$$|p\uparrow\rangle = \frac{1}{\sqrt{2}}\left(|p\rangle^S|S_{pin}\rangle^S + |p\rangle^A|S_{pin}\rangle^A\right)$$

$$= \frac{1}{\sqrt{2}}\left[\frac{1}{\sqrt{6}}(2uud - udu - duu)\frac{1}{\sqrt{6}}(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow)\right] + \frac{1}{\sqrt{2}}\left[\frac{1}{\sqrt{2}}(udu - duu)\frac{1}{\sqrt{2}}(\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow)\right]$$

$$|p\uparrow\rangle = \frac{1}{\sqrt{2}}\frac{1}{6}\Big[2uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + -udu(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + -duu(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + \frac{1}{\sqrt{2}}\frac{1}{2}\Big[udu(\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) - duu(\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow)\Big]$$

$$|p\uparrow\rangle = \frac{1}{3.2.\sqrt{2}}\Big[2uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + -udu(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) - duu(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + 3udu(\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) - 3duu(\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow)\Big]$$

$$|p\uparrow\rangle = \frac{1}{3.2.\sqrt{2}}\Big[2uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + -udu(2\uparrow\uparrow\downarrow - 4\uparrow\downarrow\uparrow + 2\downarrow\uparrow\uparrow) + -duu(2\uparrow\uparrow\downarrow + 2\uparrow\downarrow\uparrow - 4\downarrow\uparrow\uparrow)\Big]$$

$$|p\uparrow\rangle = \frac{1}{3\sqrt{2}}\Big[uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + -udu(\uparrow\uparrow\downarrow - 2\uparrow\downarrow\uparrow + \downarrow\uparrow\uparrow) + -duu(\uparrow\uparrow\downarrow + \uparrow\downarrow\uparrow - 2\downarrow\uparrow\uparrow)\Big]$$

$$|p\uparrow\rangle = \frac{1}{3\sqrt{2}}\Big[uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + udu(-\uparrow\uparrow\downarrow + 2\uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + duu(-\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow + 2\downarrow\uparrow\uparrow)\Big]$$

$$|p\uparrow\rangle = \frac{1}{\sqrt{18}}\Big[uud(2\uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow - \downarrow\uparrow\uparrow) + udu(2\uparrow\downarrow\uparrow - \uparrow\uparrow\downarrow - \downarrow\uparrow\uparrow) + duu(2\downarrow\uparrow\uparrow - \uparrow\uparrow\downarrow - \uparrow\downarrow\uparrow)\Big]$$