$$ {}_{o}\mathfrak{b}_{\mu\underline{\mathfrak{a}}\,\nu\underline{\mathfrak{a}}}\left(d\mathfrak{h}^{g}\right)\mathfrak{a}^{o} = d\left(\underset{\sim}{d^{\mathfrak{a}}\ldots\mathfrak{b}g}\right)_{\mu\nu} $$

$$ {}_{o}\mathfrak{b}_{i\mathfrak{b}\,j\mathfrak{b}}\left(d\mathfrak{h}^{g}\right)\mathfrak{a}^{o} = d\left(\underset{\sim}{d^{\mathfrak{a}}\ldots\mathfrak{b}g}\right)_{ij} $$

$$ {}_{o}\mathfrak{b}_{\mathfrak{b}\mathfrak{t}}\left(d\mathfrak{h}^{g}\right)\mathfrak{a}^{o} = d\left(\underset{\sim}{d^{\mathfrak{a}}\ldots\mathfrak{b}g}\right)_{\mathfrak{b}\mathfrak{t}} $$

$$ \text{LHS} = {}_{o}\mathfrak{b}\,\overbrace{\mathfrak{h}_{\mathfrak{b}}^{g}\times\mathfrak{h}_{\mathfrak{t}}^{g}-\mathfrak{h}_{\mathfrak{b}\times\mathfrak{t}}^{g}}\,\mathfrak{a}^{o} = \left({}_{o}\mathfrak{b}\mathfrak{h}_{\mathfrak{b}}^{g}\mathfrak{a}^{o}\right)\times\left({}_{o}\mathfrak{b}\mathfrak{h}_{\mathfrak{t}}^{g}\mathfrak{a}^{o}\right) - {}_{o}\mathfrak{b}\,\mathfrak{h}_{\mathfrak{b}\times\mathfrak{t}}^{g}\,\mathfrak{a}^{o} $$

$$ = \overbrace{\mathfrak{b}\ltimes+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}}\times\overbrace{\mathfrak{t}\ltimes+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}} - \underbrace{\mathfrak{b}\times\mathfrak{t}}\ltimes+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}\times\mathfrak{t}} = $$

$$ \underbrace{\mathfrak{b}\ltimes}\times\underbrace{\mathfrak{t}\ltimes}-\underbrace{\mathfrak{b}\times\mathfrak{t}\ltimes}+\underbrace{\mathfrak{b}\ltimes}\times\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{t}}+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}\times\underbrace{\mathfrak{t}\ltimes}+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}\times\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{t}}-\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}\times\mathfrak{t}} $$

$$ = \mathfrak{b}\ltimes\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{t}}-\mathfrak{t}\ltimes\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}+\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}}\times\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{t}}-\underbrace{d^{\mathfrak{a}}\ldots\mathfrak{b}g}_{\mathfrak{b}\times\mathfrak{t}} = {}_{\mathfrak{b}\mathfrak{t}}\underbrace{dd\left(\mathfrak{a}\ldots\mathfrak{b}g\right)}_{\sim} = \text{RHS} $$

$$ -\overset{*}{\mathfrak{h}}{}^{g}\,\mathfrak{h}^{g} = \underline{\mathfrak{v}}^{\mu}\,\mathbf{x}\,\underline{\mathfrak{v}}^{\nu}\,\mathfrak{h}_{\mu\underline{\mathfrak{a}}}^{g}\,\mathfrak{h}_{\nu\underline{\mathfrak{a}}}^{g} - {}_{\mu}\left(d^{\mathfrak{a}}\ldots\mathfrak{b}g\right)_{\lambda}^{\nu}\mathfrak{h}_{\lambda\mathfrak{a}}^{g} $$

$$ \underline{\mathfrak{v}}^{\mu}\,\underline{\mathfrak{v}}^{\nu}{}_{\mu\underline{\mathfrak{a}}\,\nu\underline{\mathfrak{a}}}\left(d\mathfrak{h}^{g}\right) = \mathfrak{a}^{m}\,\mathfrak{a}^{n}{}_{m\mathfrak{b}\,n\mathfrak{b}}\left(d\mathfrak{h}^{g}\right) = -\frac{1}{2}{}^{m}\left(d\left(d^{\mathfrak{a}}\ldots\mathfrak{b}g\right)\right)_{mn}^{n}\ \text{id} $$

$$ \text{LHS} = \mathfrak{a}^{m}\,{}_{m}\mathfrak{b}^{\mu}\,\mathfrak{a}^{n}\,{}_{n}\mathfrak{b}^{\nu}{}_{\mu\mathfrak{a}^{k}\,k\mathfrak{b}\,\nu\mathfrak{a}^{\ell}\,\ell\mathfrak{b}}\left(d\mathfrak{h}^{g}\right) = \left({}_{m}\mathfrak{b}^{\mu}\,{}_{\mu}\mathfrak{a}^{k}\right)\left({}_{n}\mathfrak{b}^{\nu}\,{}_{\nu}\mathfrak{a}^{\ell}\right)\mathfrak{a}^{m}\,\mathfrak{a}^{n}{}_{k\mathfrak{b}\,\ell\mathfrak{b}}\left(d\mathfrak{h}^{g}\right) = \text{MHS} $$

$$ {}_{o}\mathfrak{b}\ \text{MHS}\ \mathfrak{a}^{o} = \left(.\mathfrak{b}\mathfrak{a}^{m}\right)\left(.\mathfrak{b}\mathfrak{a}^{n}\right){}_{o}\mathfrak{b}_{m\mathfrak{b}\,n\mathfrak{b}}\left(d\mathfrak{h}^{g}\right)\mathfrak{a}^{o} = \left(.\mathfrak{b}\mathfrak{a}^{m}\right)\left(.\mathfrak{b}\mathfrak{a}^{n}\right){}_{.}\left(d\left(\underset{\sim}{d^{\mathfrak{a}}\ldots\mathfrak{b}g}\right)\right)_{mn}^{.} = $$

$$ \overbrace{\left(.\mathfrak{b}\mathfrak{a}^{m}\right)\times\left(.\mathfrak{b}\mathfrak{a}^{n}\right)\times{}_{.}\left(d\left(d^{\mathfrak{a}}\ldots\mathfrak{b}g\right)\right)_{mn}^{.}}^{\sim} = -\frac{1}{2}{}^{m}\left(d\left(d^{\mathfrak{a}}\ldots\mathfrak{b}g\right)\right)_{mn}^{n}{}_{o}\mathfrak{b}\ \text{id}\ \mathfrak{a}^{o} $$

$$\overset{2}{\mathsf{H}}{}^{g} = -\overset{*}{\mathsf{H}}{}^{g}\,\mathsf{H}^{g} - \frac{1}{4}{}^{i}\left(d\left(d^{\mathfrak{l}}_{\cdot\cdot}\mathfrak{b}g\right)\right)^{j}_{ij} I$$

$$\text{LHS} = \underline{\mathfrak{v}}^{\mu}\,\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}}\,\underline{\mathfrak{v}}^{\nu}\,\mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}} = \underline{\mathfrak{v}}^{\mu}\,\underbrace{\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}} \times \underline{\mathfrak{v}}^{\nu}}\,\mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}} + \frac{\underline{\mathfrak{v}}^{\mu}\underline{\mathfrak{v}}^{\nu} + \underline{\mathfrak{v}}^{\nu}\underline{\mathfrak{v}}^{\mu}}{2}\,\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}}\,\mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}} + \frac{\underline{\mathfrak{v}}^{\mu}\underline{\mathfrak{v}}^{\nu} - \underline{\mathfrak{v}}^{\nu}\underline{\mathfrak{v}}^{\mu}}{2}\,\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}}\,\mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}}$$

$$= -\underline{\mathfrak{v}}^{\mu} \blacktriangle \underline{\mathfrak{v}}^{\nu}\;{}_{\mu}\left(d^{\mathfrak{l}}_{\cdot\cdot}\mathfrak{b}g\right)^{\nu}_{\lambda}\mathsf{H}^{g}_{\lambda\underline{\mathfrak{l}}} + \underline{\mathfrak{v}}^{\mu} \blacktriangle \underline{\mathfrak{v}}^{\nu}\,\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}}\,\mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}} + \frac{1}{2}\underline{\mathfrak{v}}^{\mu}\,\underline{\mathfrak{v}}^{\nu}\,\underbrace{\mathsf{H}^{g}_{\mu\underline{\mathfrak{l}}} \times \mathsf{H}^{g}_{\nu\underline{\mathfrak{l}}}} = -\overset{*}{\mathsf{H}}{}^{g}\,\mathsf{H}^{g} + \frac{1}{2}\underline{\mathfrak{v}}^{\mu}\,\underline{\mathfrak{v}}^{\nu}\;{}_{\mu\underline{\mathfrak{l}}\,\nu\underline{\mathfrak{l}}}\left(d\mathsf{H}^{g}\right) = \text{RHS}$$