_{k6}^HZ_{l2}^H \\
& + 4ie^{2i\eta}l_{5p}^*Z_{j6}^HZ_{k6}^HZ_{l2}^H - 2ie^{i(\eta+2\zeta)}l_{3p}Z_{j3}^HZ_{k1}^HZ_{l3}^H - 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k1}^HZ_{l3}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k1}^HZ_{l3}^H - 2ie^{3i\eta+2i\zeta}l_{3p}^*Z_{j3}^HZ_{k1}^HZ_{l3}^H - 2ie^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k1}^HZ_{l3}^H \\
& - 2ie^{i\eta}l_{7p}^*Z_{j3}^HZ_{k1}^HZ_{l3}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k1}^HZ_{l3}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k1}^HZ_{l3}^H \\
& - 2e^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k1}^HZ_{l3}^H - 2e^{i\eta}l_{7p}^*Z_{j6}^HZ_{k1}^HZ_{l3}^H - 4ie^{2i(\eta+\zeta)}l_{2p}Z_{j3}^HZ_{k2}^HZ_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)}l_{5p}Z_{j3}^HZ_{k2}^HZ_{l3}^H - 4ie^{2i\eta}l_{5p}^*Z_{j3}^HZ_{k2}^HZ_{l3}^H + 4e^{2i(\eta+2\zeta)}l_{5p}Z_{j6}^HZ_{k2}^HZ_{l3}^H \\
& - 4e^{2i\eta}l_{5p}^*Z_{j6}^HZ_{k2}^HZ_{l3}^H - 2e^{i(\eta+2\zeta)}l_{3p}Z_{j4}^HZ_{k3}^HZ_{l3}^H - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j4}^HZ_{k3}^HZ_{l3}^H \\
& + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j4}^HZ_{k3}^HZ_{l3}^H + 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j4}^HZ_{k3}^HZ_{l3}^H + 2e^{3i\eta}l_{6p}^*Z_{j4}^HZ_{k3}^HZ_{l3}^H \\
& - 2e^{i\eta}l_{7p}^*Z_{j4}^HZ_{k3}^HZ_{l3}^H - 2e^{i(\eta+2\zeta)}l_{3p}Z_{j3}^HZ_{k4}^HZ_{l3}^H - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k4}^HZ_{l3}^H \\
& + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k4}^HZ_{l3}^H + 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j3}^HZ_{k4}^HZ_{l3}^H + 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k4}^HZ_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& -2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k4}^HZ_{l3}^H - 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k4}^HZ_{l3}^H + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k4}^HZ_{l3}^H \\
& - 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k4}^HZ_{l3}^H + 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k4}^HZ_{l3}^H - 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j4}^HZ_{k6}^HZ_{l3}^H \\
& + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j4}^HZ_{k6}^HZ_{l3}^H - 2ie^{3i\eta}l_{6p}^*Z_{j4}^HZ_{k6}^HZ_{l3}^H + 2ie^{i\eta}l_{7p}^*Z_{j4}^HZ_{k6}^HZ_{l3}^H \\
& - ie^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k1}^HZ_{l4}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k1}^HZ_{l4}^H - ie^{2i\zeta}l_5Z_{j5}^HZ_{k1}^HZ_{l4}^H \\
& - ie^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k1}^HZ_{l4}^H - 2ie^{2i(\eta+\zeta)}l_3Z_{j4}^HZ_{k2}^HZ_{l4}^H - 2ie^{2i(\eta+\zeta)}l_4Z_{j4}^HZ_{k2}^HZ_{l4}^H \\
& + ie^{2i\zeta}l_5Z_{j4}^HZ_{k2}^HZ_{l4}^H + ie^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k2}^HZ_{l4}^H - ie^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k2}^HZ_{l4}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k2}^HZ_{l4}^H - 2e^{i(\eta+2\zeta)}l_{3p}Z_{j3}^HZ_{k3}^HZ_{l4}^H \\
& - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k3}^HZ_{l4}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k3}^HZ_{l4}^H + 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j3}^HZ_{k3}^HZ_{l4}^H \\
& + 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k3}^HZ_{l4}^H - 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k3}^HZ_{l4}^H - 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k3}^HZ_{l4}^H \\
& + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k3}^HZ_{l4}^H - 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k3}^HZ_{l4}^H + 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k3}^HZ_{l4}^H \\
& - 3e^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k4}^HZ_{l4}^H + 3e^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k4}^HZ_{l4}^H - e^{2i\zeta}l_5Z_{j5}^HZ_{k4}^HZ_{l4}^H \\
& + e^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k4}^HZ_{l4}^H - e^{2i\zeta}l_5Z_{j4}^HZ_{k5}^HZ_{l4}^H + e^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k5}^HZ_{l4}^H \\
& - e^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k5}^HZ_{l4}^H + e^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k5}^HZ_{l4}^H - 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k6}^HZ_{l4}^H \\
& + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k6}^HZ_{l4}^H - 2ie^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k6}^HZ_{l4}^H + 2ie^{i\eta}l_{7p}^*Z_{j3}^HZ_{k6}^HZ_{l4}^H \\
& - 2e^{i(\eta+2\zeta)}l_{3p}Z_{j6}^HZ_{k6}^HZ_{l4}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k6}^HZ_{l4}^H - 2e^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k6}^HZ_{l4}^H \\
& + 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j6}^HZ_{k6}^HZ_{l4}^H - 2e^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k6}^HZ_{l4}^H + 2e^{i\eta}l_{7p}^*Z_{j6}^HZ_{k6}^HZ_{l4}^H \\
& - ie^{2i\zeta}l_5Z_{j4}^HZ_{k1}^HZ_{l5}^H - ie^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k1}^HZ_{l5}^H - ie^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k1}^HZ_{l5}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k1}^HZ_{l5}^H - ie^{i(\eta+2\zeta)}l_7Z_{j4}^HZ_{k2}^HZ_{l5}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j4}^HZ_{k2}^HZ_{l5}^H - 2ie^{2i(\eta+\zeta)}l_2Z_{j5}^HZ_{k2}^HZ_{l5}^H - e^{2i\zeta}l_5Z_{j4}^HZ_{k4}^HZ_{l5}^H \\
& + e^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k4}^HZ_{l5}^H - e^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k4}^HZ_{l5}^H + e^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k4}^HZ_{l5}^H \\
& - e^{i(\eta+2\zeta)}l_7Z_{j4}^HZ_{k5}^HZ_{l5}^H + e^{3i\eta+2i\zeta}l_7^*Z_{j4}^HZ_{k5}^HZ_{l5}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k1}^HZ_{l6}^H \\
& + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k1}^HZ_{l6}^H - 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k1}^HZ_{l6}^H - 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k1}^HZ_{l6}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i(\eta+2\zeta)} l_{3p} Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j6}^H Z_{k1}^H Z_{l6}^H \\
& -2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2ie^{3i\eta} l_{6p}^* Z_{j6}^H Z_{k1}^H Z_{l6}^H + 2ie^{i\eta} l_{7p}^* Z_{j6}^H Z_{k1}^H Z_{l6}^H \\
& + 4e^{2i(\eta+2\zeta)} l_{5p} Z_{j3}^H Z_{k2}^H Z_{l6}^H - 4e^{2i\eta} l_{5p}^* Z_{j3}^H Z_{k2}^H Z_{l6}^H - 4ie^{2i(\eta+\zeta)} l_{2p} Z_{j6}^H Z_{k2}^H Z_{l6}^H \\
& + 4ie^{2i(\eta+2\zeta)} l_{5p} Z_{j6}^H Z_{k2}^H Z_{l6}^H + 4ie^{2i\eta} l_{5p}^* Z_{j6}^H Z_{k2}^H Z_{l6}^H - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j4}^H Z_{k3}^H Z_{l6}^H \\
& + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j4}^H Z_{k3}^H Z_{l6}^H - 2ie^{3i\eta} l_{6p}^* Z_{j4}^H Z_{k3}^H Z_{l6}^H + 2ie^{i\eta} l_{7p}^* Z_{j4}^H Z_{k3}^H Z_{l6}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j3}^H Z_{k4}^H Z_{l6}^H + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j3}^H Z_{k4}^H Z_{l6}^H - 2ie^{3i\eta} l_{6p}^* Z_{j3}^H Z_{k4}^H Z_{l6}^H \\
& + 2ie^{i\eta} l_{7p}^* Z_{j3}^H Z_{k4}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{3p} Z_{j6}^H Z_{k4}^H Z_{l6}^H + 2e^{i(\eta+4\zeta)} l_{6p} Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& - 2e^{3i\eta+4i\zeta} l_{7p} Z_{j6}^H Z_{k4}^H Z_{l6}^H + 2e^{3i\eta+2i\zeta} l_{3p}^* Z_{j6}^H Z_{k4}^H Z_{l6}^H - 2e^{3i\eta} l_{6p}^* Z_{j6}^H Z_{k4}^H Z_{l6}^H \\
& + 2e^{i\eta} l_{7p}^* Z_{j6}^H Z_{k4}^H Z_{l6}^H - 2e^{i(\eta+2\zeta)} l_{3p} Z_{j4}^H Z_{k6}^H Z_{l6}^H + 2e^{i(\eta+4\zeta)} l_{6p} Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& - 2e^{3i\eta+4i\zeta} l_{7p} Z_{j4}^H Z_{k6}^H Z_{l6}^H + 2e^{3i\eta+2i\zeta} l_{3p}^* Z_{j4}^H Z_{k6}^H Z_{l6}^H - 2e^{3i\eta} l_{6p}^* Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& + 2e^{i\eta} l_{7p}^* Z_{j4}^H Z_{k6}^H Z_{l6}^H \\
& + Z_{j2}^H \left(-e^{2i\zeta} l_5 Z_{k4}^H Z_{l1}^H + e^{2i(2\eta+\zeta)} l_5^* Z_{k4}^H Z_{l1}^H + e^{i(\eta+2\zeta)} l_7 Z_{k5}^H Z_{l1}^H \right. \\
& \left. - e^{3i\eta+2i\zeta} l_7^* Z_{k5}^H Z_{l1}^H - 3e^{i(\eta+2\zeta)} l_7 Z_{k4}^H Z_{l2}^H + 3e^{3i\eta+2i\zeta} l_7^* Z_{k4}^H Z_{l2}^H \right. \\
& \left. - 4ie^{2i(\eta+\zeta)} l_{2p} Z_{k3}^H Z_{l3}^H - 4ie^{2i(\eta+2\zeta)} l_{5p} Z_{k3}^H Z_{l3}^H - 4ie^{2i\eta} l_{5p}^* Z_{k3}^H Z_{l3}^H \right. \\
& \left. + 4e^{2i(\eta+2\zeta)} l_{5p} Z_{k6}^H Z_{l3}^H - 4e^{2i\eta} l_{5p}^* Z_{k6}^H Z_{l3}^H - 2ie^{2i(\eta+\zeta)} l_3 Z_{k4}^H Z_{l4}^H \right. \\
& \left. - 2ie^{2i(\eta+\zeta)} l_4 Z_{k4}^H Z_{l4}^H + ie^{2i\zeta} l_5 Z_{k4}^H Z_{l4}^H + ie^{2i(2\eta+\zeta)} l_5^* Z_{k4}^H Z_{l4}^H \right. \\
& \left. - ie^{i(\eta+2\zeta)} l_7 Z_{k5}^H Z_{l4}^H - ie^{3i\eta+2i\zeta} l_7^* Z_{k5}^H Z_{l4}^H \right. \\
& \left. + 3e^{i(\eta+2\zeta)} Z_{k2}^H \left(-2ie^{i\eta} l_2 Z_{l2}^H - \left(-e^{2i\eta} l_7^* + l_7 \right) Z_{l4}^H - i \left(e^{2i\eta} l_7^* + l_7 \right) Z_{l1}^H \right) \right. \\
& \left. - ie^{i(\eta+2\zeta)} l_7 Z_{k4}^H Z_{l5}^H - ie^{3i\eta+2i\zeta} l_7^* Z_{k4}^H Z_{l5}^H - 2ie^{2i(\eta+\zeta)} l_2 Z_{k5}^H Z_{l5}^H \right. \\
& \left. + e^{2i\zeta} Z_{k1}^H \left(-i \left(2e^{2i\eta} (l_3 + l_4) + e^{4i\eta} l_5^* + l_5 \right) Z_{l1}^H - 3ie^{i\eta} l_7 Z_{l2}^H - 3ie^{3i\eta} l_7^* Z_{l2}^H - l_5 Z_{l4}^H \right. \right. \\
& \left. \left. + e^{4i\eta} l_5^* Z_{l4}^H + e^{i\eta} l_7 Z_{l5}^H - e^{3i\eta} l_7^* Z_{l5}^H \right) \right. \\
& \left. + 4e^{2i(\eta+2\zeta)} l_{5p} Z_{k3}^H Z_{l6}^H - 4e^{2i\eta} l_{5p}^* Z_{k3}^H Z_{l6}^H - 4ie^{2i(\eta+\zeta)} l_{2p} Z_{k6}^H Z_{l6}^H \right)
\end{aligned}$$

$$\begin{aligned}
& + 4ie^{2i(\eta+2\zeta)} l_{5p} Z_{k6}^H Z_{l6}^H + 4ie^{2i\eta} l_{5p}^* Z_{k6}^H Z_{l6}^H \\
& + Z_{j1}^H \left(-e^{i(\eta+2\zeta)} l_6 Z_{k4}^H Z_{l1}^H + e^{3i\eta+2i\zeta} l_6^* Z_{k4}^H Z_{l1}^H + e^{2i\zeta} l_5 Z_{k5}^H Z_{l1}^H \right. \\
& - e^{2i(2\eta+\zeta)} l_5^* Z_{k5}^H Z_{l1}^H - e^{2i\zeta} l_5 Z_{k4}^H Z_{l2}^H + e^{2i(2\eta+\zeta)} l_5^* Z_{k4}^H Z_{l2}^H \\
& + e^{i(\eta+2\zeta)} l_7 Z_{k5}^H Z_{l2}^H - e^{3i\eta+2i\zeta} l_7^* Z_{k5}^H Z_{l2}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{k3}^H Z_{l3}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{k3}^H Z_{l3}^H - 2ie^{3i\eta+4i\zeta} l_{7p} Z_{k3}^H Z_{l3}^H - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{k3}^H Z_{l3}^H \\
& - 2ie^{3i\eta} l_{6p}^* Z_{k3}^H Z_{l3}^H - 2ie^{i\eta} l_{7p}^* Z_{k3}^H Z_{l3}^H + 2e^{i(\eta+4\zeta)} l_{6p} Z_{k6}^H Z_{l3}^H \\
& + 2e^{3i\eta+4i\zeta} l_{7p} Z_{k6}^H Z_{l3}^H - 2e^{3i\eta} l_{6p}^* Z_{k6}^H Z_{l3}^H - 2e^{i\eta} l_{7p}^* Z_{k6}^H Z_{l3}^H \\
& - ie^{i(\eta+2\zeta)} l_6 Z_{k4}^H Z_{l4}^H - ie^{3i\eta+2i\zeta} l_6^* Z_{k4}^H Z_{l4}^H - ie^{2i\zeta} l_5 Z_{k5}^H Z_{l4}^H \\
& - ie^{2i(2\eta+\zeta)} l_5^* Z_{k5}^H Z_{l4}^H - ie^{2i\zeta} l_5 Z_{k4}^H Z_{l5}^H - ie^{2i(2\eta+\zeta)} l_5^* Z_{k4}^H Z_{l5}^H \\
& - ie^{i(\eta+2\zeta)} l_7 Z_{k5}^H Z_{l5}^H - ie^{3i\eta+2i\zeta} l_7^* Z_{k5}^H Z_{l5}^H \\
& + e^{2i\zeta} Z_{k1}^H \left(-3ie^{i\eta} (e^{2i\eta} l_6^* + l_6) Z_{l1}^H - i(2e^{2i\eta} (l_3 + l_4) + e^{4i\eta} l_5^* + l_5) Z_{l2}^H - e^{i\eta} l_6 Z_{l4}^H \right. \\
& + e^{3i\eta} l_6^* Z_{l4}^H + l_5 Z_{l5}^H - e^{4i\eta} l_5^* Z_{l5}^H) \\
& + e^{2i\zeta} Z_{k2}^H \left(-i(2e^{2i\eta} (l_3 + l_4) + e^{4i\eta} l_5^* + l_5) Z_{l1}^H - 3ie^{i\eta} l_7 Z_{l2}^H - 3ie^{3i\eta} l_7^* Z_{l2}^H - l_5 Z_{l4}^H \right. \\
& + e^{4i\eta} l_5^* Z_{l4}^H + e^{i\eta} l_7 Z_{l5}^H - e^{3i\eta} l_7^* Z_{l5}^H) \\
& + 2e^{i(\eta+4\zeta)} l_{6p} Z_{k3}^H Z_{l6}^H + 2e^{3i\eta+4i\zeta} l_{7p} Z_{k3}^H Z_{l6}^H - 2e^{3i\eta} l_{6p}^* Z_{k3}^H Z_{l6}^H \\
& - 2e^{i\eta} l_{7p}^* Z_{k3}^H Z_{l6}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+4\zeta)} l_{6p} Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{k6}^H Z_{l6}^H - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{k6}^H Z_{l6}^H + 2ie^{3i\eta} l_{6p}^* Z_{k6}^H Z_{l6}^H \\
& + 2ie^{i\eta} l_{7p}^* Z_{k6}^H Z_{l6}^H) \\
& + e^{2i\zeta} Z_{l1}^H \left(3e^{i(\eta+2\zeta)} l_6 Z_{j5}^H Z_{k1}^H Z_{l1}^H - 3e^{3i\eta+2i\zeta} l_6^* Z_{j5}^H Z_{k1}^H Z_{l1}^H \right. \\
& - e^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k2}^H Z_{l1}^H + e^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k2}^H Z_{l1}^H + e^{2i\zeta} l_5 Z_{j5}^H Z_{k2}^H Z_{l1}^H \\
& - e^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k2}^H Z_{l1}^H - 4ie^{2i(\eta+\zeta)} l_{1p} Z_{j3}^H Z_{k3}^H Z_{l1}^H - 4ie^{2i(\eta+2\zeta)} l_{4p} Z_{j3}^H Z_{k3}^H Z_{l1}^H \\
& - 4ie^{2i\eta} l_{4p}^* Z_{j3}^H Z_{k3}^H Z_{l1}^H + 4e^{2i(\eta+2\zeta)} l_{4p} Z_{j6}^H Z_{k3}^H Z_{l1}^H - 4e^{2i\eta} l_{4p}^* Z_{j6}^H Z_{k3}^H Z_{l1}^H
\end{aligned}$$

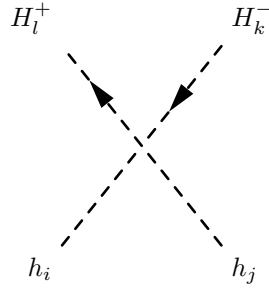
$$\begin{aligned}
& -2ie^{2i(\eta+\zeta)} l_1 Z_{j4}^H Z_{k4}^H Z_{l1}^H - ie^{i(\eta+2\zeta)} l_6 Z_{j5}^H Z_{k4}^H Z_{l1}^H - ie^{3i\eta+2i\zeta} l_6^* Z_{j5}^H Z_{k4}^H Z_{l1}^H \\
& - ie^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k5}^H Z_{l1}^H - ie^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k5}^H Z_{l1}^H - 2ie^{2i(\eta+\zeta)} l_3 Z_{j5}^H Z_{k5}^H Z_{l1}^H \\
& - 2ie^{2i(\eta+\zeta)} l_4 Z_{j3}^H Z_{k5}^H Z_{l1}^H + ie^{2i\zeta} l_5 Z_{j5}^H Z_{k5}^H Z_{l1}^H + ie^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k5}^H Z_{l1}^H \\
& + 4e^{2i(\eta+2\zeta)} l_{4p} Z_{j3}^H Z_{k6}^H Z_{l1}^H - 4e^{2i\eta} l_{4p}^* Z_{j3}^H Z_{k6}^H Z_{l1}^H - 4ie^{2i(\eta+\zeta)} l_{1p} Z_{j6}^H Z_{k6}^H Z_{l1}^H \\
& + 4ie^{2i(\eta+2\zeta)} l_{4p} Z_{j6}^H Z_{k6}^H Z_{l1}^H + 4ie^{2i\eta} l_{4p}^* Z_{j6}^H Z_{k6}^H Z_{l1}^H - e^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k1}^H Z_{l2}^H \\
& + e^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k1}^H Z_{l2}^H + e^{2i\zeta} l_5 Z_{j5}^H Z_{k1}^H Z_{l2}^H - e^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k1}^H Z_{l2}^H \\
& - e^{2i\zeta} l_5 Z_{j4}^H Z_{k2}^H Z_{l2}^H + e^{2i(2\eta+\zeta)} l_5^* Z_{j4}^H Z_{k2}^H Z_{l2}^H + e^{i(\eta+2\zeta)} l_7 Z_{j5}^H Z_{k2}^H Z_{l2}^H \\
& - e^{3i\eta+2i\zeta} l_7^* Z_{j5}^H Z_{k2}^H Z_{l2}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{j3}^H Z_{k3}^H Z_{l2}^H \\
& - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j3}^H Z_{k3}^H Z_{l2}^H - 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j3}^H Z_{k3}^H Z_{l2}^H \\
& - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{j3}^H Z_{k3}^H Z_{l2}^H - 2ie^{3i\eta} l_{6p}^* Z_{j3}^H Z_{k3}^H Z_{l2}^H - 2ie^{i\eta} l_{7p}^* Z_{j3}^H Z_{k3}^H Z_{l2}^H \\
& + 2e^{i(\eta+4\zeta)} l_{6p} Z_{j6}^H Z_{k3}^H Z_{l2}^H + 2e^{3i\eta+4i\zeta} l_{7p} Z_{j6}^H Z_{k3}^H Z_{l2}^H - 2e^{3i\eta} l_{6p}^* Z_{j6}^H Z_{k3}^H Z_{l2}^H \\
& - 2e^{i\eta} l_{7p}^* Z_{j6}^H Z_{k3}^H Z_{l2}^H - ie^{i(\eta+2\zeta)} l_6 Z_{j4}^H Z_{k4}^H Z_{l2}^H - ie^{3i\eta+2i\zeta} l_6^* Z_{j4}^H Z_{k4}^H Z_{l2}^H \\
& - ie^{2i\zeta} l_5 Z_{j5}^H Z_{k4}^H Z_{l2}^H - ie^{2i(2\eta+\zeta)} l_5^* Z_{j5}^H Z_{k4}^H Z_{l2}^H - ie^{2i\zeta} l_5 Z_{j4}^H Z_{k5}^H Z_{l2}^H \\
& - ie^{2i(2\eta+\zeta)} l_5^* Z_{j4}^H Z_{k5}^H Z_{l2}^H - ie^{i(\eta+2\zeta)} l_7 Z_{j5}^H Z_{k5}^H Z_{l2}^H \\
& - ie^{3i\eta+2i\zeta} l_7^* Z_{j5}^H Z_{k5}^H Z_{l2}^H + 2e^{i(\eta+4\zeta)} l_{6p} Z_{j3}^H Z_{k6}^H Z_{l2}^H + 2e^{3i\eta+4i\zeta} l_{7p} Z_{j3}^H Z_{k6}^H Z_{l2}^H \\
& - 2e^{3i\eta} l_{6p}^* Z_{j3}^H Z_{k6}^H Z_{l2}^H - 2e^{i\eta} l_{7p}^* Z_{j3}^H Z_{k6}^H Z_{l2}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{j6}^H Z_{k6}^H Z_{l2}^H \\
& + 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j6}^H Z_{k6}^H Z_{l2}^H + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j6}^H Z_{k6}^H Z_{l2}^H - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{j6}^H Z_{k6}^H Z_{l2}^H \\
& + 2ie^{3i\eta} l_{6p}^* Z_{j6}^H Z_{k6}^H Z_{l2}^H + 2ie^{i\eta} l_{7p}^* Z_{j6}^H Z_{k6}^H Z_{l2}^H - 4ie^{2i(\eta+\zeta)} l_{1p} Z_{j3}^H Z_{k1}^H Z_{l3}^H \\
& - 4ie^{2i(\eta+2\zeta)} l_{4p} Z_{j3}^H Z_{k1}^H Z_{l3}^H - 4ie^{2i\eta} l_{4p}^* Z_{j3}^H Z_{k1}^H Z_{l3}^H + 4e^{2i(\eta+2\zeta)} l_{4p} Z_{j6}^H Z_{k1}^H Z_{l3}^H \\
& - 4e^{2i\eta} l_{4p}^* Z_{j6}^H Z_{k1}^H Z_{l3}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{j3}^H Z_{k2}^H Z_{l3}^H - 2ie^{i(\eta+4\zeta)} l_{6p} Z_{j3}^H Z_{k2}^H Z_{l3}^H \\
& - 2ie^{3i\eta+4i\zeta} l_{7p} Z_{j3}^H Z_{k2}^H Z_{l3}^H - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{j3}^H Z_{k2}^H Z_{l3}^H - 2ie^{3i\eta} l_{6p}^* Z_{j3}^H Z_{k2}^H Z_{l3}^H
\end{aligned}$$

$$\begin{aligned}
& -2ie^{i\eta}l_{7p}^*Z_{j3}^HZ_{k2}^HZ_{l3}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k2}^HZ_{l3}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k2}^HZ_{l3}^H \\
& -2e^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k2}^HZ_{l3}^H - 2e^{i\eta}l_{7p}^*Z_{j6}^HZ_{k2}^HZ_{l3}^H + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j5}^HZ_{k3}^HZ_{l3}^H \\
& + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j5}^HZ_{k3}^HZ_{l3}^H - 2e^{3i\eta+4i\zeta}l_{7p}Z_{j5}^HZ_{k3}^HZ_{l3}^H \\
& - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j5}^HZ_{k3}^HZ_{l3}^H - 2e^{3i\eta}l_{6p}^*Z_{j5}^HZ_{k3}^HZ_{l3}^H + 2e^{i\eta}l_{7p}^*Z_{j5}^HZ_{k3}^HZ_{l3}^H \\
& + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j3}^HZ_{k5}^HZ_{l3}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k5}^HZ_{l3}^H - 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k5}^HZ_{l3}^H \\
& - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j3}^HZ_{k5}^HZ_{l3}^H - 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k5}^HZ_{l3}^H + 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k5}^HZ_{l3}^H \\
& + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k5}^HZ_{l3}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k5}^HZ_{l3}^H + 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k5}^HZ_{l3}^H \\
& - 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k5}^HZ_{l3}^H + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j5}^HZ_{k6}^HZ_{l3}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j5}^HZ_{k6}^HZ_{l3}^H \\
& + 2ie^{3i\eta}l_{6p}^*Z_{j5}^HZ_{k6}^HZ_{l3}^H - 2ie^{i\eta}l_{7p}^*Z_{j5}^HZ_{k6}^HZ_{l3}^H - 2ie^{2i(\eta+\zeta)}l_1Z_{j4}^HZ_{k1}^HZ_{l4}^H \\
& - ie^{i(\eta+2\zeta)}l_6Z_{j5}^HZ_{k1}^HZ_{l4}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{j5}^HZ_{k1}^HZ_{l4}^H \\
& - ie^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k2}^HZ_{l4}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k2}^HZ_{l4}^H - ie^{2i\zeta}l_5Z_{j5}^HZ_{k2}^HZ_{l4}^H \\
& - ie^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k2}^HZ_{l4}^H + e^{i(\eta+2\zeta)}l_6Z_{j5}^HZ_{k4}^HZ_{l4}^H \\
& - e^{3i\eta+2i\zeta}l_6^*Z_{j5}^HZ_{k4}^HZ_{l4}^H + e^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k5}^HZ_{l4}^H \\
& - e^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k5}^HZ_{l4}^H + e^{2i\zeta}l_5Z_{j5}^HZ_{k5}^HZ_{l4}^H - e^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k5}^HZ_{l4}^H \\
& - ie^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k1}^HZ_{l5}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k1}^HZ_{l5}^H - 2ie^{2i(\eta+\zeta)}l_3Z_{j5}^HZ_{k1}^HZ_{l5}^H \\
& - 2ie^{2i(\eta+\zeta)}l_4Z_{j5}^HZ_{k1}^HZ_{l5}^H + ie^{2i\zeta}l_5Z_{j5}^HZ_{k1}^HZ_{l5}^H + ie^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k1}^HZ_{l5}^H \\
& - ie^{2i\zeta}l_5Z_{j4}^HZ_{k2}^HZ_{l5}^H - ie^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k2}^HZ_{l5}^H - ie^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k2}^HZ_{l5}^H \\
& - ie^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k2}^HZ_{l5}^H + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j3}^HZ_{k3}^HZ_{l5}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k3}^HZ_{l5}^H \\
& - 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k3}^HZ_{l5}^H - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j3}^HZ_{k3}^HZ_{l5}^H - 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k3}^HZ_{l5}^H \\
& + 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k3}^HZ_{l5}^H + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k3}^HZ_{l5}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k3}^HZ_{l5}^H \\
& + 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k3}^HZ_{l5}^H - 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k3}^HZ_{l5}^H + e^{i(\eta+2\zeta)}l_6Z_{j4}^HZ_{k4}^HZ_{l5}^H
\end{aligned}$$

$$\begin{aligned}
& -e^{3i\eta+2i\zeta}l_6^*Z_{j4}^HZ_{k4}^HZ_{l5}^H + e^{2i\zeta}l_5Z_{j5}^HZ_{k4}^HZ_{l5}^H - e^{2i(2\eta+\zeta)}l_5^*Z_{j5}^HZ_{k4}^HZ_{l5}^H \\
& + e^{2i\zeta}l_5Z_{j4}^HZ_{k5}^HZ_{l5}^H - e^{2i(2\eta+\zeta)}l_5^*Z_{j4}^HZ_{k5}^HZ_{l5}^H + 3e^{i(\eta+2\zeta)}l_7Z_{j5}^HZ_{k5}^HZ_{l5}^H \\
& - 3e^{3i\eta+2i\zeta}l_7^*Z_{j5}^HZ_{k5}^HZ_{l5}^H + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k6}^HZ_{l5}^H \\
& - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k6}^HZ_{l5}^H + 2ie^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k6}^HZ_{l5}^H - 2ie^{i\eta}l_{7p}^*Z_{j3}^HZ_{k6}^HZ_{l5}^H \\
& + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j6}^HZ_{k6}^HZ_{l5}^H - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k6}^HZ_{l5}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k6}^HZ_{l5}^H \\
& - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j6}^HZ_{k6}^HZ_{l5}^H + 2e^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k6}^HZ_{l5}^H - 2e^{i\eta}l_{7p}^*Z_{j6}^HZ_{k6}^HZ_{l5}^H \\
& + 4e^{2i(\eta+2\zeta)}l_{4p}Z_{j3}^HZ_{k1}^HZ_{l6}^H - 4e^{2i\eta}l_{4p}^*Z_{j3}^HZ_{k1}^HZ_{l6}^H - 4ie^{2i(\eta+\zeta)}l_{1p}Z_{j6}^HZ_{k1}^HZ_{l6}^H \\
& + 4ie^{2i(\eta+2\zeta)}l_{4p}Z_{j6}^HZ_{k1}^HZ_{l6}^H + 4ie^{2i\eta}l_{4p}^*Z_{j6}^HZ_{k1}^HZ_{l6}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k2}^HZ_{l6}^H \\
& + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k2}^HZ_{l6}^H - 2e^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k2}^HZ_{l6}^H - 2e^{i\eta}l_{7p}^*Z_{j3}^HZ_{k2}^HZ_{l6}^H \\
& - 2ie^{i(\eta+2\zeta)}l_{3p}Z_{j6}^HZ_{k2}^HZ_{l6}^H + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k2}^HZ_{l6}^H + 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k2}^HZ_{l6}^H \\
& - 2ie^{3i\eta+2i\zeta}l_{3p}^*Z_{j6}^HZ_{k2}^HZ_{l6}^H + 2ie^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k2}^HZ_{l6}^H + 2ie^{i\eta}l_{7p}^*Z_{j6}^HZ_{k2}^HZ_{l6}^H \\
& + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j5}^HZ_{k3}^HZ_{l6}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j5}^HZ_{k3}^HZ_{l6}^H + 2ie^{3i\eta}l_{6p}^*Z_{j5}^HZ_{k3}^HZ_{l6}^H \\
& - 2ie^{i\eta}l_{7p}^*Z_{j5}^HZ_{k3}^HZ_{l6}^H + 2ie^{i(\eta+4\zeta)}l_{6p}Z_{j3}^HZ_{k5}^HZ_{l6}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{j3}^HZ_{k5}^HZ_{l6}^H \\
& + 2ie^{3i\eta}l_{6p}^*Z_{j3}^HZ_{k5}^HZ_{l6}^H - 2ie^{i\eta}l_{7p}^*Z_{j3}^HZ_{k5}^HZ_{l6}^H + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j6}^HZ_{k5}^HZ_{l6}^H \\
& - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j6}^HZ_{k5}^HZ_{l6}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j6}^HZ_{k5}^HZ_{l6}^H \\
& - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j6}^HZ_{k5}^HZ_{l6}^H + 2e^{3i\eta}l_{6p}^*Z_{j6}^HZ_{k5}^HZ_{l6}^H - 2e^{i\eta}l_{7p}^*Z_{j6}^HZ_{k5}^HZ_{l6}^H \\
& + 2e^{i(\eta+2\zeta)}l_{3p}Z_{j5}^HZ_{k6}^HZ_{l6}^H - 2e^{i(\eta+4\zeta)}l_{6p}Z_{j5}^HZ_{k6}^HZ_{l6}^H + 2e^{3i\eta+4i\zeta}l_{7p}Z_{j5}^HZ_{k6}^HZ_{l6}^H \\
& - 2e^{3i\eta+2i\zeta}l_{3p}^*Z_{j5}^HZ_{k6}^HZ_{l6}^H + 2e^{3i\eta}l_{6p}^*Z_{j5}^HZ_{k6}^HZ_{l6}^H - 2e^{i\eta}l_{7p}^*Z_{j5}^HZ_{k6}^HZ_{l6}^H \\
& + Z_{j1}^H\left(3e^{i(\eta+2\zeta)}l_6Z_{k5}^HZ_{l1}^H - 3e^{3i\eta+2i\zeta}l_6^*Z_{k5}^HZ_{l1}^H - e^{i(\eta+2\zeta)}l_6Z_{k4}^HZ_{l2}^H\right. \\
& + e^{3i\eta+2i\zeta}l_6^*Z_{k4}^HZ_{l2}^H + e^{2i\zeta}l_5Z_{k5}^HZ_{l2}^H - e^{2i(2\eta+\zeta)}l_5^*Z_{k5}^HZ_{l2}^H \\
& \left. - 4ie^{2i(\eta+\zeta)}l_{1p}Z_{k3}^HZ_{l3}^H - 4ie^{2i(\eta+2\zeta)}l_{4p}Z_{k3}^HZ_{l3}^H - 4ie^{2i\eta}l_{4p}^*Z_{k3}^HZ_{l3}^H\right. \\
& \left. + 4e^{2i(\eta+2\zeta)}l_{4p}Z_{k6}^HZ_{l3}^H - 4e^{2i\eta}l_{4p}^*Z_{k6}^HZ_{l3}^H - 2ie^{2i(\eta+\zeta)}l_1Z_{k4}^HZ_{l4}^H\right)
\end{aligned}$$

$$\begin{aligned}
& -ie^{i(\eta+2\zeta)}l_6Z_{k5}^HZ_{l4}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{k5}^HZ_{l4}^H - ie^{i(\eta+2\zeta)}l_6Z_{k4}^HZ_{l5}^H \\
& - ie^{3i\eta+2i\zeta}l_6^*Z_{k4}^HZ_{l5}^H - 2ie^{2i(\eta+\zeta)}l_3Z_{k5}^HZ_{l5}^H - 2ie^{2i(\eta+\zeta)}l_4Z_{k5}^HZ_{l5}^H \\
& + ie^{2i\zeta}l_5Z_{k5}^HZ_{l5}^H + ie^{2i(2\eta+\zeta)}l_5^*Z_{k5}^HZ_{l5}^H \\
& + e^{2i\zeta}Z_{k2}^H\left(-3ie^{i\eta}(e^{2i\eta}l_6^*+l_6)Z_{l1}^H - i(2e^{2i\eta}(l_3+l_4)+e^{4i\eta}l_5^*+l_5)Z_{l2}^H - e^{i\eta}l_6Z_{l4}^H\right. \\
& \left.+ e^{3i\eta}l_6^*Z_{l4}^H + l_5Z_{l5}^H - e^{4i\eta}l_5^*Z_{l5}^H\right) \\
& + 3e^{i(\eta+2\zeta)}Z_{k1}^H\left(-2ie^{i\eta}l_1Z_{l1}^H + (-e^{2i\eta}l_6^*+l_6)Z_{l5}^H - i(e^{2i\eta}l_6^*+l_6)Z_{l2}^H\right) \\
& + 4e^{2i(\eta+2\zeta)}l_{4p}Z_{k3}^HZ_{l6}^H - 4e^{2i\eta}l_{4p}^*Z_{k3}^HZ_{l6}^H - 4ie^{2i(\eta+\zeta)}l_{1p}Z_{k6}^HZ_{l6}^H \\
& + 4ie^{2i(\eta+2\zeta)}l_{4p}Z_{k6}^HZ_{l6}^H + 4ie^{2i\eta}l_{4p}^*Z_{k6}^HZ_{l6}^H \\
& + Z_{j2}^H\left(-e^{i(\eta+2\zeta)}l_6Z_{k4}^HZ_{l1}^H + e^{3i\eta+2i\zeta}l_6^*Z_{k4}^HZ_{l1}^H + e^{2i\zeta}l_5Z_{k5}^HZ_{l1}^H\right. \\
& \left.- e^{2i(2\eta+\zeta)}l_5^*Z_{k5}^HZ_{l1}^H - e^{2i\zeta}l_5Z_{k4}^HZ_{l2}^H + e^{2i(2\eta+\zeta)}l_5^*Z_{k4}^HZ_{l2}^H\right. \\
& \left.+ e^{i(\eta+2\zeta)}l_7Z_{k5}^HZ_{l2}^H - e^{3i\eta+2i\zeta}l_7^*Z_{k5}^HZ_{l2}^H - 2ie^{i(\eta+2\zeta)}l_{3p}Z_{k3}^HZ_{l3}^H\right. \\
& \left.- 2ie^{i(\eta+4\zeta)}l_{6p}Z_{k3}^HZ_{l3}^H - 2ie^{3i\eta+4i\zeta}l_{7p}Z_{k3}^HZ_{l3}^H - 2ie^{3i\eta+2i\zeta}l_{3p}^*Z_{k3}^HZ_{l3}^H\right. \\
& \left.- 2ie^{3i\eta}l_{6p}^*Z_{k3}^HZ_{l3}^H - 2ie^{i\eta}l_{7p}^*Z_{k3}^HZ_{l3}^H + 2e^{i(\eta+4\zeta)}l_{6p}Z_{k6}^HZ_{l3}^H\right. \\
& \left.+ 2e^{3i\eta+4i\zeta}l_{7p}Z_{k6}^HZ_{l3}^H - 2e^{3i\eta}l_{6p}^*Z_{k6}^HZ_{l3}^H - 2e^{i\eta}l_{7p}^*Z_{k6}^HZ_{l3}^H\right. \\
& \left.- ie^{i(\eta+2\zeta)}l_6Z_{k4}^HZ_{l4}^H - ie^{3i\eta+2i\zeta}l_6^*Z_{k4}^HZ_{l4}^H - ie^{2i\zeta}l_5Z_{k5}^HZ_{l4}^H\right. \\
& \left.- ie^{2i(2\eta+\zeta)}l_5^*Z_{k5}^HZ_{l4}^H - ie^{2i\zeta}l_5Z_{k4}^HZ_{l5}^H - ie^{2i(2\eta+\zeta)}l_5^*Z_{k4}^HZ_{l5}^H\right. \\
& \left.- ie^{i(\eta+2\zeta)}l_7Z_{k5}^HZ_{l5}^H - ie^{3i\eta+2i\zeta}l_7^*Z_{k5}^HZ_{l5}^H\right. \\
& \left.+ e^{2i\zeta}Z_{k1}^H\left(-3ie^{i\eta}(e^{2i\eta}l_6^*+l_6)Z_{l1}^H - i(2e^{2i\eta}(l_3+l_4)+e^{4i\eta}l_5^*+l_5)Z_{l2}^H - e^{i\eta}l_6Z_{l4}^H\right. \right. \\
& \left. \left.+ e^{3i\eta}l_6^*Z_{l4}^H + l_5Z_{l5}^H - e^{4i\eta}l_5^*Z_{l5}^H\right)\right. \\
& \left.+ e^{2i\zeta}Z_{k2}^H\left(-i(2e^{2i\eta}(l_3+l_4)+e^{4i\eta}l_5^*+l_5)Z_{l1}^H - 3ie^{i\eta}l_7Z_{l2}^H - 3ie^{3i\eta}l_7^*Z_{l2}^H - l_5Z_{l4}^H\right. \right. \\
& \left. \left.+ e^{4i\eta}l_5^*Z_{l4}^H + e^{i\eta}l_7Z_{l5}^H - e^{3i\eta}l_7^*Z_{l5}^H\right)\right)
\end{aligned}$$

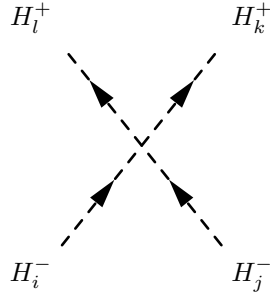
$$\begin{aligned}
& + 2e^{i(\eta+4\zeta)} l_{6p} Z_{k3}^H Z_{l6}^H + 2e^{3i\eta+4i\zeta} l_{7p} Z_{k3}^H Z_{l6}^H - 2e^{3i\eta} l_{6p}^* Z_{k3}^H Z_{l6}^H \\
& - 2e^{i\eta} l_{7p}^* Z_{k3}^H Z_{l6}^H - 2ie^{i(\eta+2\zeta)} l_{3p} Z_{k6}^H Z_{l6}^H + 2ie^{i(\eta+4\zeta)} l_{6p} Z_{k6}^H Z_{l6}^H \\
& + 2ie^{3i\eta+4i\zeta} l_{7p} Z_{k6}^H Z_{l6}^H - 2ie^{3i\eta+2i\zeta} l_{3p}^* Z_{k6}^H Z_{l6}^H + 2ie^{3i\eta} l_{6p}^* Z_{k6}^H Z_{l6}^H \\
& + 2ie^{i\eta} l_{7p}^* Z_{k6}^H Z_{l6}^H \Big) \Big) \Big) \Big) \quad (233)
\end{aligned}$$



$$\begin{aligned}
& \frac{1}{2} e^{-2i(\eta+\zeta)} \left(e^{i(\eta+2\zeta)} l_6 Z_{i5}^H Z_{j1}^H Z_{k1}^+ Z_{l1}^+ - e^{3i\eta+2i\zeta} l_6^* Z_{i5}^H Z_{j1}^H Z_{k1}^+ Z_{l1}^+ \right. \\
& - e^{i(\eta+2\zeta)} l_6 Z_{i4}^H Z_{j2}^H Z_{k1}^+ Z_{l1}^+ + e^{3i\eta+2i\zeta} l_6^* Z_{i4}^H Z_{j2}^H Z_{k1}^+ Z_{l1}^+ \\
& - 4i e^{2i(\eta+\zeta)} l_{1p} Z_{i3}^H Z_{j3}^H Z_{k1}^+ Z_{l1}^+ - 4i e^{2i(\eta+2\zeta)} l_{4p} Z_{i3}^H Z_{j3}^H Z_{k1}^+ Z_{l1}^+ \\
& - 4i e^{2i\eta} l_{4p}^* Z_{i3}^H Z_{j3}^H Z_{k1}^+ Z_{l1}^+ + 4e^{2i(\eta+2\zeta)} l_{4p} Z_{i6}^H Z_{j3}^H Z_{k1}^+ Z_{l1}^+ \\
& - 4e^{2i\eta} l_{4p}^* Z_{i6}^H Z_{j3}^H Z_{k1}^+ Z_{l1}^+ - 2i e^{2i(\eta+\zeta)} l_1 Z_{i4}^H Z_{j4}^H Z_{k1}^+ Z_{l1}^+ \\
& - i e^{i(\eta+2\zeta)} l_6 Z_{i5}^H Z_{j4}^H Z_{k1}^+ Z_{l1}^+ - i e^{3i\eta+2i\zeta} l_6^* Z_{i5}^H Z_{j4}^H Z_{k1}^+ Z_{l1}^+ \\
& - i e^{i(\eta+2\zeta)} l_6 Z_{i4}^H Z_{j5}^H Z_{k1}^+ Z_{l1}^+ - i e^{3i\eta+2i\zeta} l_6^* Z_{i4}^H Z_{j5}^H Z_{k1}^+ Z_{l1}^+ \\
& - 2i e^{2i(\eta+\zeta)} l_3 Z_{i5}^H Z_{j5}^H Z_{k1}^+ Z_{l1}^+ + 4e^{2i(\eta+2\zeta)} l_{4p} Z_{i3}^H Z_{j6}^H Z_{k1}^+ Z_{l1}^+ \\
& - 4e^{2i\eta} l_{4p}^* Z_{i3}^H Z_{j6}^H Z_{k1}^+ Z_{l1}^+ - 4i e^{2i(\eta+\zeta)} l_{1p} Z_{i6}^H Z_{j6}^H Z_{k1}^+ Z_{l1}^+ \\
& + 4i e^{2i(\eta+2\zeta)} l_{4p} Z_{i6}^H Z_{j6}^H Z_{k1}^+ Z_{l1}^+ + 4i e^{2i\eta} l_{4p}^* Z_{i6}^H Z_{j6}^H Z_{k1}^+ Z_{l1}^+ \\
& + e^{2i(\eta+\zeta)} l_4 Z_{i5}^H Z_{j1}^H Z_{k2}^+ Z_{l1}^+ - e^{2i(2\eta+\zeta)} l_5^* Z_{i5}^H Z_{j1}^H Z_{k2}^+ Z_{l1}^+ \\
& \left. - e^{2i(\eta+\zeta)} l_4 Z_{i4}^H Z_{j2}^H Z_{k2}^+ Z_{l1}^+ + e^{2i(2\eta+\zeta)} l_5^* Z_{i4}^H Z_{j2}^H Z_{k2}^+ Z_{l1}^+ \right)
\end{aligned}$$

$$\begin{aligned}
& -4ie^{3i\eta+4i\zeta}l_{7p}Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l1}^+ -4ie^{3i\eta+2i\zeta}l_{3p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l1}^+ \\
& -4ie^{3i\eta}l_{6p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l1}^+ +4e^{3i\eta+4i\zeta}l_{7p}Z_{i6}^HZ_{j3}^HZ_{k2}^+Z_{l1}^+ \\
& -4e^{3i\eta}l_{6p}^*Z_{i6}^HZ_{j3}^HZ_{k2}^+Z_{l1}^+ -2ie^{3i\eta+2i\zeta}l_6^*Z_{i4}^HZ_{j4}^HZ_{k2}^+Z_{l1}^+ \\
& -ie^{2i\left(\eta+\zeta\right)}l_4Z_{i5}^HZ_{j4}^HZ_{k2}^+Z_{l1}^+ -ie^{2i\left(2\eta+\zeta\right)}l_5^*Z_{i5}^HZ_{j4}^HZ_{k2}^+Z_{l1}^+ \\
& -ie^{2i\left(\eta+\zeta\right)}l_4Z_{i4}^HZ_{j5}^HZ_{k2}^+Z_{l1}^+ -ie^{2i\left(2\eta+\zeta\right)}l_5^*Z_{i4}^HZ_{j5}^HZ_{k2}^+Z_{l1}^+ \\
& -2ie^{3i\eta+2i\zeta}l_7^*Z_{i5}^HZ_{j5}^HZ_{k2}^+Z_{l1}^+ +4e^{3i\eta+4i\zeta}l_{7p}Z_{i3}^HZ_{j6}^HZ_{k2}^+Z_{l1}^+ \\
& -4e^{3i\eta}l_{6p}^*Z_{i3}^HZ_{j6}^HZ_{k2}^+Z_{l1}^+ +4ie^{3i\eta+4i\zeta}l_{7p}Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l1}^+ \\
& -4ie^{3i\eta+2i\zeta}l_{3p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l1}^+ +4ie^{3i\eta}l_{6p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l1}^+ \\
& -e^{2i\left(\eta+\zeta\right)}l_4Z_{i5}^HZ_{j1}^HZ_{k1}^+Z_{l2}^+ +e^{2i\zeta}l_5Z_{i5}^HZ_{j1}^HZ_{k1}^+Z_{l2}^+ \\
& +e^{2i\left(\eta+\zeta\right)}l_4Z_{i4}^HZ_{j2}^HZ_{k1}^+Z_{l2}^+ -e^{2i\zeta}l_5Z_{i4}^HZ_{j2}^HZ_{k1}^+Z_{l2}^+ \\
& -4ie^{i\left(\eta+2\zeta\right)}l_{3p}Z_{i3}^HZ_{j3}^HZ_{k1}^+Z_{l2}^+ -4ie^{i\left(\eta+4\zeta\right)}l_{6p}Z_{i3}^HZ_{j3}^HZ_{k1}^+Z_{l2}^+ \\
& -4ie^{i\eta}l_{7p}^*Z_{i3}^HZ_{j3}^HZ_{k1}^+Z_{l2}^+ +4e^{i\left(\eta+4\zeta\right)}l_{6p}Z_{i6}^HZ_{j3}^HZ_{k1}^+Z_{l2}^+ \\
& -4e^{i\eta}l_{7p}^*Z_{i6}^HZ_{j3}^HZ_{k1}^+Z_{l2}^+ -2ie^{i\left(\eta+2\zeta\right)}l_6Z_{i4}^HZ_{j4}^HZ_{k1}^+Z_{l2}^+ \\
& -ie^{2i\left(\eta+\zeta\right)}l_4Z_{i5}^HZ_{j4}^HZ_{k1}^+Z_{l2}^+ -ie^{2i\zeta}l_5Z_{i5}^HZ_{j4}^HZ_{k1}^+Z_{l2}^+ \\
& -ie^{2i\left(\eta+\zeta\right)}l_4Z_{i4}^HZ_{j5}^HZ_{k1}^+Z_{l2}^+ -ie^{2i\zeta}l_5Z_{i4}^HZ_{j5}^HZ_{k1}^+Z_{l2}^+ \\
& -2ie^{i\left(\eta+2\zeta\right)}l_7Z_{i5}^HZ_{j5}^HZ_{k1}^+Z_{l2}^+ +4e^{i\left(\eta+4\zeta\right)}l_{6p}Z_{i3}^HZ_{j6}^HZ_{k1}^+Z_{l2}^+ \\
& -4e^{i\eta}l_{7p}^*Z_{i3}^HZ_{j6}^HZ_{k1}^+Z_{l2}^+ -4ie^{i\left(\eta+2\zeta\right)}l_{3p}Z_{i6}^HZ_{j6}^HZ_{k1}^+Z_{l2}^+ \\
& +4ie^{i\left(\eta+4\zeta\right)}l_{6p}Z_{i6}^HZ_{j6}^HZ_{k1}^+Z_{l2}^+ +4ie^{i\eta}l_{7p}^*Z_{i6}^HZ_{j6}^HZ_{k1}^+Z_{l2}^+ \\
& +e^{i\left(\eta+2\zeta\right)}l_7Z_{i5}^HZ_{j1}^HZ_{k2}^+Z_{l2}^+ -e^{3i\eta+2i\zeta}l_7^*Z_{i5}^HZ_{j1}^HZ_{k2}^+Z_{l2}^+ \\
& -e^{i\left(\eta+2\zeta\right)}l_7Z_{i4}^HZ_{j2}^HZ_{k2}^+Z_{l2}^+ +e^{3i\eta+2i\zeta}l_7^*Z_{i4}^HZ_{j2}^HZ_{k2}^+Z_{l2}^+ \\
& -4ie^{2i\left(\eta+\zeta\right)}l_{2p}Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l2}^+ -4ie^{2i\left(\eta+2\zeta\right)}l_{5p}Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l2}^+ \\
& -4ie^{2i\eta}l_{5p}^*Z_{i3}^HZ_{j3}^HZ_{k2}^+Z_{l2}^+ +4e^{2i\left(\eta+2\zeta\right)}l_{5p}Z_{i6}^HZ_{j3}^HZ_{k2}^+Z_{l2}^+
\end{aligned}$$

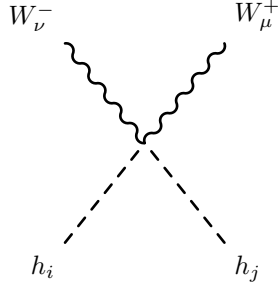
$$\begin{aligned}
& -4e^{2i\eta}l_{5p}^*Z_{i6}^HZ_{j3}^HZ_{k2}^+Z_{l2}^+ - 2ie^{2i(\eta+\zeta)}l_3Z_{i4}^HZ_{j4}^HZ_{k2}^+Z_{l2}^+ \\
& -ie^{i(\eta+2\zeta)}l_7Z_{i5}^HZ_{j4}^HZ_{k2}^+Z_{l2}^+ - ie^{3i\eta+2i\zeta}l_7^*Z_{i5}^HZ_{j4}^HZ_{k2}^+Z_{l2}^+ \\
& -ie^{i(\eta+2\zeta)}l_7Z_{i4}^HZ_{j5}^HZ_{k2}^+Z_{l2}^+ - ie^{3i\eta+2i\zeta}l_7^*Z_{i4}^HZ_{j5}^HZ_{k2}^+Z_{l2}^+ \\
& -2ie^{2i(\eta+\zeta)}l_2Z_{i5}^HZ_{j5}^HZ_{k2}^+Z_{l2}^+ + 4e^{2i(\eta+2\zeta)}l_{5p}Z_{i3}^HZ_{j6}^HZ_{k2}^+Z_{l2}^+ \\
& -4e^{2i\eta}l_{5p}^*Z_{i3}^HZ_{j6}^HZ_{k2}^+Z_{l2}^+ - 4ie^{2i(\eta+\zeta)}l_{2p}Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l2}^+ \\
& + 4ie^{2i(\eta+2\zeta)}l_{5p}Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l2}^+ + 4ie^{2i\eta}l_{5p}^*Z_{i6}^HZ_{j6}^HZ_{k2}^+Z_{l2}^+ \\
& + e^{2i\zeta}Z_{i2}^H \left(-2ie^{i\eta}Z_{j2}^H \left(e^{i\eta}Z_{k2}^+ \left(e^{i\eta}l_7^*Z_{l1}^+ + l_2Z_{l2}^+ \right) + Z_{k1}^+ \left(e^{i\eta}l_3Z_{l1}^+ + l_7Z_{l2}^+ \right) \right) \right. \\
& + Z_{j4}^H \left(Z_{k1}^+ \left(\left(e^{2i\eta}l_4 - l_5 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_6^* - l_6 \right) Z_{l1}^+ \right) \right. \\
& + e^{i\eta}Z_{k2}^+ \left(- \left(-e^{2i\eta}l_7^* + l_7 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_5^* - l_4 \right) Z_{l1}^+ \right) \left. \right) \\
& - iZ_{j1}^H \left(Z_{k1}^+ \left(\left(e^{2i\eta}l_4 + l_5 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_6^* + l_6 \right) Z_{l1}^+ \right) \right. \\
& + e^{i\eta}Z_{k2}^+ \left(\left(e^{2i\eta}l_7^* + l_7 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_5^* + l_4 \right) Z_{l1}^+ \right) \left. \right) \left. \right) \\
& + e^{2i\zeta}Z_{i1}^H \left(-2ie^{i\eta}Z_{j1}^H \left(e^{i\eta}Z_{k2}^+ \left(e^{i\eta}l_6^*Z_{l1}^+ + l_3Z_{l2}^+ \right) + Z_{k1}^+ \left(e^{i\eta}l_1Z_{l1}^+ + l_6Z_{l2}^+ \right) \right) \right. \\
& - Z_{j5}^H \left(Z_{k1}^+ \left(\left(e^{2i\eta}l_4 - l_5 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_6^* - l_6 \right) Z_{l1}^+ \right) \right. \\
& + e^{i\eta}Z_{k2}^+ \left(- \left(-e^{2i\eta}l_7^* + l_7 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_5^* - l_4 \right) Z_{l1}^+ \right) \left. \right) \\
& - iZ_{j2}^H \left(Z_{k1}^+ \left(\left(e^{2i\eta}l_4 + l_5 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_6^* + l_6 \right) Z_{l1}^+ \right) \right. \\
& + e^{i\eta}Z_{k2}^+ \left(\left(e^{2i\eta}l_7^* + l_7 \right) Z_{l2}^+ + e^{i\eta} \left(e^{2i\eta}l_5^* + l_4 \right) Z_{l1}^+ \right) \left. \right) \left. \right) \left. \right) \quad (234)
\end{aligned}$$



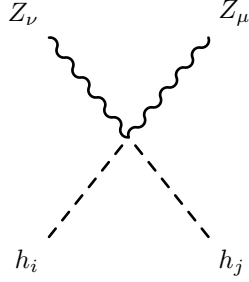
$$- ie^{-2i\eta} \left(e^{i\eta}Z_{i2}^+ \left(2e^{2i\eta}l_6^*Z_{j1}^+Z_{k1}^+Z_{l1}^+ + 2e^{3i\eta}l_5^*Z_{j2}^+Z_{k1}^+Z_{l1}^+ + e^{i\eta}l_3Z_{j1}^+Z_{k2}^+Z_{l1}^+ \right. \right.$$

$$\begin{aligned}
& + e^{i\eta} l_4 Z_{j1}^+ Z_{k2}^+ Z_{l1}^+ + 2e^{2i\eta} l_7^* Z_{j2}^+ Z_{k2}^+ Z_{l1}^+ + e^{i\eta} l_3 Z_{j1}^+ Z_{k1}^+ Z_{l2}^+ \\
& + e^{i\eta} l_4 Z_{j1}^+ Z_{k1}^+ Z_{l2}^+ + 2e^{2i\eta} l_7^* Z_{j2}^+ Z_{k1}^+ Z_{l2}^+ + 2l_7 Z_{j1}^+ Z_{k2}^+ Z_{l2}^+ \\
& + 2e^{i\eta} l_2 Z_{j2}^+ Z_{k2}^+ Z_{l2}^+ \Big) \\
& + Z_{i1}^+ \Big(2Z_{j1}^+ \Big(e^{i\eta} Z_{k1}^+ \Big(e^{i\eta} l_1 Z_{l1}^+ + l_6 Z_{l2}^+ \Big) + Z_{k2}^+ \Big(e^{i\eta} l_6 Z_{l1}^+ + l_5 Z_{l2}^+ \Big) \Big) \\
& + e^{i\eta} Z_{j2}^+ \Big(2e^{2i\eta} l_6^* Z_{k1}^+ Z_{l1}^+ + e^{i\eta} (l_3 + l_4) Z_{k1}^+ Z_{l2}^+ + Z_{k2}^+ \Big(2l_7 Z_{l2}^+ + e^{i\eta} (l_3 + l_4) Z_{l1}^+ \Big) \Big) \Big) \Big) \Big) \quad (235)
\end{aligned}$$

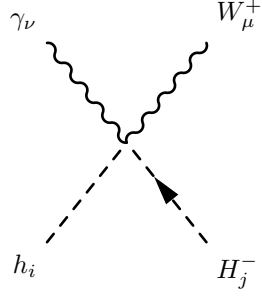
9.8 Two Scalar-Two Vector Boson-Interaction



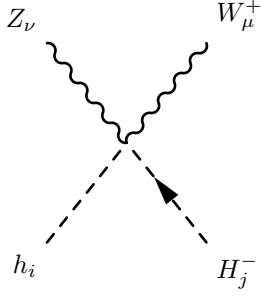
$$\frac{i}{2} g_2^2 \left(Z_{i1}^H Z_{j1}^H + Z_{i2}^H Z_{j2}^H + Z_{i4}^H Z_{j4}^H + Z_{i5}^H Z_{j5}^H \right) (g_{\mu\nu}) \quad (236)$$



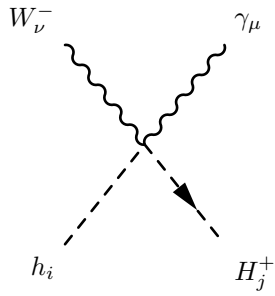
$$\frac{i}{2} \left(g_1 \sin \Theta_W + g_2 \cos \Theta_W \right)^2 \left(Z_{i1}^H Z_{j1}^H + Z_{i2}^H Z_{j2}^H + Z_{i4}^H Z_{j4}^H + Z_{i5}^H Z_{j5}^H \right) (g_{\mu\nu}) \quad (237)$$



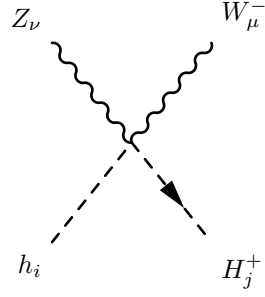
$$\frac{i}{2}g_1g_2\cos\Theta_W\left(iZ_{i4}^HZ_{j1}^++\left(iZ_{i5}^H+Z_{i2}^H\right)Z_{j2}^++Z_{i1}^HZ_{j1}^+\right)\left(g_{\mu\nu}\right) \quad (238)$$



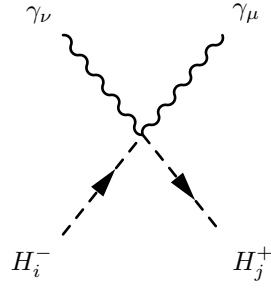
$$\frac{1}{2}g_1g_2\sin\Theta_W\left(-iZ_{i1}^HZ_{j1}^++\left(-iZ_{i2}^H+Z_{i5}^H\right)Z_{j2}^++Z_{i4}^HZ_{j1}^+\right)\left(g_{\mu\nu}\right) \quad (239)$$



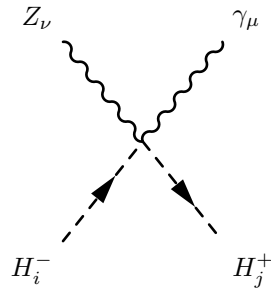
$$\frac{1}{2}g_1g_2\cos\Theta_W\left(iZ_{i1}^HZ_{j1}^++\left(iZ_{i2}^H+Z_{i5}^H\right)Z_{j2}^++Z_{i4}^HZ_{j1}^+\right)\left(g_{\mu\nu}\right) \quad (240)$$



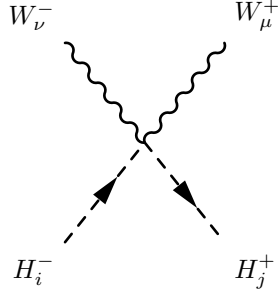
$$-\frac{i}{2}g_1g_2\sin\Theta_W\left(-iZ_{i4}^HZ_{j1}^++\left(-iZ_{i5}^H+Z_{i2}^H\right)Z_{j2}^++Z_{i1}^HZ_{j1}^+\right)\left(g_{\mu\nu}\right) \quad (241)$$



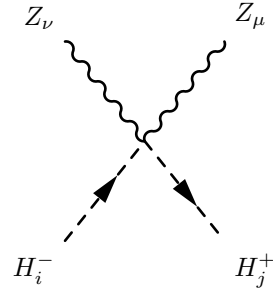
$$\frac{i}{2}\left(g_1\cos\Theta_W+g_2\sin\Theta_W\right)^2\left(Z_{i1}^+Z_{j1}^++Z_{i2}^+Z_{j2}^+\right)\left(g_{\mu\nu}\right) \quad (242)$$



$$-\frac{i}{4}\left(-2g_1g_2\cos2\Theta_W+\left(-g_2^2+g_1^2\right)\sin2\Theta_W\right)\left(Z_{i1}^+Z_{j1}^++Z_{i2}^+Z_{j2}^+\right)\left(g_{\mu\nu}\right) \quad (243)$$

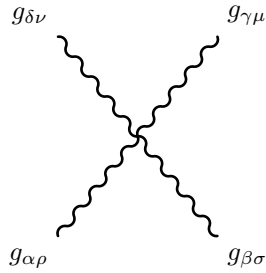


$$\frac{i}{2}g_2^2\left(Z_{i1}^+Z_{j1}^+ + Z_{i2}^+Z_{j2}^+\right)\left(g_{\mu\nu}\right) \quad (244)$$



$$\frac{i}{2}\left(-g_1\sin\Theta_W + g_2\cos\Theta_W\right)^2\left(Z_{i1}^+Z_{j1}^+ + Z_{i2}^+Z_{j2}^+\right)\left(g_{\mu\nu}\right) \quad (245)$$

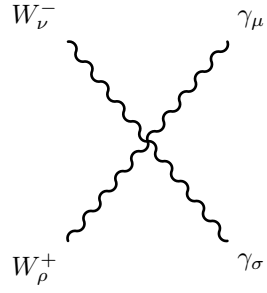
9.9 Four Vector Boson-Interaction



$$-ig_3^2\left(\sum_{a=1}^8 f_{\alpha,\delta,a}f_{\beta,\gamma,a} + \sum_{a=1}^8 f_{\alpha,\gamma,a}f_{\beta,\delta,a}\right)\left(g_{\rho\sigma}g_{\mu\nu}\right) \quad (246)$$

$$+ ig_3^2\left(-\sum_{a=1}^8 f_{\alpha,\beta,a}f_{\gamma,\delta,a} + \sum_{a=1}^8 f_{\alpha,\delta,a}f_{\beta,\gamma,a}\right)\left(g_{\rho\mu}g_{\sigma\nu}\right) \quad (247)$$

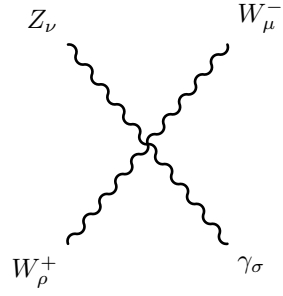
$$+ ig_3^2 \left(\sum_{a=1}^8 f_{\alpha,\gamma,a} f_{\beta,\delta,a} + \sum_{a=1}^8 f_{\alpha,\beta,a} f_{\gamma,\delta,a} \right) (g_{\rho\nu} g_{\sigma\mu}) \quad (248)$$



$$ig_2^2 \sin \Theta_W^2 (g_{\rho\sigma} g_{\mu\nu}) \quad (249)$$

$$+ ig_2^2 \sin \Theta_W^2 (g_{\rho\mu} g_{\sigma\nu}) \quad (250)$$

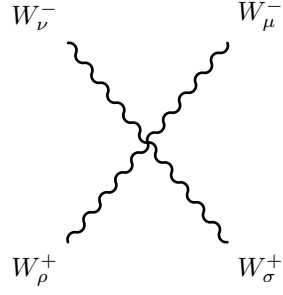
$$+ -2ig_2^2 \sin \Theta_W^2 (g_{\rho\nu} g_{\sigma\mu}) \quad (251)$$



$$ig_2^2 \cos \Theta_W \sin \Theta_W (g_{\rho\sigma} g_{\mu\nu}) \quad (252)$$

$$+ -ig_2^2 \sin 2\Theta_W (g_{\rho\mu} g_{\sigma\nu}) \quad (253)$$

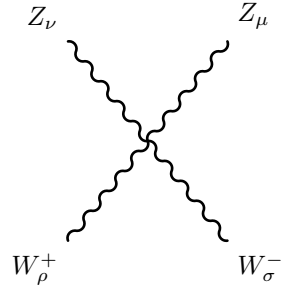
$$+ ig_2^2 \cos \Theta_W \sin \Theta_W (g_{\rho\nu} g_{\sigma\mu}) \quad (254)$$



$$2ig_2^2(g_{\rho\sigma}g_{\mu\nu}) \quad (255)$$

$$+ -ig_2^2(g_{\rho\mu}g_{\sigma\nu}) \quad (256)$$

$$+ -ig_2^2(g_{\rho\nu}g_{\sigma\mu}) \quad (257)$$

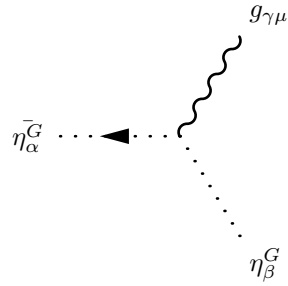


$$- 2ig_2^2 \cos \Theta_W^2(g_{\rho\sigma}g_{\mu\nu}) \quad (258)$$

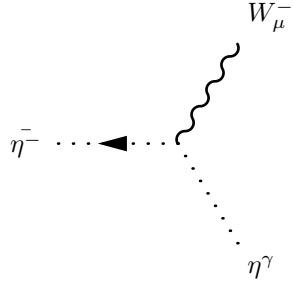
$$+ ig_2^2 \cos \Theta_W^2(g_{\rho\mu}g_{\sigma\nu}) \quad (259)$$

$$+ ig_2^2 \cos \Theta_W^2(g_{\rho\nu}g_{\sigma\mu}) \quad (260)$$

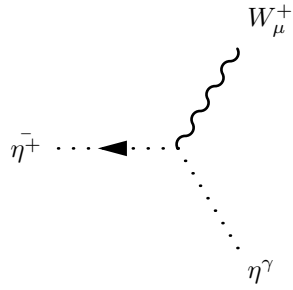
9.10 Two Ghosts-One Vector Boson-Interaction



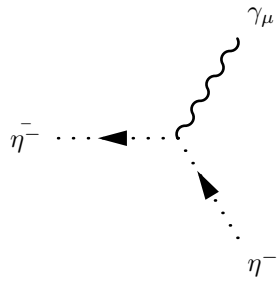
$$g_3 f_{\alpha,\beta,\gamma} \left(p_\mu^{\eta_\beta^G} \right) \quad (261)$$



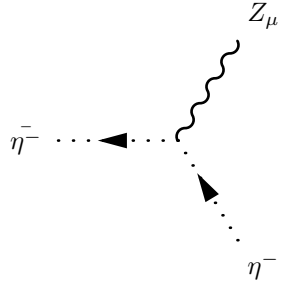
$$i g_2 \sin \Theta_W \left(p_\mu^{\eta^\gamma} \right) \quad (262)$$



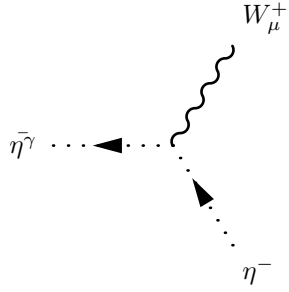
$$- i g_2 \sin \Theta_W \left(p_\mu^{\eta^\gamma} \right) \quad (263)$$



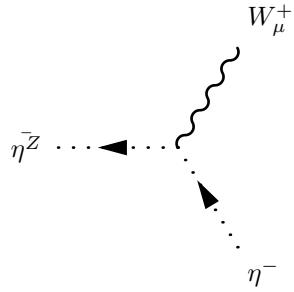
$$- i g_2 \sin \Theta_W \left(p_\mu^{\eta^-} \right) \quad (264)$$



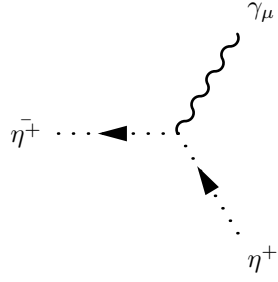
$$-ig_2 \cos \Theta_W (p_\mu^{\eta^-}) \quad (265)$$



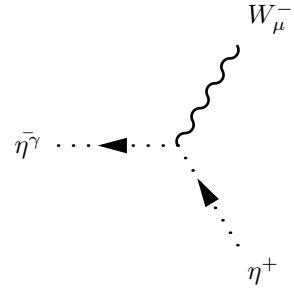
$$ig_2 \sin \Theta_W (p_\mu^{\eta^-}) \quad (266)$$



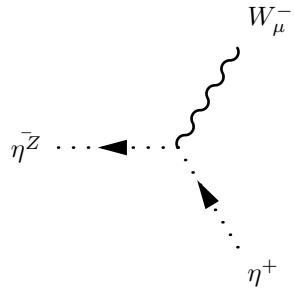
$$ig_2 \cos \Theta_W (p_\mu^{\eta^-}) \quad (267)$$



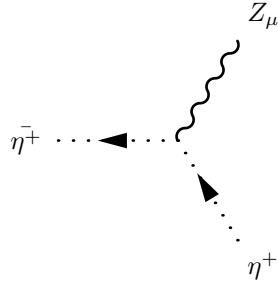
$$ig_2 \sin \Theta_W (p_\mu^{\eta^+}) \quad (268)$$



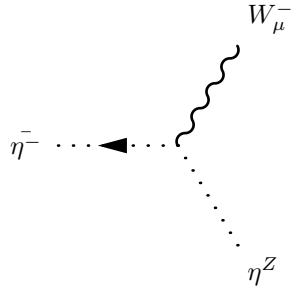
$$-ig_2 \sin \Theta_W (p_\mu^{\eta^+}) \quad (269)$$



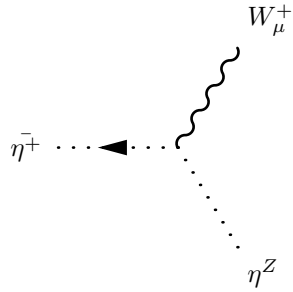
$$-ig_2 \cos \Theta_W (p_\mu^{\eta^+}) \quad (270)$$



$$ig_2 \cos \Theta_W (p_\mu^{\eta^+}) \quad (271)$$

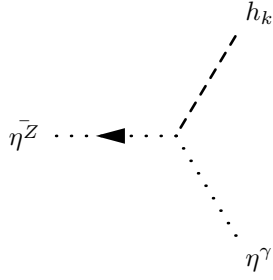


$$ig_2 \cos \Theta_W (p_\mu^{\eta^Z}) \quad (272)$$

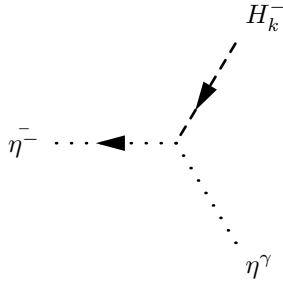


$$-ig_2 \cos \Theta_W (p_\mu^{\eta^Z}) \quad (273)$$

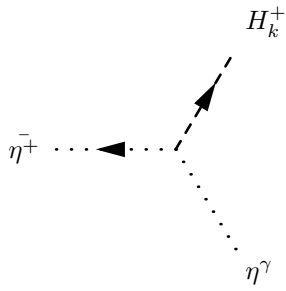
9.11 Two Ghosts-One Scalar-Interaction



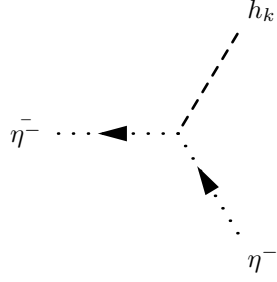
$$\frac{i}{8}\xi_Z\left(2g_1g_2\cos 2\Theta_W+\left(-g_2^2+g_1^2\right)\sin 2\Theta_W\right)\left(v_1Z_{k1}^H+v_2Z_{k2}^H\right) \quad (274)$$



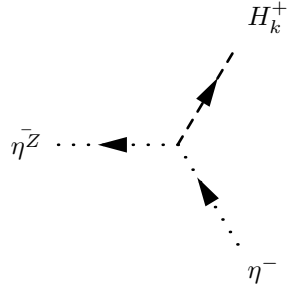
$$-\frac{i}{4}g_2\xi_{W-}\left(g_1\cos \Theta_W+g_2\sin \Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \quad (275)$$



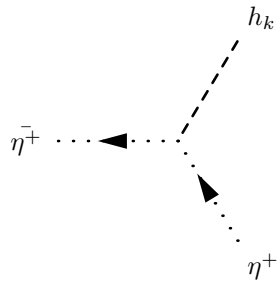
$$-\frac{i}{4}g_2\xi_{W-}\left(g_1\cos \Theta_W+g_2\sin \Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \quad (276)$$



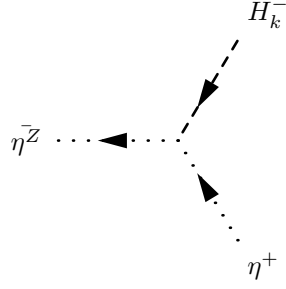
$$-\frac{i}{4}g_2^2\xi_{W^-}\left(-i\left(v_1Z_{k4}^H+v_2Z_{k5}^H\right)+v_1Z_{k1}^H+v_2Z_{k2}^H\right) \quad (277)$$



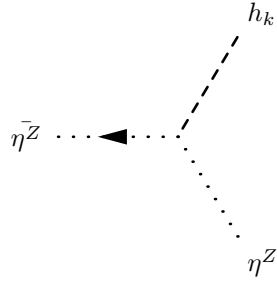
$$\frac{i}{4}g_2\xi_Z\left(g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \quad (278)$$



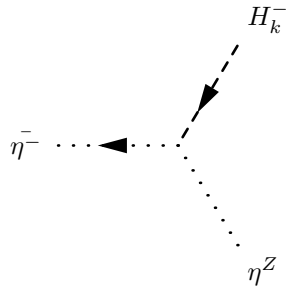
$$\frac{1}{4}g_2^2\xi_{W^-}\left(-iv_1Z_{k1}^H-iv_2Z_{k2}^H+v_1Z_{k4}^H+v_2Z_{k5}^H\right) \quad (279)$$



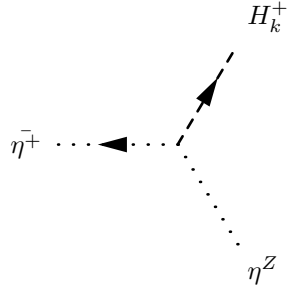
$$\frac{i}{4}g_2\xi_Z\left(g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \quad (280)$$



$$-\frac{i}{4}\xi_Z\left(g_1\sin\Theta_W+g_2\cos\Theta_W\right)^2\left(v_1Z_{k1}^H+v_2Z_{k2}^H\right) \quad (281)$$



$$-\frac{i}{4}g_2\xi_{W-}\left(-g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \quad (282)$$



$$-\frac{i}{4}g_2\xi_{W^-}\left(-g_1\sin\Theta_W+g_2\cos\Theta_W\right)\left(v_1Z_{k1}^++v_2Z_{k2}^+\right) \tag{283}$$

10 Clebsch-Gordan Coefficients