16.8 Appendix: Deriving (16-74) (Added in June 2022 revision)

To derive (16-74), start with the first part of (16-48), the 2nd order part of (16-53), and the latter part of (16-70), each given a new equation number below.

$$Z_{MS\,f}^{2nd} = 1 - e_{r\,f}^2 \frac{1}{16\pi^2} 2\,ln\,\Lambda \qquad (16\text{-}123)$$

$$e_{r\,f} \equiv \tilde{e}_0 \left(Z_{MS\,f}^{2nd} \right)^{1/2} \qquad (16\text{-}124)$$

$$Z_{MS\,V}^{2nd} = 1 + \frac{\tilde{e}_0^2}{16\pi^2} 2\,ln\,\Lambda \qquad (16\text{-}125)$$

(16-124) into (16-123) gives us

$$Z_{MS\,f}^{2nd} = 1 - Z_{MS\,f}^{2nd}\,\tilde{e}_0^2 \frac{1}{16\pi^2} 2\,ln\,\Lambda \quad \rightarrow \quad Z_{MS\,f}^{2nd} \left(1 + \tilde{e}_0^2 \frac{1}{16\pi^2} 2\,ln\,\Lambda \right) = 1. \qquad (16\text{-}126)$$

(16-125) into (16-126) yields

$$Z_{MS\,f}^{2nd} Z_{MS\,V}^{2nd} = 1, \qquad (16\text{-}127)$$

which is (16-74).