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LIST OF SYMBOLS

\( \theta \) Incident angle
\( \theta_a \) Half acceptance angle of CPC
\( \theta_z \) Zenith angle
\( \beta \) Slope of the plane surface with horizontal
\( \nu \) Surface azimuth angle
\( \delta \) Declination
\( \phi \) Latitude of the location
\( \omega_h \) Sunset or sunrise hour angle
\( \rho \) Reflectivity
\( \tau \) Transmissivity
\( \alpha \) Absorptivity
\( \alpha_a \) Solar altitude angle, absorptivity of cover
\( \alpha_v \) Solar elevation angle
\( \varepsilon \) Emissivity
\( \sigma \) Stefan-Boltzmann constant, W/m\(^2\)-K\(^4\)
\( \mu \) Absolute viscosity
\( \eta \) Thermal efficiency of the collector
\( \eta_o \) Optical efficiency of the collector
\( a \) aperture, cover
\( b \) ambient
\( c \) cover
\( d \) daily
\( f \) fluid
\( o \) outlet
\( s \) sky
\( r \) receiver, flat one-sided absorber
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CPC</td>
<td>Compound Parabolic Collector</td>
</tr>
<tr>
<td>CPSC</td>
<td>Compound Parabolic Solar Collector</td>
</tr>
<tr>
<td>CPSAH</td>
<td>Compound Parabolic Solar Air Heating Collector</td>
</tr>
<tr>
<td>DSAHC</td>
<td>Double-pass Solar Air Heating Collector</td>
</tr>
<tr>
<td>ETC</td>
<td>Evacuated Tube Collector</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FPC</td>
<td>Flat Plate Collector</td>
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<tr>
<td>GSAHC</td>
<td>Glazed Solar Air Heating Collector</td>
</tr>
<tr>
<td>GHG</td>
<td>Green House Gas</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>RE</td>
<td>Renewable Energy</td>
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<tr>
<td>RET</td>
<td>Renewable Energy Technology</td>
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<tr>
<td>RES</td>
<td>Renewable Energy Sources</td>
</tr>
<tr>
<td>SSAHC</td>
<td>Single-Pass Solar Air Heating Collector</td>
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<tr>
<td>USAHC</td>
<td>Unglazed Solar Air Heating Collector</td>
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# NOMENCLATURE

- **A_a**: Total aperture area (m²)
- **A_r**: Total receiver area (m²)
- **C_a**: Concentration ratio
- **C_p**: Specific heat of air (J/kg-K)
- **D_H**: Hydraulic Diameter
- **F_r**: Heat removal factor
- **F'**: Collector efficiency factor
- **g**: Gap size
- **H**: Height of the collector
- **h_d**: Height of the duct
- **H_b**: Incident beam solar radiation (W/m²)
- **H_d**: Incident diffuse solar radiation (W/m²)
- **H_t**: Total solar radiation on the aperture (W/m²)
- **h_c/a**: Convection heat transfer coefficient from cover to ambient (W/m²-K)
- **h_c/c**: Convection heat transfer coefficient from receiver to cover (W/m²-K)
- **h_Rr**: Radiative heat transfer coefficient from receiver to cover (W/m²-K)
- **h_Rs**: Radiative heat transfer coefficient from cover to sky (W/m²-K)
- **k**: Thermal conductivity of absorber wall (W/m-K)
- **k_f**: Thermal conductivity of air (W/m-K)
- **L**: Collector length
- **m**: Mass flow rate of air (kg/s)
- **N_u**: Nusselt number
- **n**: Average number of reflections
- **P_r**: Prandtl number
- **Q_u**: Useful energy gain, W
- **R_e**: Reynolds number
- **T_b**: Ambient temperature (°C)
- **T_f**: Mean air temperature (°C)
- **T_in**: Inlet temperature of air (°C)
- **T_o**: Outlet temperature of air (°C)
- **T_r**: Temperature of receiver plate (°C)
- **T_s**: Sky temperature (°C)
- **U_L**: Overall heat loss coefficient (W/m²-K)
- **u**: Wind velocity (m/s)
- **W_a**: Aperture width for CPC
- **W_r**: Receiver width for CPC