

es-causl-iff^{11,40}

$\forall the_es:ES, e, e':E.$

$(e < e')$

$$\iff (((\neg(\uparrow\text{first}(e'))) \text{ c} \wedge ((e < \text{pred}(e') \vee (e = \text{pred}(e')))) \vee ((\uparrow\text{isrcv}(e')) \text{ c} \wedge ((e < \text{sender}(e') \vee (e = \text{sender}(e'))))))$$