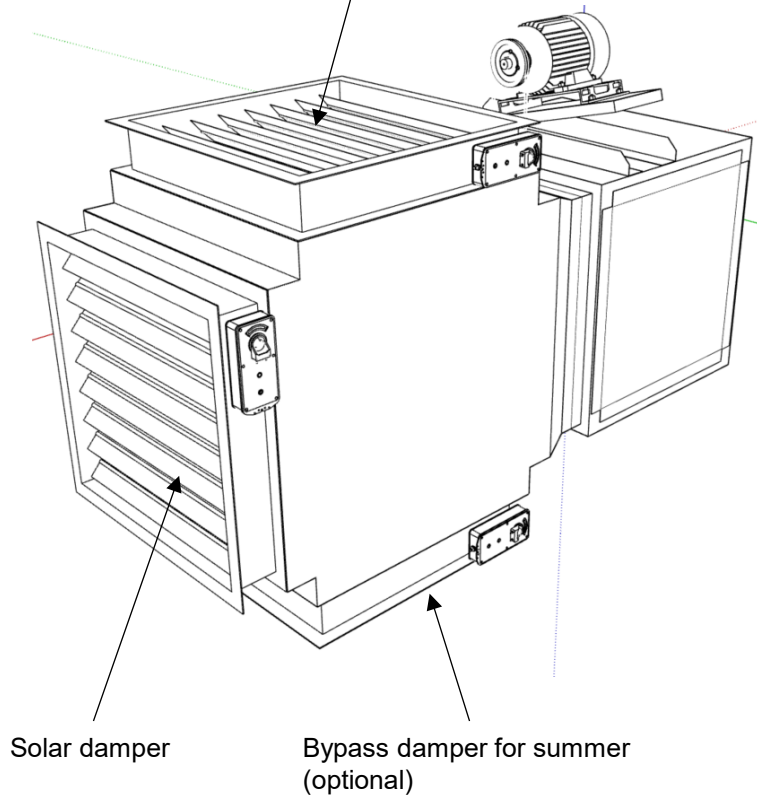
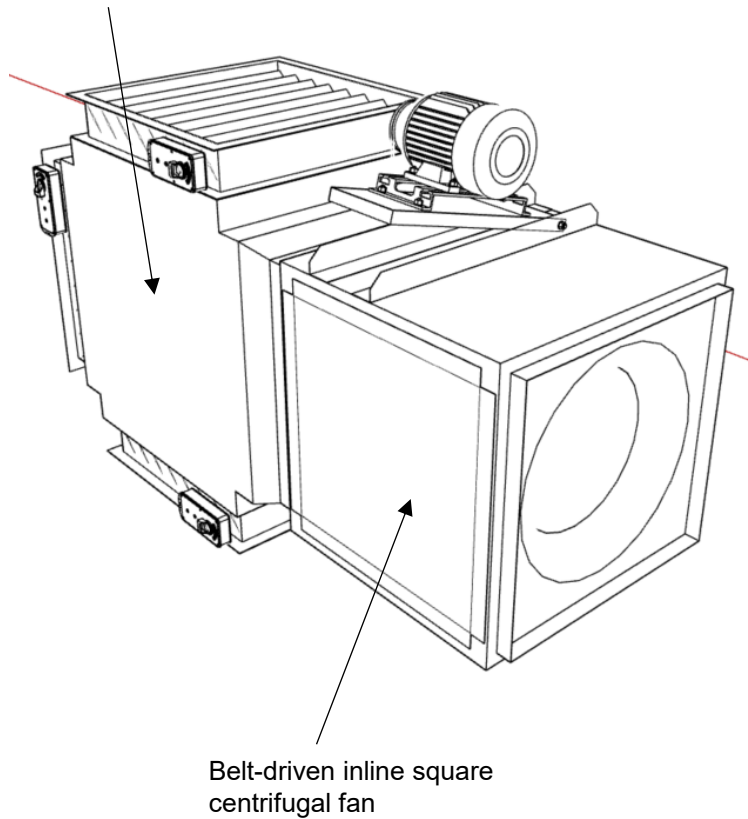


Mixing box with three controlled dampers

To manage solar air heating systems in winter and summer modes

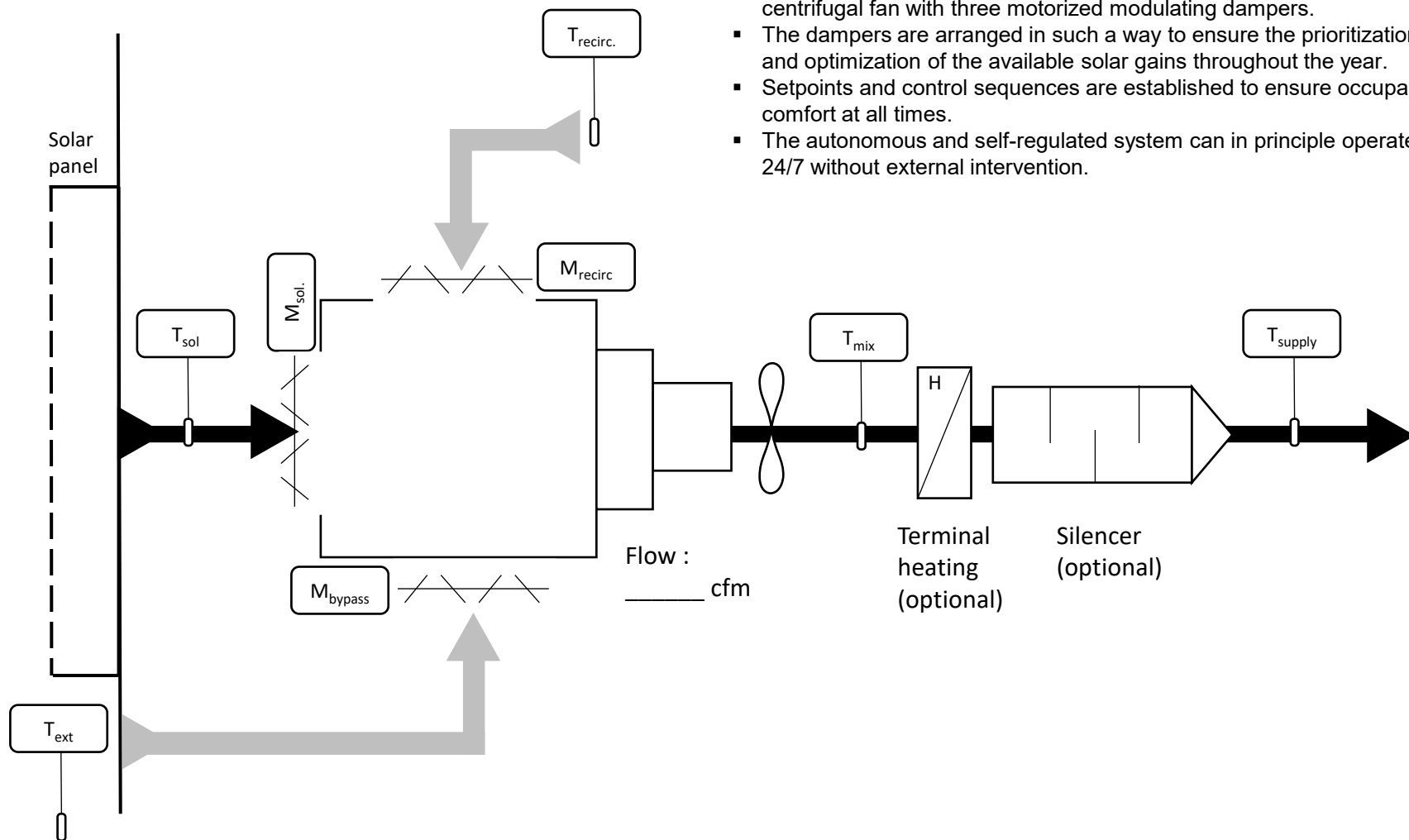
Mixing box upstream of
the fan

Recirculation damper for winter



Mixing box with three controlled dampers

General diagram – Summer and winter modes

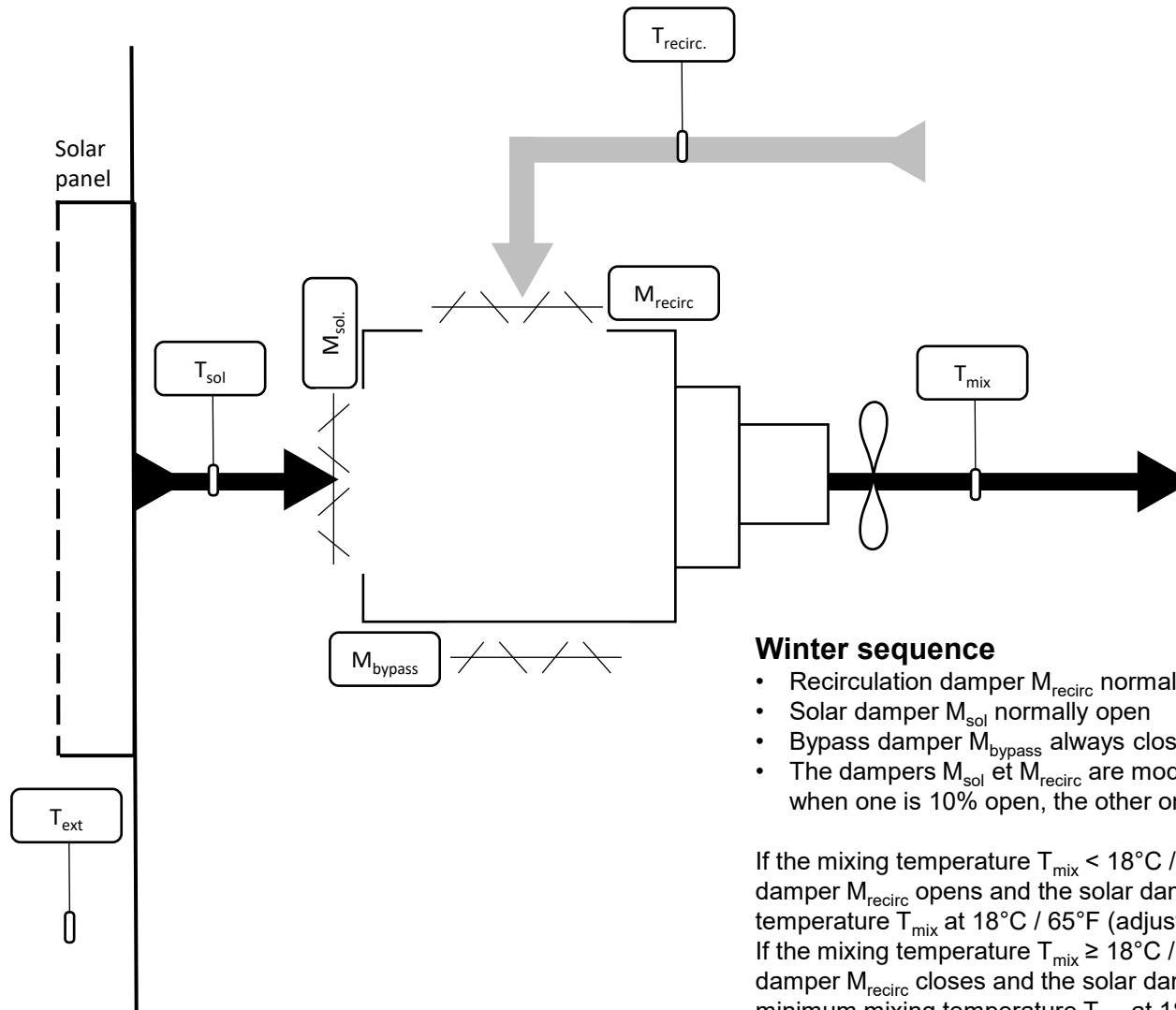


Working objectives

- 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 $T_{ext} < 15^{\circ}\text{C} / 59^{\circ}\text{F}$



Winter sequence

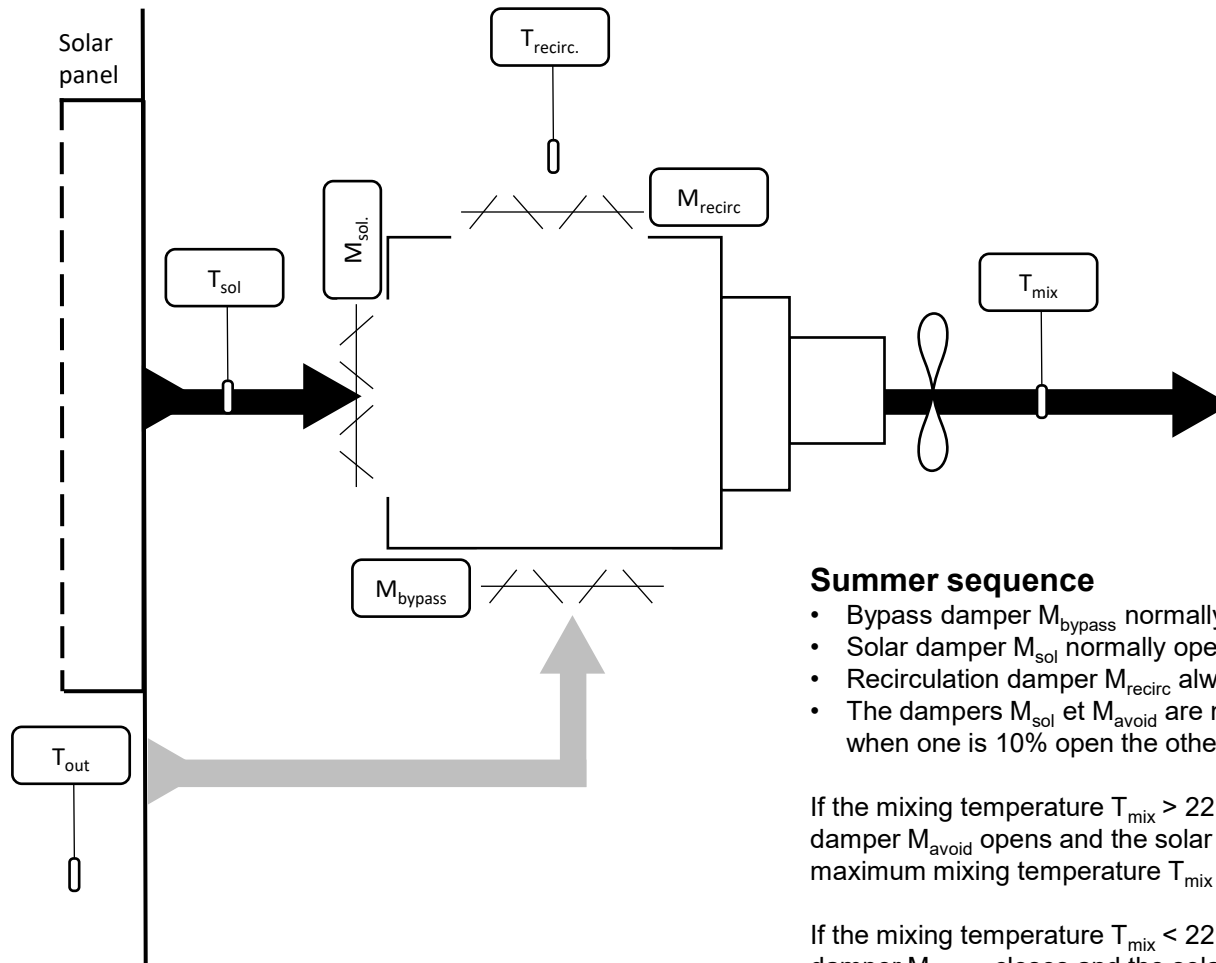
- Recirculation damper M_{recirc} normally closed
- Solar damper M_{sol} normally open
- Bypass damper M_{bypass} always closed
- The dampers M_{sol} et M_{recirc} are modular and inversely proportional, (i.e. when one is 10% open, the other one is 90% open)

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

If the mixing temperature $T_{mix} \geq 18^{\circ}\text{C} / 65^{\circ}\text{F}$ (adjustable), then the recirculation damper M_{recirc} closes and the solar damper M_{sol} opens to maintain the minimum mixing temperature T_{mix} at $18^{\circ}\text{C} / 65^{\circ}\text{F}$ (adjustable).

Mixing box with three controlled dampers

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



Summer sequence

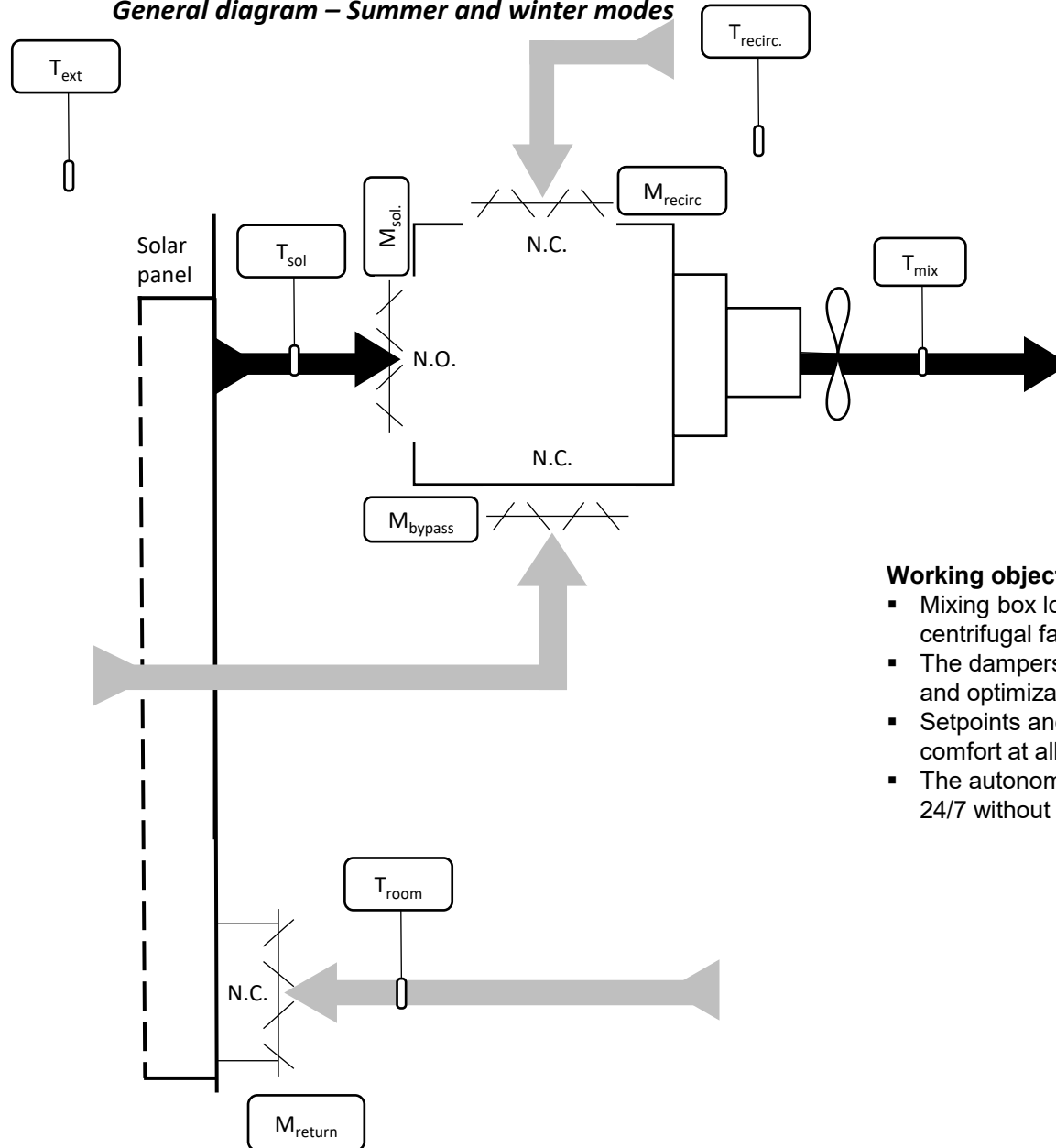
- Bypass damper M_{bypass} normally closed
- Solar damper M_{sol} normally open
- Recirculation damper M_{recirc} always closed
- The dampers M_{sol} et M_{avoid} are modular and inversely proportional, (i.e. when one is 10% open the other is 90% open)

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

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

Mixing box with three controlled dampers

General diagram – Summer and winter modes

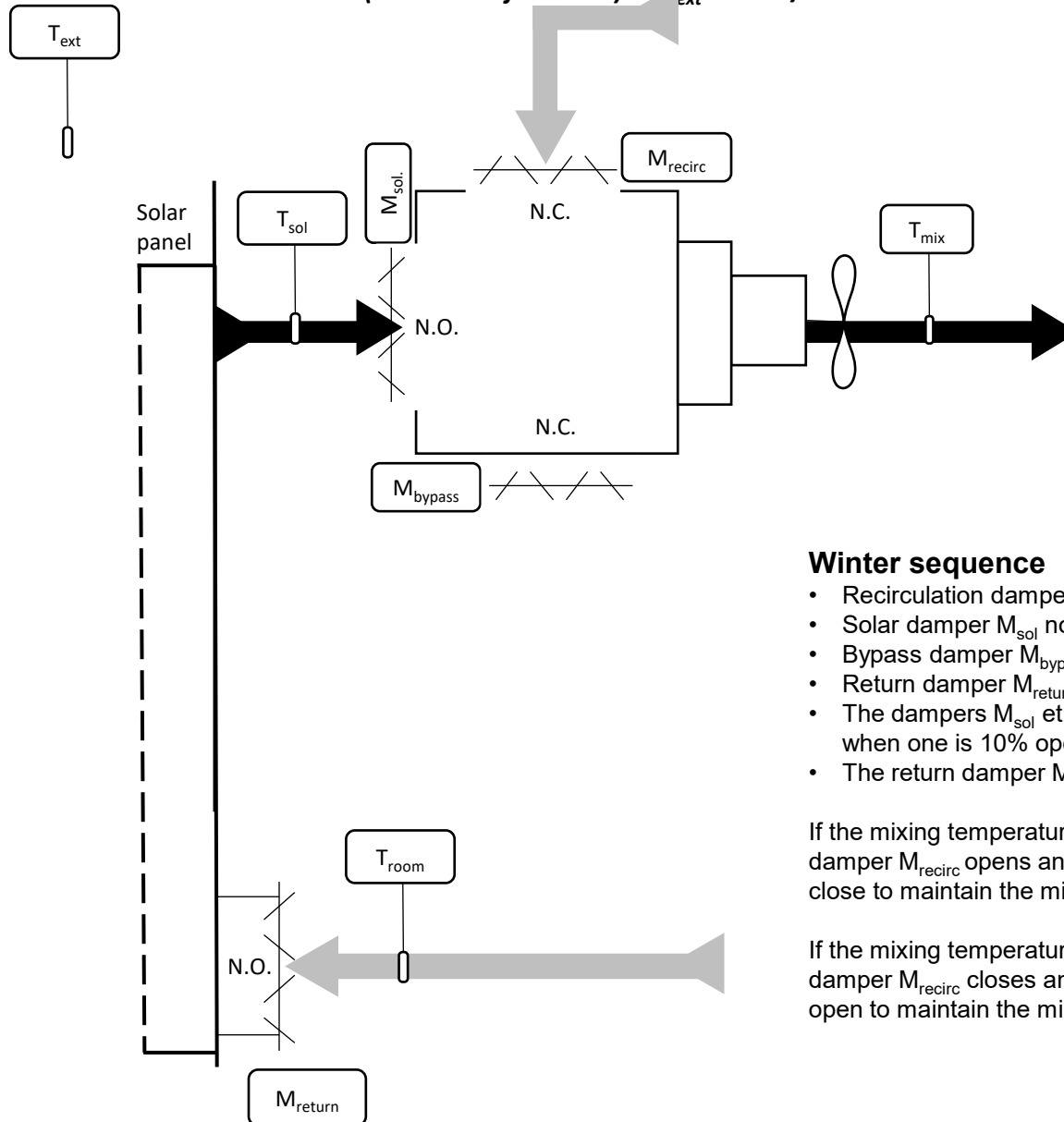


Working objectives

- 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 $T_{ext} < 15^{\circ}\text{C} / 59^{\circ}\text{F}$



Winter sequence

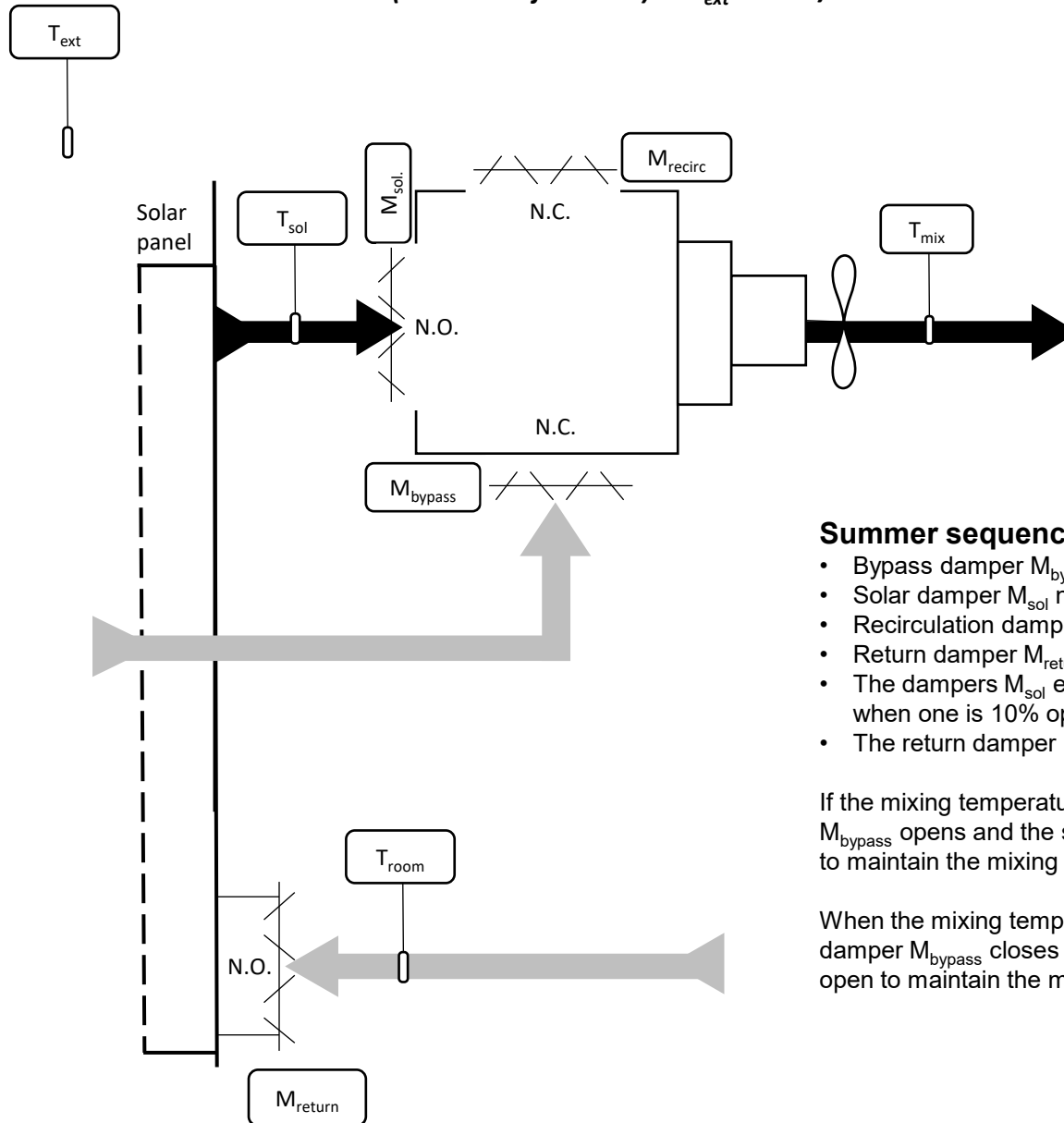
- Recirculation damper M_{recirc} normally closed
- Solar damper M_{sol} normally open
- Bypass damper M_{bypass} always closed
- Return damper M_{return} normally open
- The dampers M_{sol} et M_{recirc} are modular and inversely proportional, (i.e. when one is 10% open, the other one is 90% open)
-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

If the mixing temperature $T_{mix} < 18^{\circ}\text{C}$ (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 $T_{mix} \geq 18^{\circ}\text{C}$ (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 $T_{ext} \geq 15^{\circ}\text{C} / 59^{\circ}\text{F}$



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_{bypass} 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 $T_{mix} > 22^{\circ}\text{C}$ (adjustable), then the bypass damper M_{bypass} opens and the solar 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 $T_{mix} < 22^{\circ}\text{C}$ (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

