$$\widetilde{\underline{R}_g}\,\widetilde{\underline{R}_g}^{\,g}\widetilde{\nabla}\P = \flat \overset{+}{\bowtie} \flat + \frac{1}{2}\underbrace{\flat \bowtie \flat}^{+}$$

$$\dot{g}_1\,\dot{g}_2\,{}^{g}\widetilde{\nabla}\P = \dot{g}_1\,\dot{g}_2\,{}^{g}\widetilde{d\P} + \frac{1}{2}\underbrace{\dot{g}_1\,{}^{g}\P} \bowtie \underbrace{\dot{g}_2\,{}^{g}\P}$$

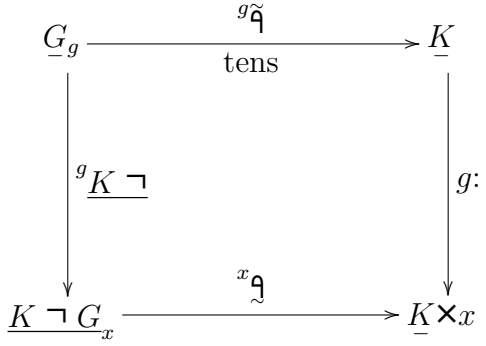
$$\underset{\sim}{\flat}_g = \flat\,\underline{R}_g \in \underline{G}_g$$

$${}^{y}\widetilde{\underset{\sim}{\flat}|R_g \ltimes \P} = \underset{\sim}{\flat}_y|\,R_g \ltimes \P = \underset{\sim}{\flat}_y\,{}^{y}\underline{R}^{g\;yg}\underline{\P} = \flat\,\underline{R}_y\,{}^{y}\underline{R}^{g\;yg}\underline{\P} = \flat\,{}^{y}\underline{R}^{yg\;yg}\underline{\P} = \overset{+}{\flat}$$

$$\Longrightarrow \flat\flat\;{}^{e}\widetilde{d\,\underbrace{R_g \ltimes \P}} = \underset{\sim}{\flat}_e\,\underset{\sim}{\flat}_e\,{}^{e}\widetilde{d\,\underbrace{R_g \ltimes \P}} = {}^{e}\widetilde{\underset{\sim}{\flat} \ltimes \underbrace{\underset{\sim}{\flat}|R_g \ltimes \P}_{\text{cst}}} - {}^{e}\widetilde{\underset{\sim}{\flat} \ltimes \underbrace{\underset{\sim}{\flat}|R_g \ltimes \P}_{\text{cst}}} - {}^{e}\widetilde{\underbrace{\underset{\sim}{\flat} \ltimes \underset{\sim}{\flat}}_{\flat\bowtie\flat}|R_g \ltimes \P} = -\flat \overset{+}{\bowtie} \flat$$

$$\Longrightarrow \text{LHS} = \widetilde{\underline{R}_g}\,\widetilde{\underline{R}_g}^{\,g}\widetilde{d\P} + \frac{1}{2}\underbrace{\widetilde{\underline{R}_g}^{\,g}\P} \bowtie \underbrace{\widetilde{\underline{R}_g}^{\,g}\P}$$

$$= \underbrace{\flat\flat}\;{}^{e}\widetilde{d\,\underbrace{R_g \ltimes \P}} + \frac{1}{2}\underbrace{\flat \bowtie \flat}^{+} = \text{RHS}$$



$$p{:}\widetilde{\dot{p}_1 \cdots \dot{p}_m\,{}^{p}\widetilde{\P}} = \dot{x}_1 \cdots \dot{x}_m\,{}^{x}\underset{\sim}{\P}$$

$$\dot{p}_1\,\dot{p}_2\,{}^{p}\widetilde{\Omega} = \dot{p}_1\,\dot{p}_2\,{}^{p}\widetilde{d\P} + \frac{1}{2}\underbrace{\dot{p}_1\,{}^{p}\widetilde{\P}} \bowtie \underbrace{\dot{p}_2\,{}^{p}\widetilde{\P}}$$

$$\dot{x}_1\,\dot{x}_2\,{}^{x}\Omega = \underbrace{\mathfrak{b}\underline{R}_g\,{}^{g}\underline{\pi}}\,\underbrace{\mathfrak{b}\underline{R}_g\,{}^{g}\underline{\pi}}\,{}^{g\pi}\Omega \overset{\text{KN}}{=\!=} {}^{o}\underline{g}\left(\mathfrak{b}\underline{R}_g{:}\mathfrak{b}\underline{R}_g\,{}^{g}\widetilde{\Omega}\right)$$

$$= {}^{o}\underline{g}\left(\mathfrak{b}\underline{R}_g{:}\mathfrak{b}\underline{R}_g\,{}^{g}\widetilde{d\Omega} + \frac{1}{2}\widetilde{\mathfrak{b}\underline{R}_g\,{}^{g}\P} \bowtie \widetilde{\mathfrak{b}\underline{R}_g\,{}^{g}\P}\right)$$