$$
H_{31} = \begin{bmatrix}
-2\,h-6\,\mu+U & 0 & 0 & 0 & 0 & 0 & \sqrt{2-2\,\sqrt{\frac{2}{11}}}\,t & -2\,\sqrt{\frac{2}{11\left(2+2\,\sqrt{\frac{2}{11}}\right)}}\,t-\frac{2\,t}{\sqrt{2+2\,\sqrt{\frac{2}{11}}}} \\
0 & -2\,h-6\,\mu+2\,U & 2\,t & 0 & 0 & 0 & 0 & 0 \\
0 & 2\,t & -2\,h-6\,\mu+2\,U & -\left(\sqrt{2}\,t\right) & 0 & 0 & \frac{\sqrt{\frac{4-4\,\sqrt{\frac{2}{11}}}{52-8\,\sqrt{22}}}\,t}{2}+\frac{7\,\sqrt{\frac{121-11\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t}{11}-\sqrt{\frac{22-2\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t & \frac{91\,\sqrt{\frac{2+2\,\sqrt{\frac{2}{11}}}{26+4\,\sqrt{22}}}\,t}{24}+\frac{5\,\sqrt{\frac{11+\sqrt{22}}{22\left(26+4\,\sqrt{22}\right)}}\,t}{12}+\sqrt{\frac{11+\sqrt{22}}{26+4\,\sqrt{22}}}\,t \\
0 & 0 & -\left(\sqrt{2}\,t\right) & -2\,h-6\,\mu+2\,U & 0 & 2\,t & 0 & 0 \\
0 & 0 & 0 & 0 & -2\,h-6\,\mu+2\,U & 0 & -3\,\sqrt{\frac{2-2\,\sqrt{\frac{2}{11}}}{52-8\,\sqrt{22}}}\,t-\frac{5\,\sqrt{\frac{242-22\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t}{11}+2\,\sqrt{\frac{11-\sqrt{22}}{52-8\,\sqrt{22}}}\,t & \frac{-91\,\sqrt{\frac{4+4\,\sqrt{\frac{2}{11}}}{26+4\,\sqrt{22}}}\,t}{24}-\frac{5\,\sqrt{\frac{11+\sqrt{22}}{11\left(26+4\,\sqrt{22}\right)}}\,t}{12}-\sqrt{\frac{2\left(11+\sqrt{22}\right)}{26+4\,\sqrt{22}}}\,t \\
0 & 0 & 0 & 2\,t & 0 & -2\,h-6\,\mu+U & \sqrt{\frac{2}{2-2\,\sqrt{\frac{2}{11}}}}\,t-\frac{2\,t}{\sqrt{11\left(2-2\,\sqrt{\frac{2}{11}}\right)}} & -\left(\sqrt{\frac{2}{2+2\,\sqrt{\frac{2}{11}}}}\,t\right)-\frac{2\,t}{\sqrt{11\left(2+2\,\sqrt{\frac{2}{11}}\right)}} \\
\sqrt{2-2\,\sqrt{\frac{2}{11}}}\,t & 0 & \frac{\sqrt{\frac{4-4\,\sqrt{\frac{2}{11}}}{52-8\,\sqrt{22}}}\,t}{2}+\frac{7\,\sqrt{\frac{121-11\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t}{11}-\sqrt{\frac{22-2\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t & 0 & -3\,\sqrt{\frac{2-2\,\sqrt{\frac{2}{11}}}{52-8\,\sqrt{22}}}\,t-\frac{5\,\sqrt{\frac{242-22\,\sqrt{22}}{52-8\,\sqrt{22}}}\,t}{11}+2\,\sqrt{\frac{11-\sqrt{22}}{52-8\,\sqrt{22}}}\,t & \sqrt{\frac{2}{2-2\,\sqrt{\frac{2}{11}}}}\,t-\frac{2\,t}{\sqrt{11\left(2-2\,\sqrt{\frac{2}{11}}\right)}} & \frac{26\,h}{-13+2\,\sqrt{22}}-\frac{4\,\sqrt{22}\,h}{-13+2\,\sqrt{22}}+\frac{78\,\mu}{-13+2\,\sqrt{22}}-\frac{12\,\sqrt{22}\,\mu}{-13+2\,\sqrt{22}}-\frac{13\,U}{-13+2\,\sqrt{22}}+\frac{2\,\sqrt{22}\,U}{-13+2\,\sqrt{22}} & 0 \\
-2\,\sqrt{\frac{2}{11\left(2+2\,\sqrt{\frac{2}{11}}\right)}}\,t-\frac{2\,t}{\sqrt{2+2\,\sqrt{\frac{2}{11}}}} & 0 & \frac{91\,\sqrt{\frac{2+2\,\sqrt{\frac{2}{11}}}{26+4\,\sqrt{22}}}\,t}{24}+\frac{5\,\sqrt{\frac{11+\sqrt{22}}{22\left(26+4\,\sqrt{22}\right)}}\,t}{12}+\sqrt{\frac{11+\sqrt{22}}{26+4\,\sqrt{22}}}\,t & 0 & \frac{-91\,\sqrt{\frac{4+4\,\sqrt{\frac{2}{11}}}{26+4\,\sqrt{22}}}\,t}{24}-\frac{5\,\sqrt{\frac{11+\sqrt{22}}{11\left(26+4\,\sqrt{22}\right)}}\,t}{12}-\sqrt{\frac{2\left(11+\sqrt{22}\right)}{26+4\,\sqrt{22}}}\,t & -\left(\sqrt{\frac{2}{2+2\,\sqrt{\frac{2}{11}}}}\,t\right)-\frac{2\,t}{\sqrt{11\left(2+2\,\sqrt{\frac{2}{11}}\right)}} & 0 & -2\,h-6\,\mu+U
\end{bmatrix}
$$