```
w-sender_wf  THM

⊢  ∀the_w:World, e:E. FairFifo ⇒ isrcv(kind(e)) ⇒ sender(e) ∈ E
| by Auto THEN Assert (∃n:ℕ. match(lnk(kind(e));n;time(e)))
|
|\
| .....assertion .....
| 1. the_w : World
| 2. e : E
| 3. FairFifo
| 4. isrcv(kind(e))
| ⊢  ∃n:ℕ. match(lnk(kind(e));n;time(e))
|   by AssertBY (∃n:ℕtime(e). match(lnk(kind(e));n;time(e)))
|      (BackThru
|       Thm* ∀the_w:World, e:E.
|            FairFifo
|            ⇒
|            isrcv(kind(e))
|            ⇒
|            (∃t:ℕtime(e). match(lnk(kind(e));t;time(e)))
|       {w_DASH_match_DASH_exists})
|      THEN
|      ParallelOp -1
|
.\
. 1. the_w : World
. 2. e : E
. 3. FairFifo
. 4. isrcv(kind(e))
. 5. ∃n:ℕ. match(lnk(kind(e));n;time(e))
. ⊢  sender(e) ∈ E
. | by Inst
. |    Thm* ∀f:(ℕ→𝔹).
. |         (∃n:ℕ. f(n)) ⇒ f(mu(f)) & (∀i:ℕ. i<mu(f) ⇒ ¬f(i))
. |    {mu_DASH_property}
. |    [λt.match(lnk(kind(e));t;time(e))]
. |    THEN
. |    All Reduce
. |    THEN
. |    Unfold `w-sender` 0
. |    THEN
. |    Unfold `w-E` 0
. |    THEN
. |    Analyze
. |    THEN
. |    All Reduce
. |
. 1. the_w : World
. 2. e : E
. 3. FairFifo
. 4. isrcv(kind(e))
. 5. ∃n:ℕ. match(lnk(kind(e));n;time(e))
. 6. match(lnk(kind(e));mu(λt.match(lnk(kind(e));t;time(e)));time(e))
. 7. ∀i:ℕ.
. |  i<mu(λt.match(lnk(kind(e));t;time(e)))
```

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. |  ⇒
. |  ¬match(lnk(kind(e));i;time(e))
. ⊢  ¬isnull(a(source(lnk(kind(e)));mu(λt.
. |  match(lnk(kind(e));t;time(e)))))
. | by Thin -1 THEN MoveToConcl -1
. |    THEN
. |    GenConcl (mu(λt.match(lnk(kind(e));t;time(e))) = t)
. |    THENA
. |    (Auto THEN Reduce 0)
. |    THEN
. |    Thin -1
. |    THEN
. |    GenConcl (lnk(kind(e)) = l)
. |    THEN
. |    Thin -1
. |
. 1. the_w : World
. 2. e : E
. 3. FairFifo
. 4. isrcv(kind(e))
. 5. ∃n:ℕ. match(lnk(kind(e));n;time(e))
. 6. t : ℕ
. 7. l : IdLnk
. ⊢  match(l;t;time(e)) ⇒ ¬isnull(a(source(l);t))
. | by AssertBY (||onlnk(l;m(source(l);t))|| ∈ ℤ)
. |    (GenConclAtAddr [2;1;2] THEN Fold ‘w-Msg‘ -2
. |     THEN
. |     Unfold ‘w-Msg‘ -1)
. |    THEN
. |    Unfold ‘fair-fifo‘ 3
. |    THEN
. |    Analyze 3
. |    THEN
. |    Analyze 4
. |    THEN
. |    Analyze 5
. |    THEN
. |    Analyze 0
. |    THEN
. |    Unfold ‘w-match‘ -1
. |    THEN
. |    RW assert_pushdownC -1
. |
. 1. the_w : World
. 2. e : E
. 3. ∀i:Id, t:ℕ, l:IdLnk. ¬source(l) = i ⇒ onlnk(l;m(i;t)) = nil
. 4. ∀i:Id, t:ℕ.
. |  isnull(a(i;t)) ⇒ (∀x:Id. s(i;t+1).x = s(i;t).x) & m(i;t) = nil
. 5. ∀i:Id, t:ℕ, l:IdLnk.
. |  isrcv(l;a(i;t))
. |  ⇒
. |  destination(l) = i
. |  & ||queue(l;t)||≥1 & hd(queue(l;t)) = msg(a(i;t))
. 6. ∀l:IdLnk, t:ℕ.
. |  ∃t':ℕ. t≤t' & isrcv(l;a(destination(l);t')) ∨ queue(l;t') = nil
```

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. 7. isrcv(kind(e))
. 8. ∃n:ℕ. match(lnk(kind(e));n;time(e))
. 9. t : ℕ
. 10. l : IdLnk
. 11. ||onlnk(l;m(source(l);t))|| ∈ ℤ
. 12. ||snds(l;t)||≤||rcvs(l;time(e))||
. 13. ||rcvs(l;time(e))||<||snds(l;t)||+||onlnk(l;m(source(l);t))||
. ⊢  ¬isnull(a(source(l);t))
. | by Analyze 0 THEN InstHyp [source(l);t] 4
. |
. 1. the_w : World
. 2. e : E
. 3. ∀i:Id, t:ℕ, l:IdLnk. ¬source(l) = i ⇒ onlnk(l;m(i;t)) = nil
. 4. ∀i:Id, t:ℕ.
.    isnull(a(i;t)) ⇒ (∀x:Id. s(i;t+1).x = s(i;t).x) & m(i;t) = nil
. 5. ∀i:Id, t:ℕ, l:IdLnk.
.    isrcv(l;a(i;t))
.    ⇒
.    destination(l) = i
.    & ||queue(l;t)||≥1 & hd(queue(l;t)) = msg(a(i;t))
. 6. ∀l:IdLnk, t:ℕ.
.    ∃t':ℕ. t≤t' & isrcv(l;a(destination(l);t')) ∨ queue(l;t') = nil
. 7. isrcv(kind(e))
. 8. ∃n:ℕ. match(lnk(kind(e));n;time(e))
. 9. t : ℕ
. 10. l : IdLnk
. 11. ||onlnk(l;m(source(l);t))|| ∈ ℤ
. 12. ||snds(l;t)||≤||rcvs(l;time(e))||
. 13. ||rcvs(l;time(e))||<||snds(l;t)||+||onlnk(l;m(source(l);t))||
. 14. isnull(a(source(l);t))
. 15. ∀x:Id. s(source(l);t+1).x = s(source(l);t).x
. 16. m(source(l);t) = nil
. ⊢  False  by HypSubst -1 -4 THEN Unfold ‘w-onlnk‘ -4 THEN Reduce -4
END
```