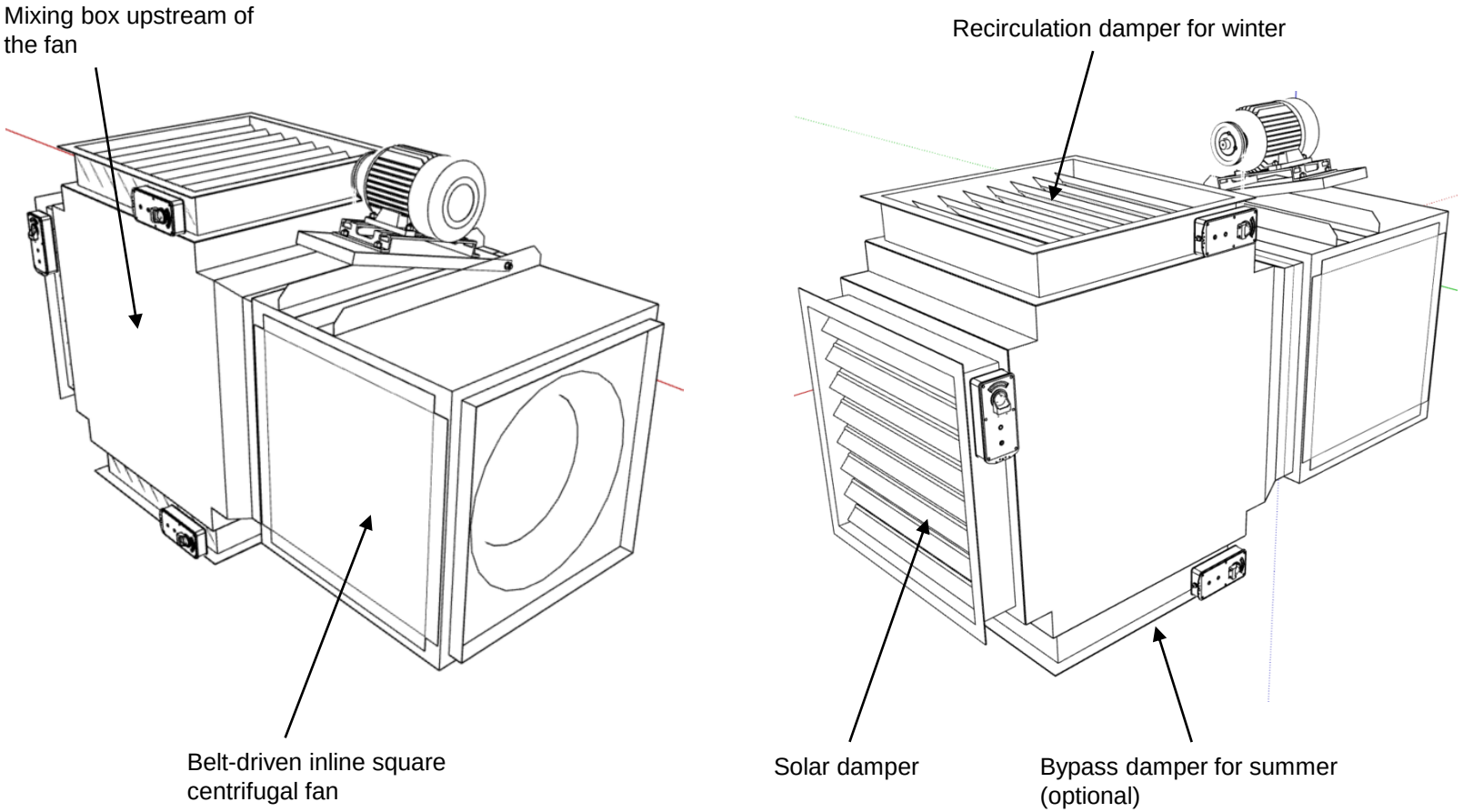
Mixing box with three controlled dampers

To manage solar air heating systems in winter and summer modes

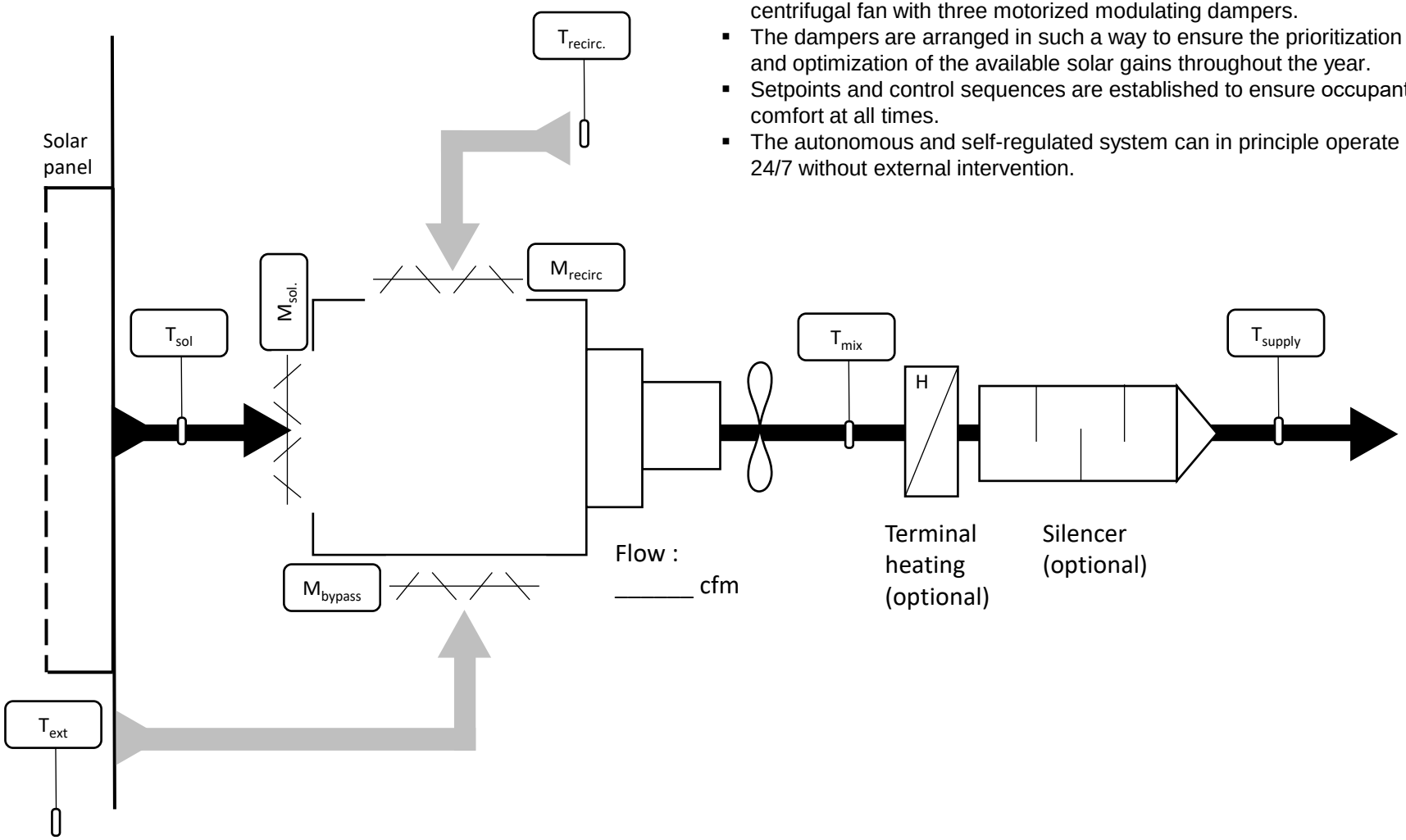


Mixing box with three controlled dampers

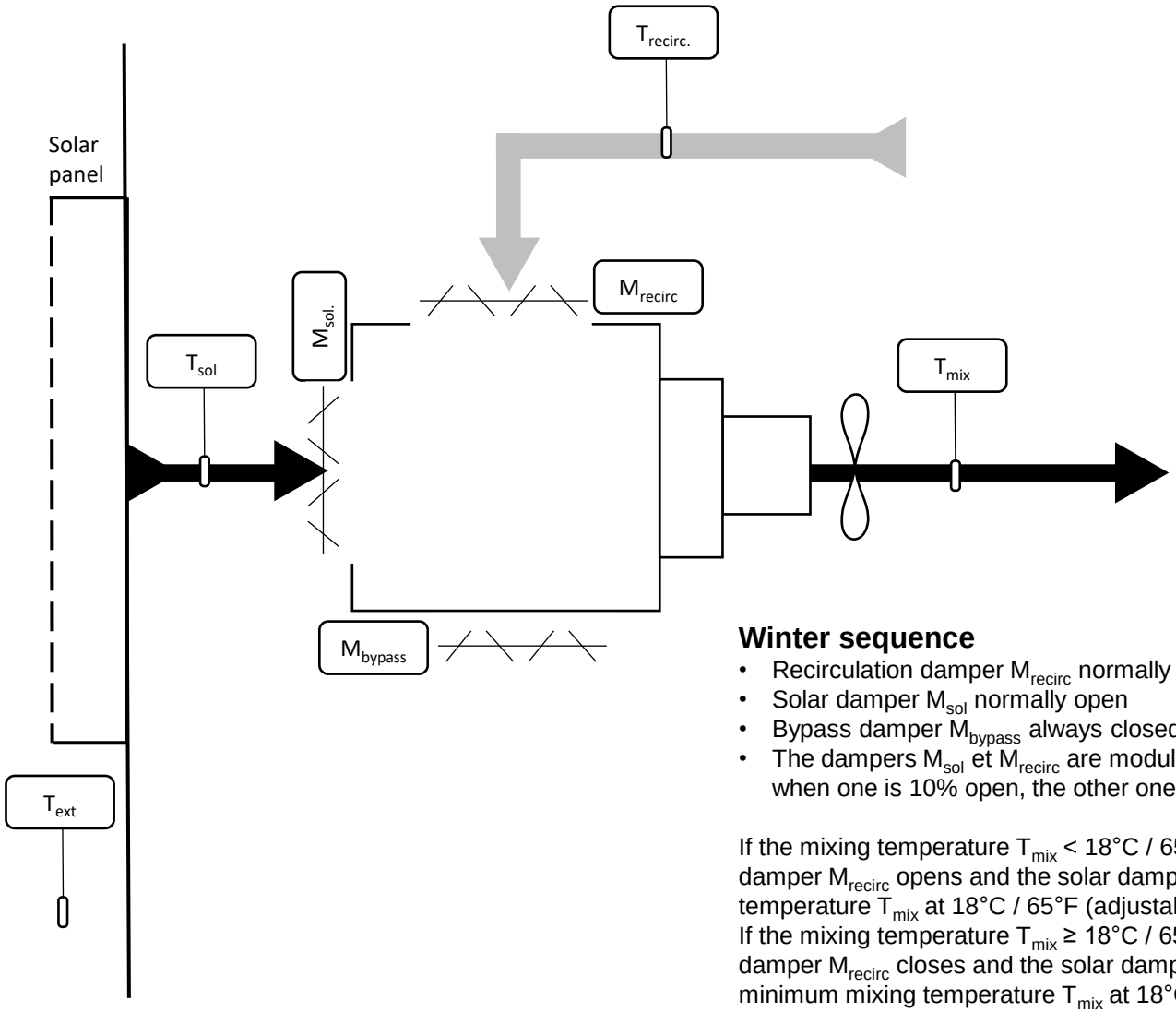
General diagram – Summer and winter modes

Working objectives

- Mixing box located upstream from the belt-driven inline square centrifugal fan with three motorized modulating dampers.
- The dampers are arranged in such a way to ensure the prioritization and optimization of the available solar gains throughout the year.
- Setpoints and control sequences are established to ensure occupants' comfort at all times.
- The autonomous and self-regulated system can in principle operate 24/7 without external intervention.



Mixing box with three controlled dampers
Winter mode *(manual adjustment) or T_{ext} < 15°C / 59°F*

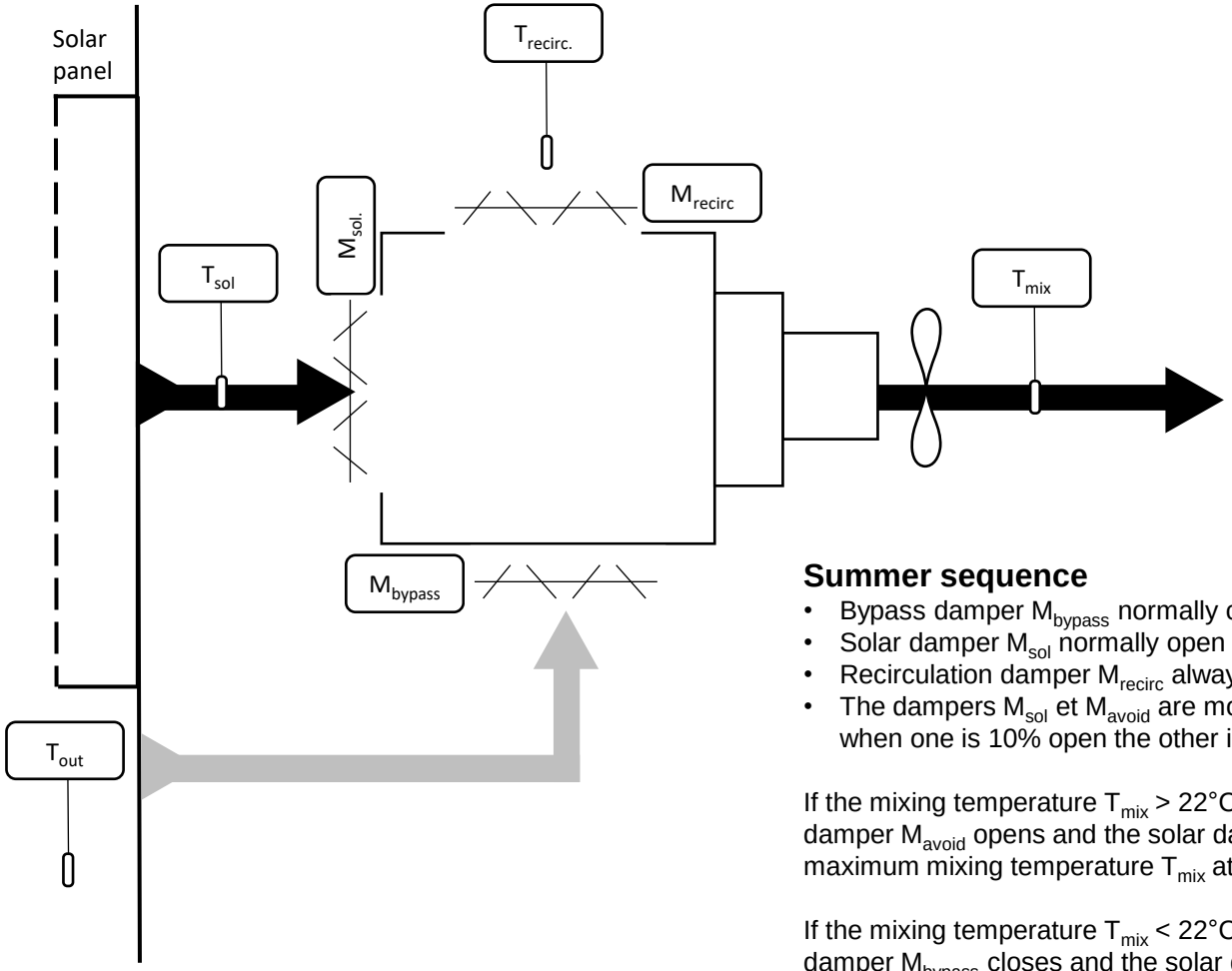


Winter sequence

- Recirculation damper M_{recirc} normally closed
- Solar damper M_{sol} normally open
- Bypass damper M_{bypass} always closed
- The dampers M_{sol} et M_{recirc} are modular and inversely proportional, (i.e. when one is 10% open, the other one is 90% open)

If the mixing temperature T_{mix} < 18°C / 65°F (adjustable), then the recirculation damper M_{recirc} opens and the solar damper M_{sol} closes to maintain the mixing temperature T_{mix} at 18°C / 65°F (adjustable).
If the mixing temperature T_{mix} ≥ 18°C / 65°F (adjustable), then the recirculation damper M_{recirc} closes and the solar damper M_{sol} opens to maintain the minimum mixing temperature T_{mix} at 18°C / 65°F (adjustable).

Mixing box with three controlled dampers
Summer mode *(manual adjustment) or $T_{ext} \geq 15°C / 59°F$*



Summer sequence

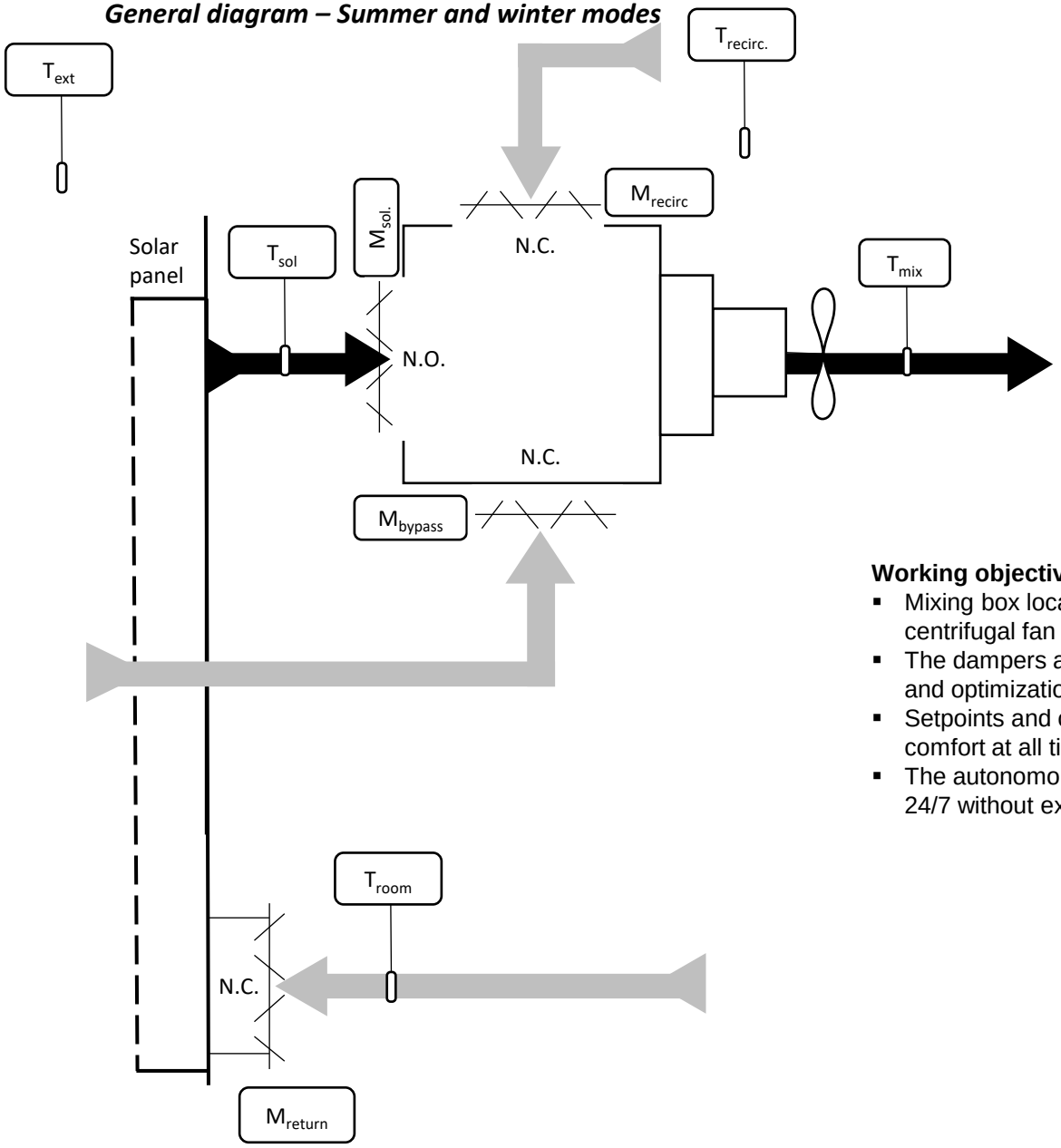
- Bypass damper M_{bypass} normally closed
- Solar damper M_{sol} normally open
- Recirculation damper M_{recirc} always closed
- The dampers M_{sol} et M_{avoid} are modular and inversely proportional, (i.e. when one is 10% open the other is 90% open)

If the mixing temperature T_{mix} > 22°C / 72°F(adjustable), then the bypass damper M_{avoid} opens and the solar damper M_{sol} closes to maintain the maximum mixing temperature T_{mix} at 22°C / 72°F (adjustable).

If the mixing temperature T_{mix} < 22°C / 72°F (adjustable), then the bypass damper M_{bypass} closes and the solar damper M_{sol} opens to maintain the maximum mixing temperature T_{mel} at 22°C / 72°F (adjustable)

Mixing box with three controlled dampers

General diagram – Summer and winter modes

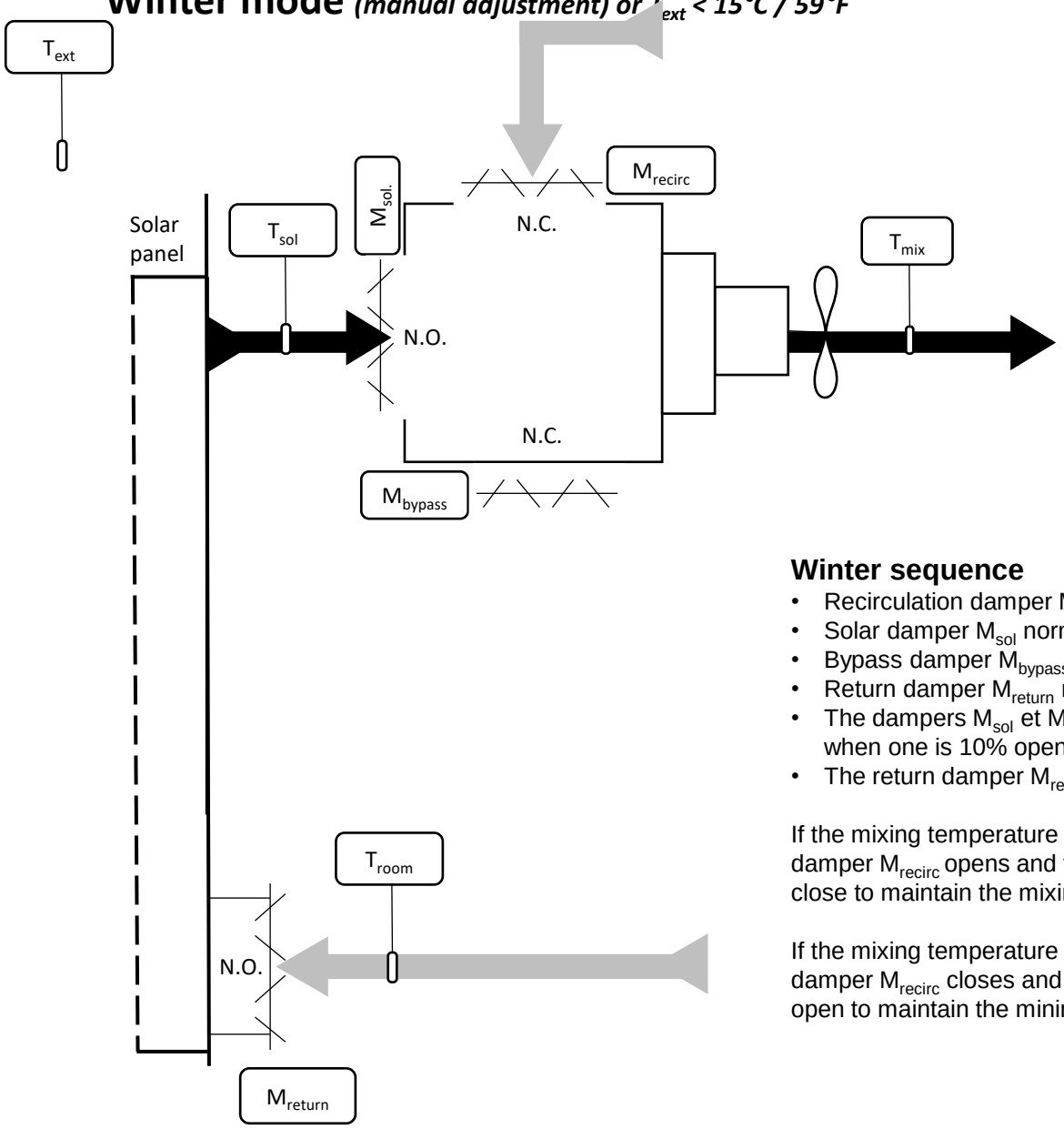


Working objectives

- Mixing box located upstream from the belt-driven inline square centrifugal fan with three motorized modulating dampers.
- The dampers are arranged in such a way to ensure the prioritization and optimization of the available solar gains throughout the year.
- Setpoints and control sequences are established to ensure occupants' comfort at all times.
- The autonomous and self-regulated system can in principle operate 24/7 without external intervention.

Mixing box with three controlled dampers

Winter mode *(manual adjustment) or T_{ext} < 15°C / 59°F*



Winter sequence

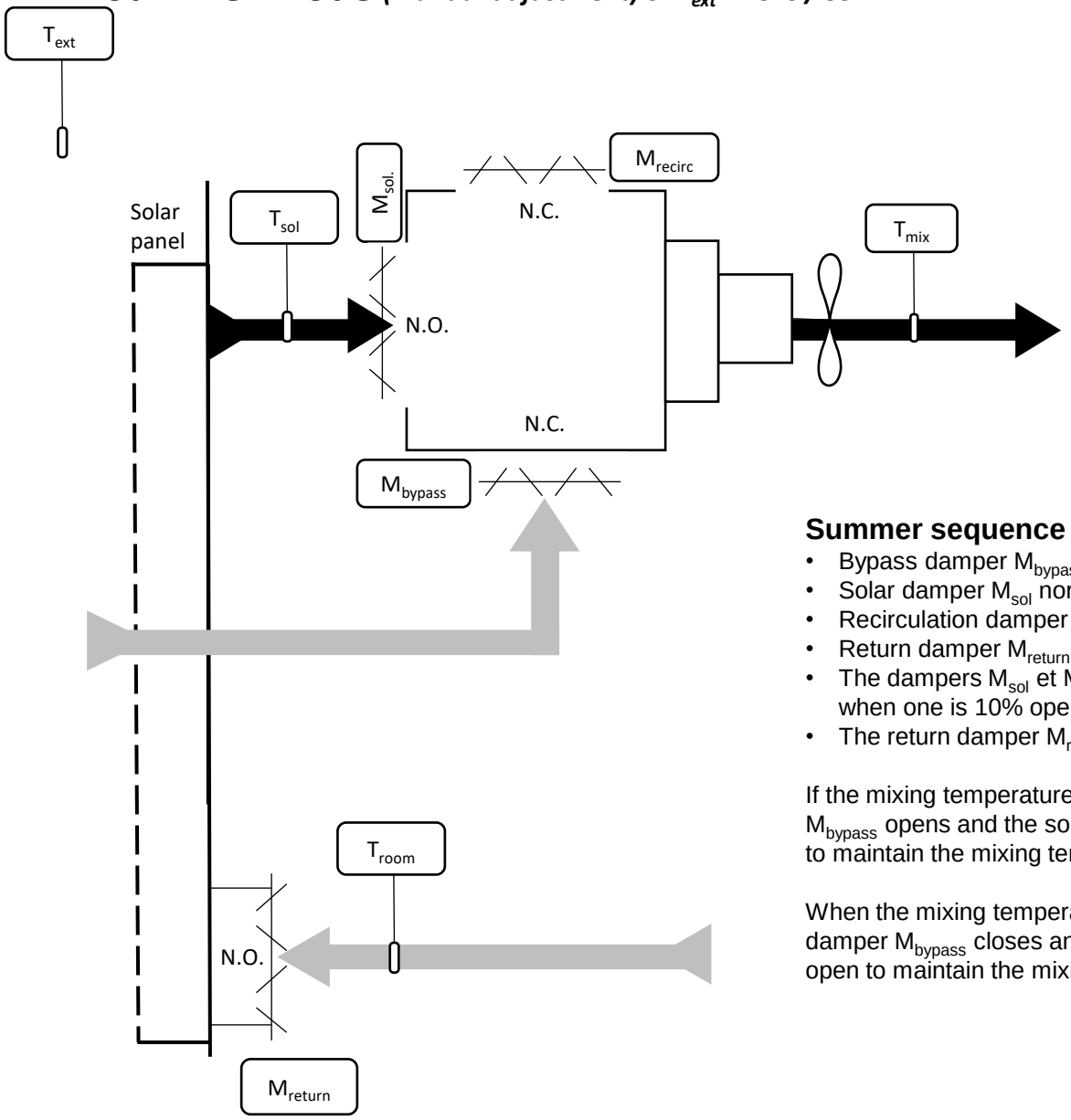
- Recirculation damper M_{recirc} normally closed
- Solar damper M_{sol} normally open
- Bypass damper M_{bypass} always closed
- Return damper M_{return} normaly open
- The dampers M_{sol} et M_{recirc} are modular and inversely proportional, (i.e. when one is 10% open, the other one is 90% open)
- The return damper M_{return} is isolated

If the mixing temperature T_{mix} < 18°C (adjustable), then the recirculation damper M_{recirc} opens and the solar damper M_{sol} and the return damper M_{return} close to maintain the mixing temperature T_{mix} at 18°C (adjustable)

If the mixing temperature T_{mix} ≥ 18°C (adjustable), then the recirculation damper M_{recirc} closes and the solar damper M_{sol} and the return damper M_{return} open to maintain the minimal mixing temperature T_{mix} at 18°C (adjustable)

Mixing box with three controlled dampers

Summer mode *(manual adjustment) or $T_{ext} \geq 15°C / 59°F$*



Summer sequence

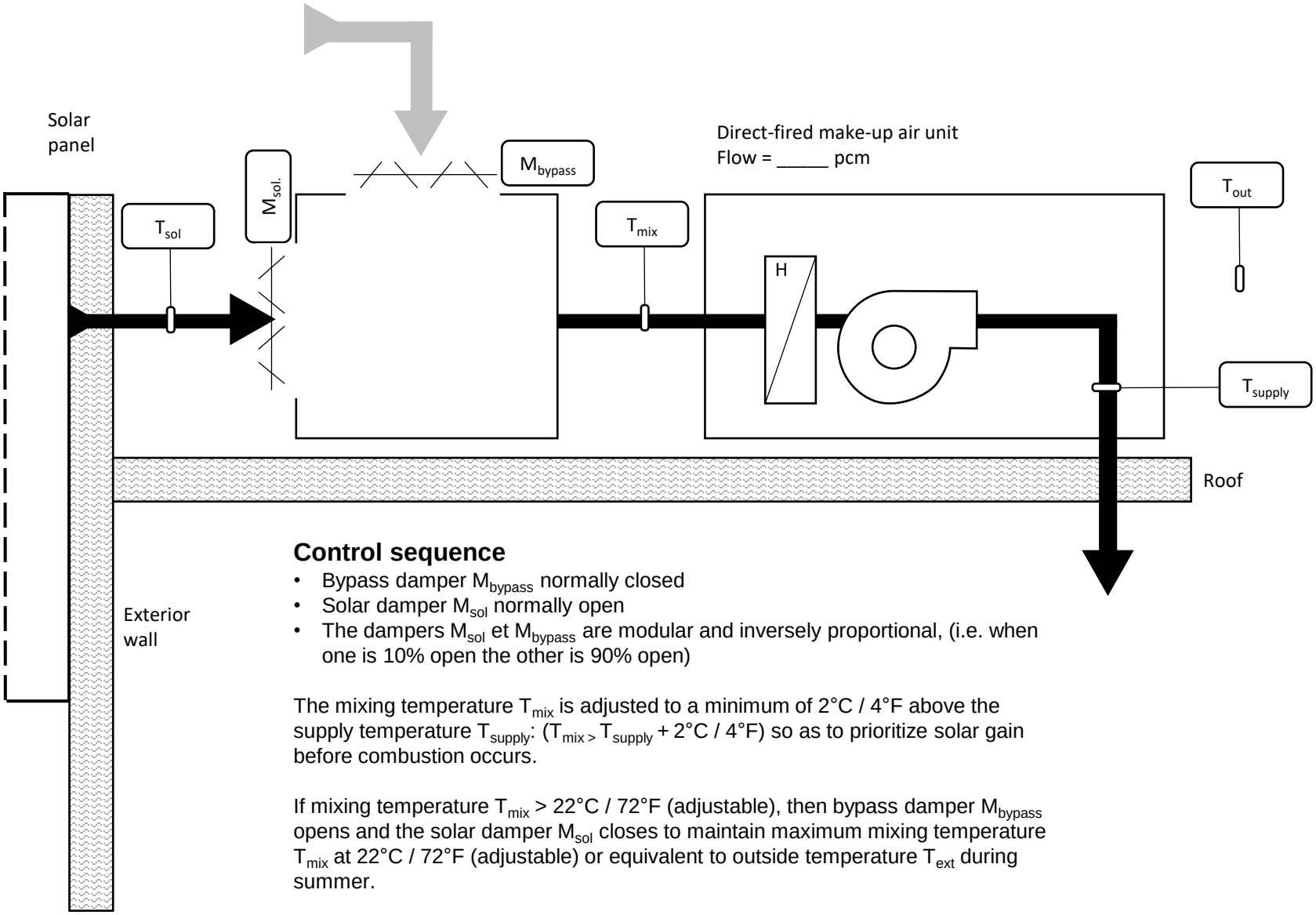
- Bypass damper M_{bypass} normally closed
- Solar damper M_{sol} normally open
- Recirculation damper M_{recirc} always closed
- Return damper M_{return} always open
- The dampers M_{sol} et M_{avoid} are modular and inversely proportional, (i.e. when one is 10% open the other is 90% open)
- The return damper M_{return} is isolated

If the mixing temperature T_{mix} > 22°C (adjustable), then the bypass damper M_{bypass} opens and the solare damper M_{sol} and the return damper M_{return} close to maintain the mixing temperature T_{mix} at 22°C (adjustable)

When the mixing temperature T_{mix} < 22°C (adjustable), then the bypass damper M_{bypass} closes and the solar damper M_{sol} and the return damper M_{return} open to maintain the mixing temperature T_{mix} at 22°C (adjustable)

Mixing box upstream from make-up air unit

General diagram for all seasons

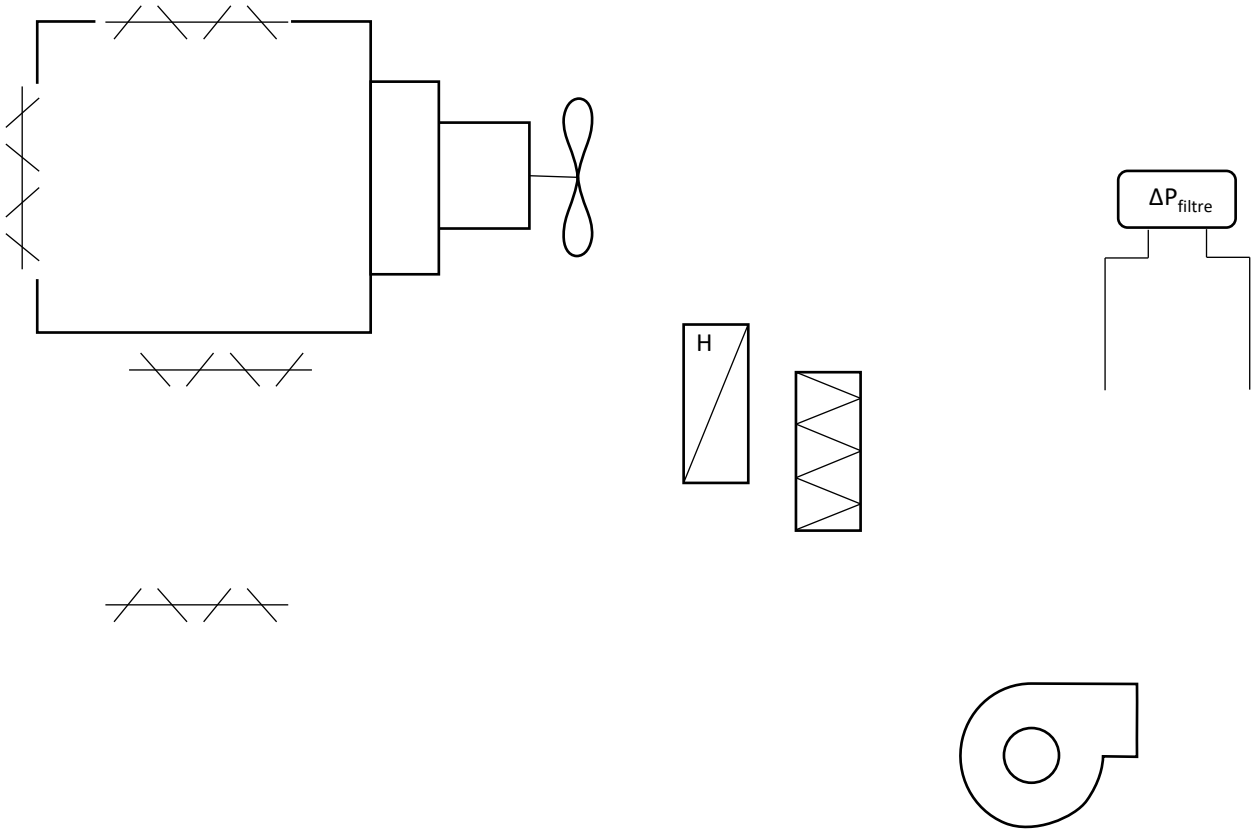


Control sequence

- Bypass damper M_{bypass} normally closed
- Solar damper M_{sol} normally open
- The dampers M_{sol} et M_{bypass} are modular and inversely proportional, (i.e. when one is 10% open the other is 90% open)

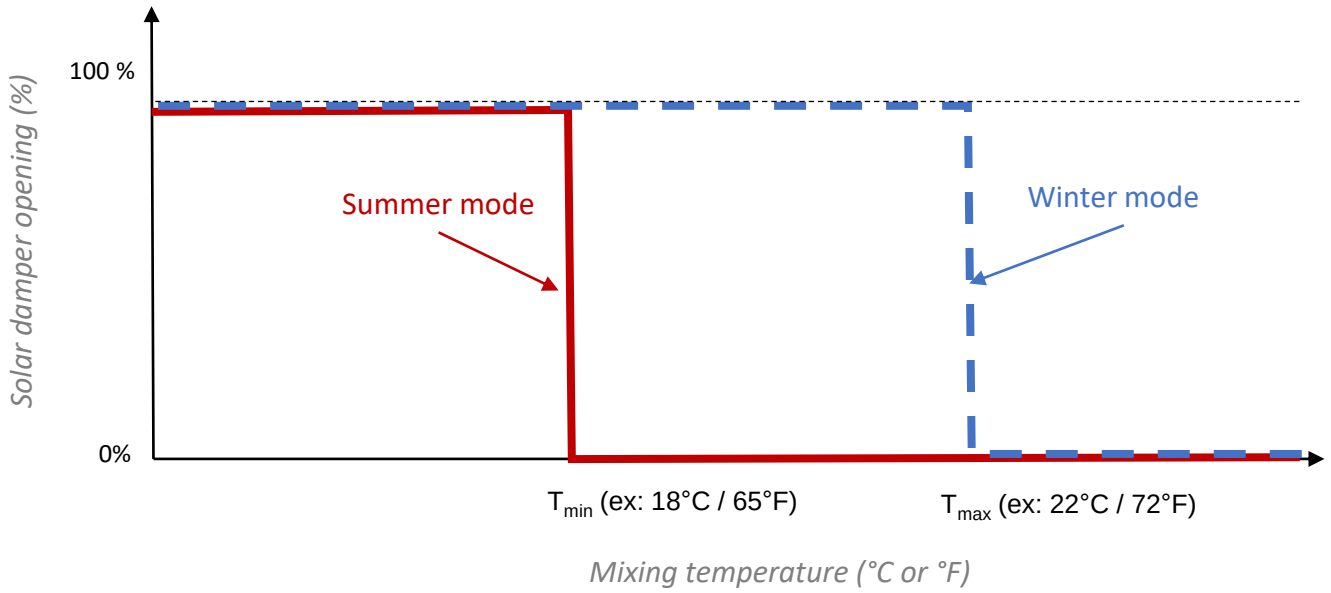
The mixing temperature T_{mix} is adjusted to a minimum of 2°C / 4°F above the supply temperature T_{supply}: ($T_{mix} > T_{supply}$ + 2°C / 4°F) so as to prioritize solar gain before combustion occurs.

If mixing temperature T_{mix} > 22°C / 72°F (adjustable), then bypass damper M_{bypass} opens and the solar damper M_{sol} closes to maintain maximum mixing temperature T_{mix} at 22°C / 72°F (adjustable) or equivalent to outside temperature T_{ext} during summer.


H
ΔP filtre

Solar damper opening

In summer and winter modes



T_{min} is the minimum mixing temperautre to be maintained in order to avoid overcooling of the space in winter

T_{max} is the maximum mixing temperature to be maintained in order to avoir over heating of the space in summer