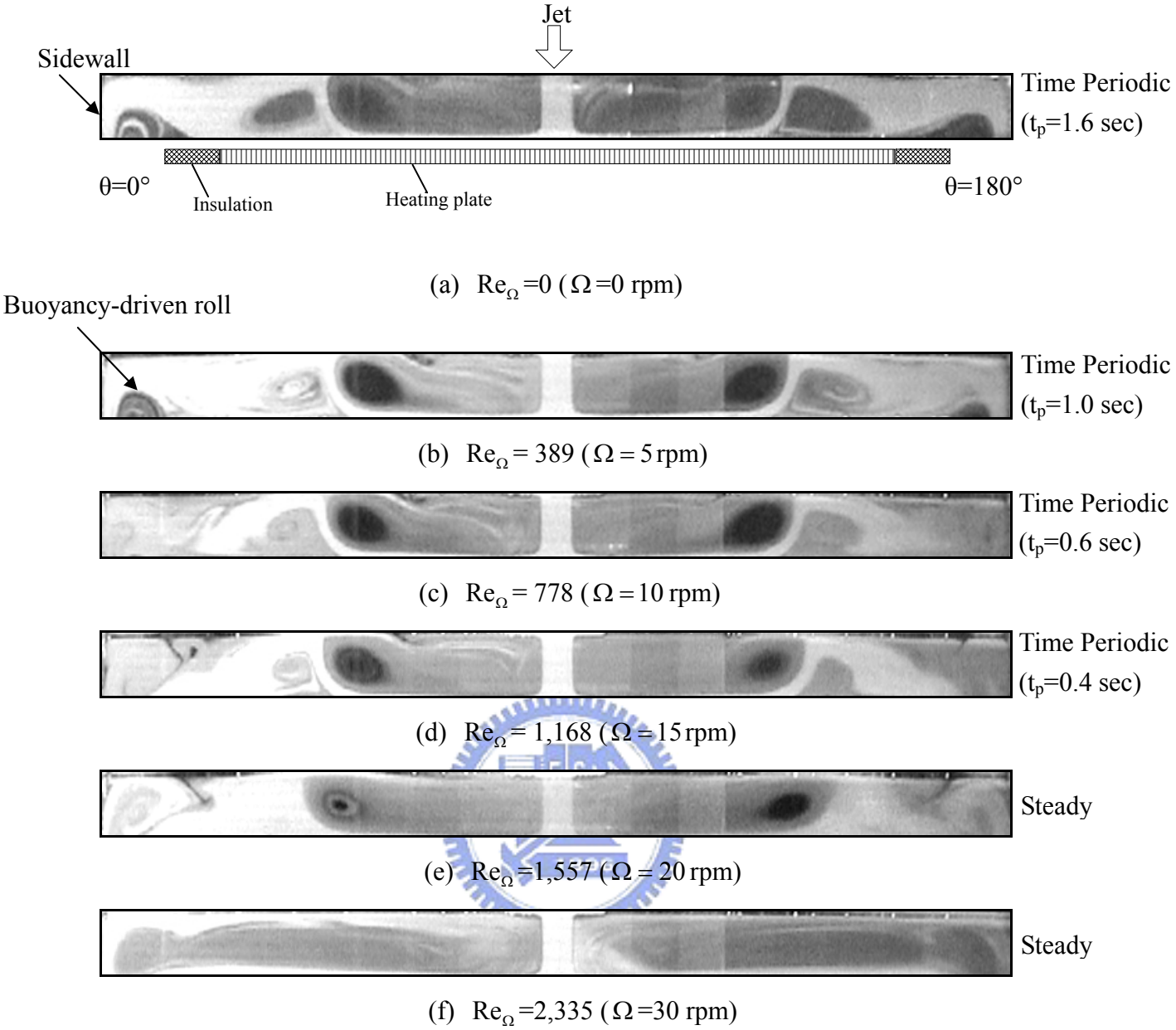
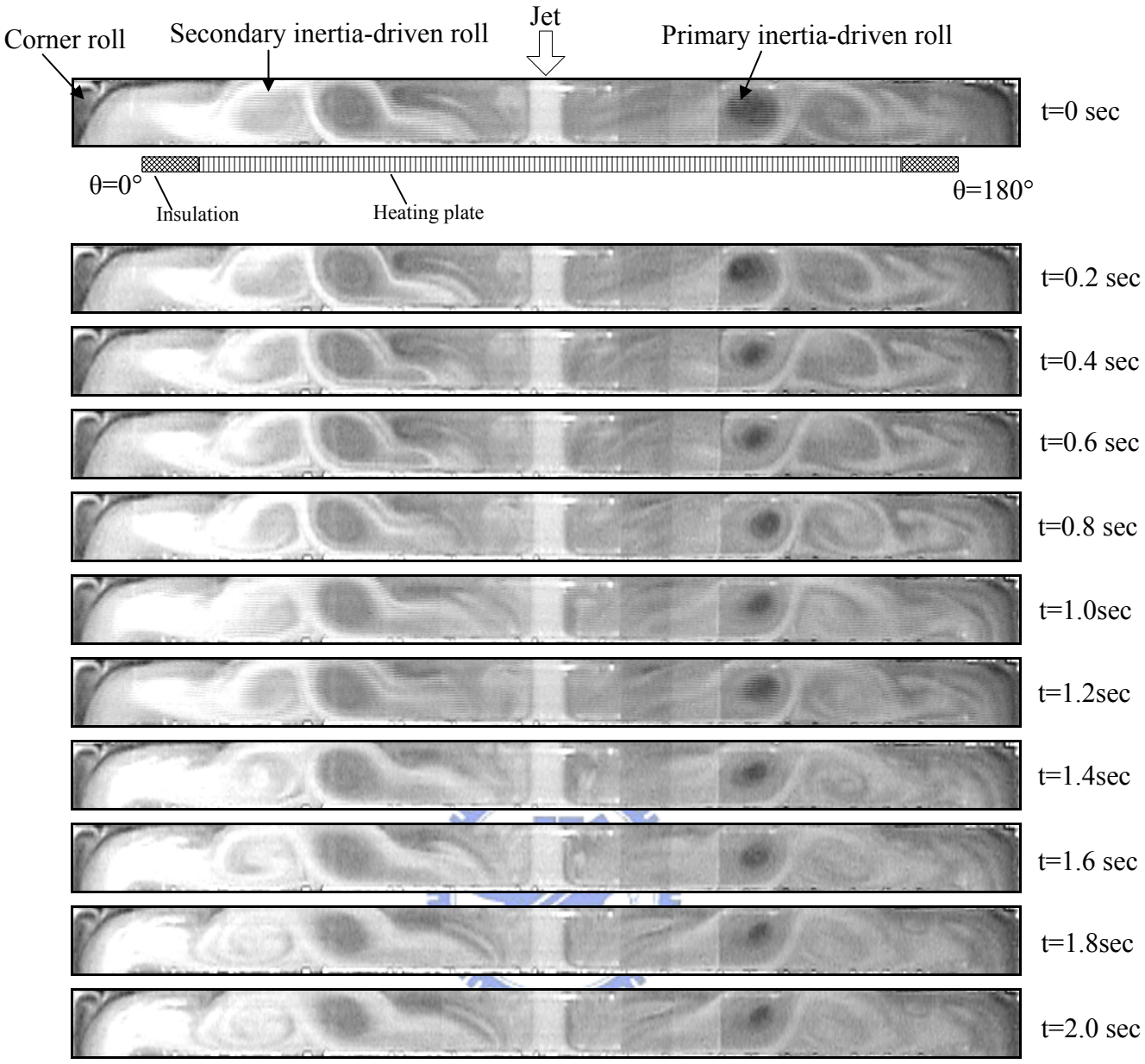
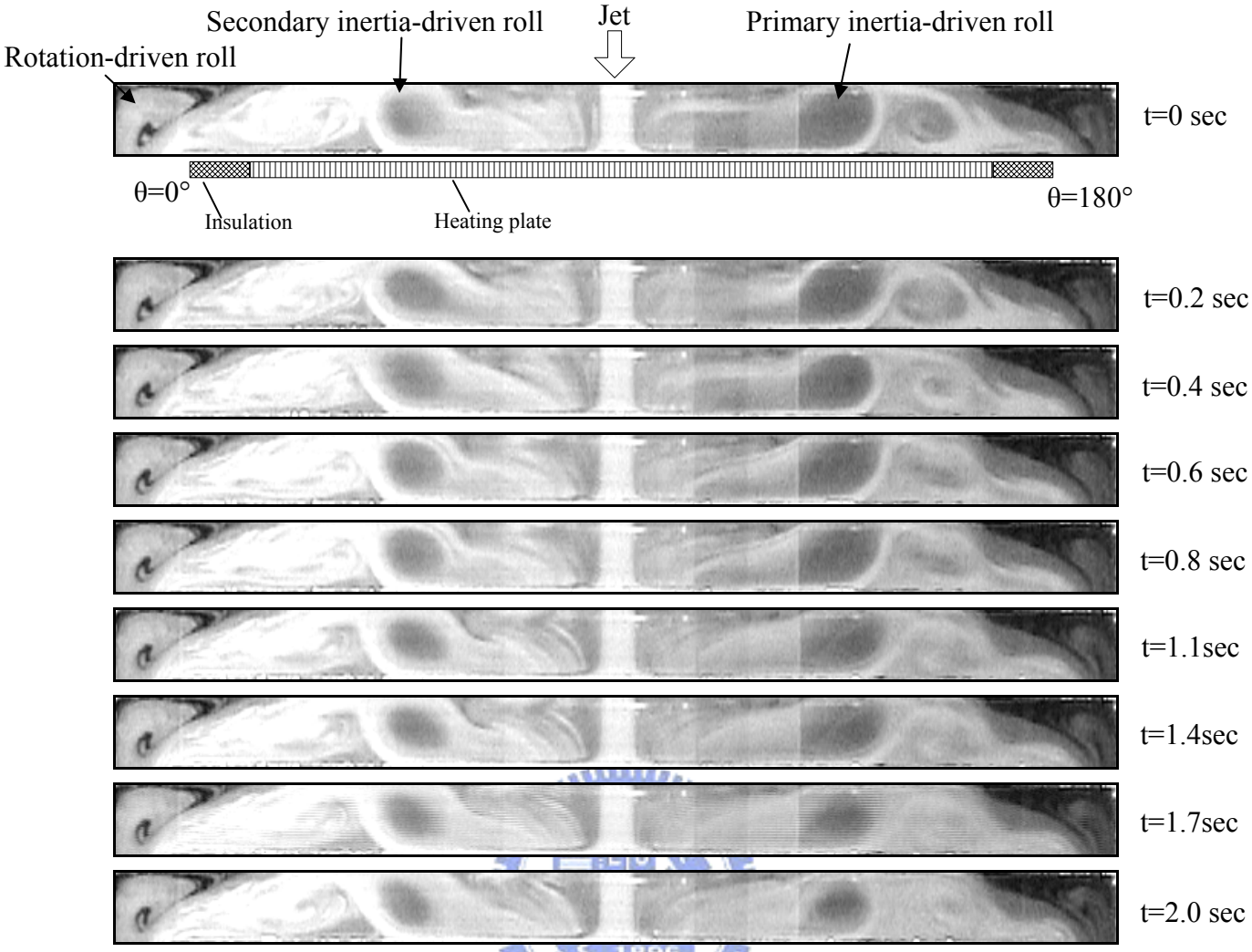


Fig. 4.45 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° at steady state or at certain instant in the statistical state at H=20.0 mm for Re_j=893 (Q_j=6.6 slpm), Ra=7,520 (ΔT=10.0 ℃), at Re_Ω = (a)0, (b)389, (c)778, (d)1,168, (e)1,557, and (f)2,335.



(Inertia-driven nonperiodic flow)

Fig. 4.46 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° at selected time instants in the statistical state for D_j=10.0 mm at Ra=0 (ΔT= 0°C), Re_j=1,082 (Q_j=8.0 slpm), and $Re_\Omega = 0$ ($\Omega = 0$ rpm).



(a) Inertia-driven nonperiodic flow ($Re_{\Omega} = 778$ (Ω=10 rpm))

(b) Steady state ($Re_{\Omega} = 1,557$ (Ω=20 rpm))

(c) Steady state ($Re_{\Omega} = 2,335$ (Ω=30 rpm))

Fig. 4.47 Side view flow photos taken at the cross plane $\theta = 0^{\circ}$ & 180° at steady stae or selected time instants in the statistical state for D_j=10.0 mm at Ra=0 (ΔT= 0℃), Re_j=1,082 (Q_j=8.0 slpm), and Re_{Ω}= (a)778, (b)1,557, and (c)2,335.

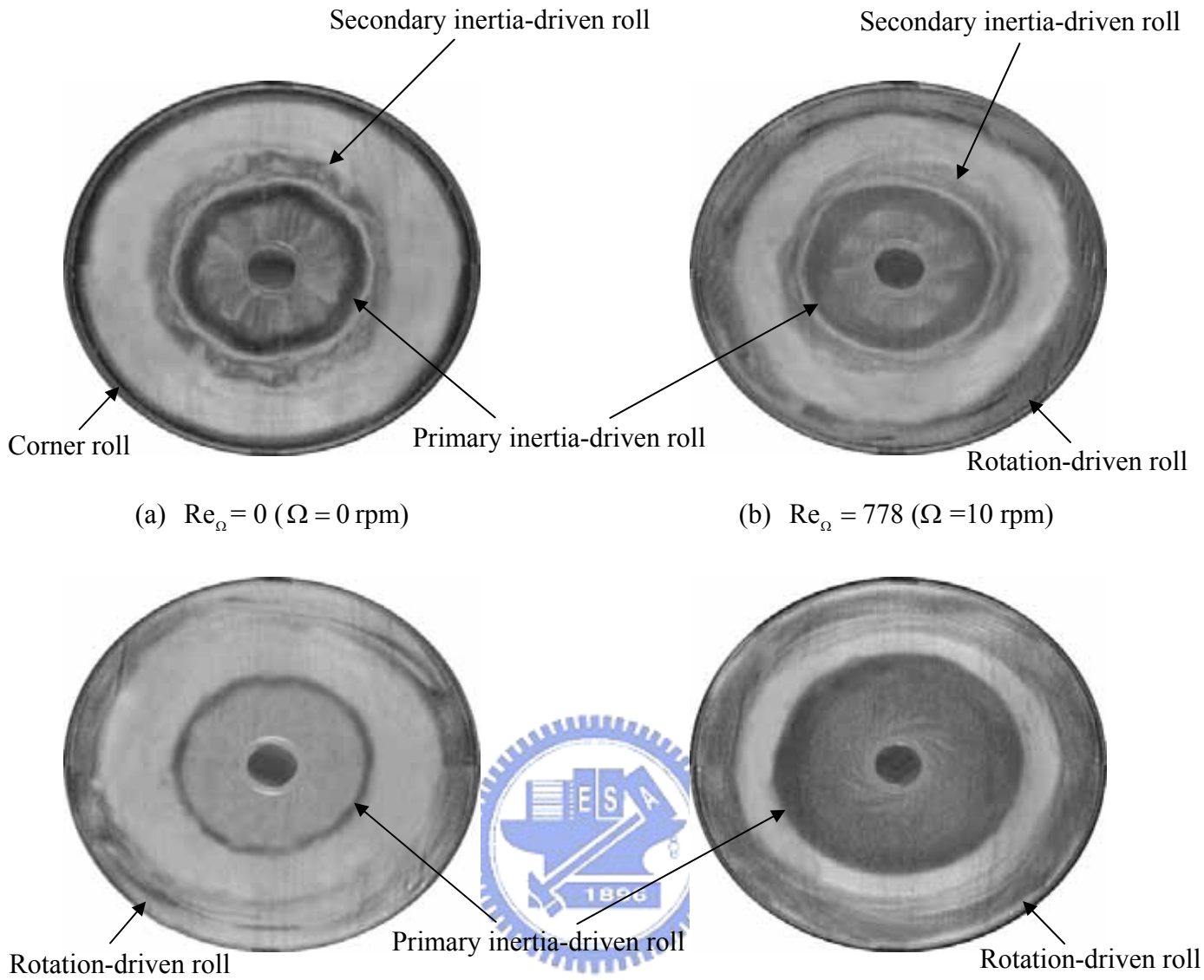
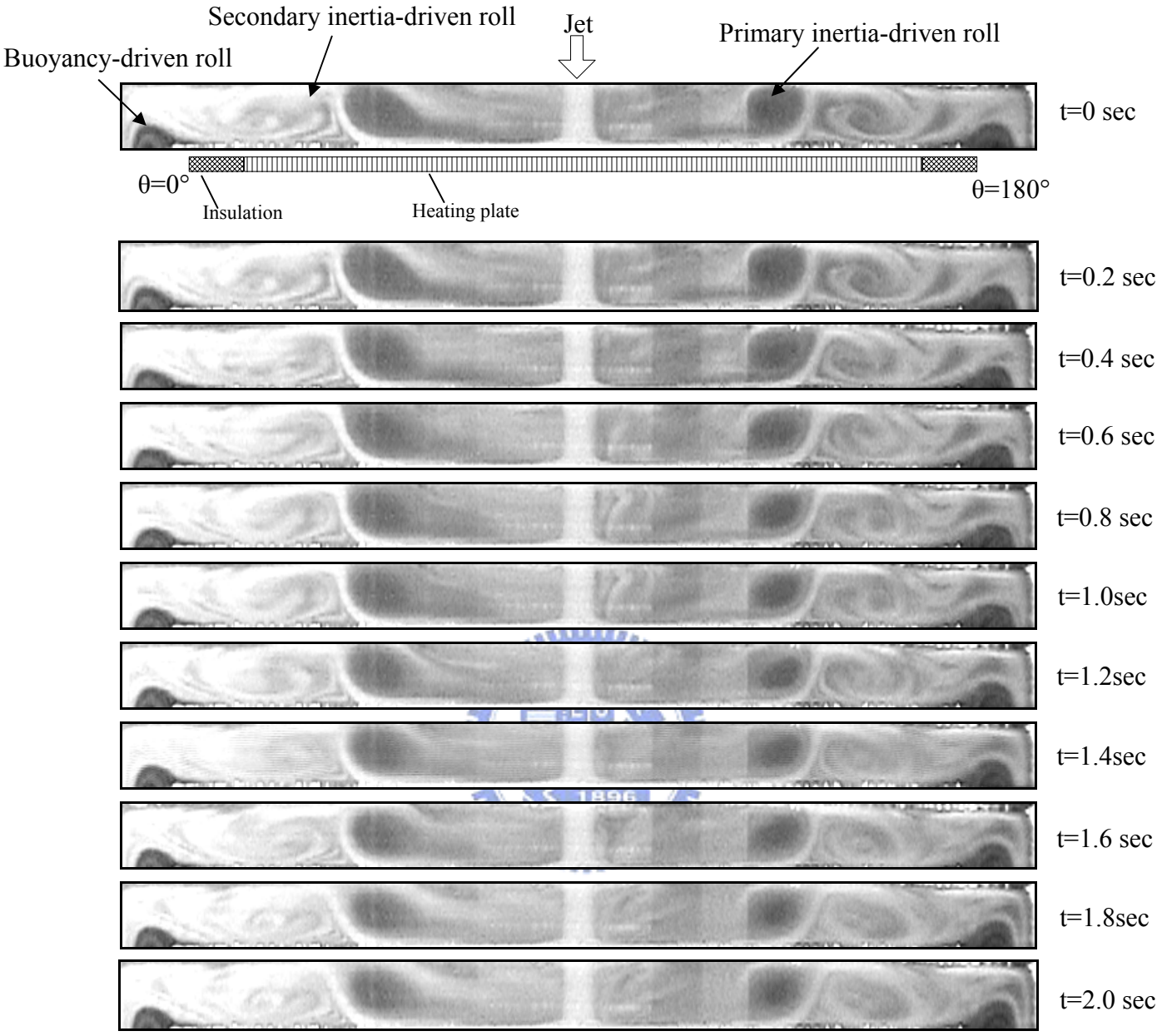
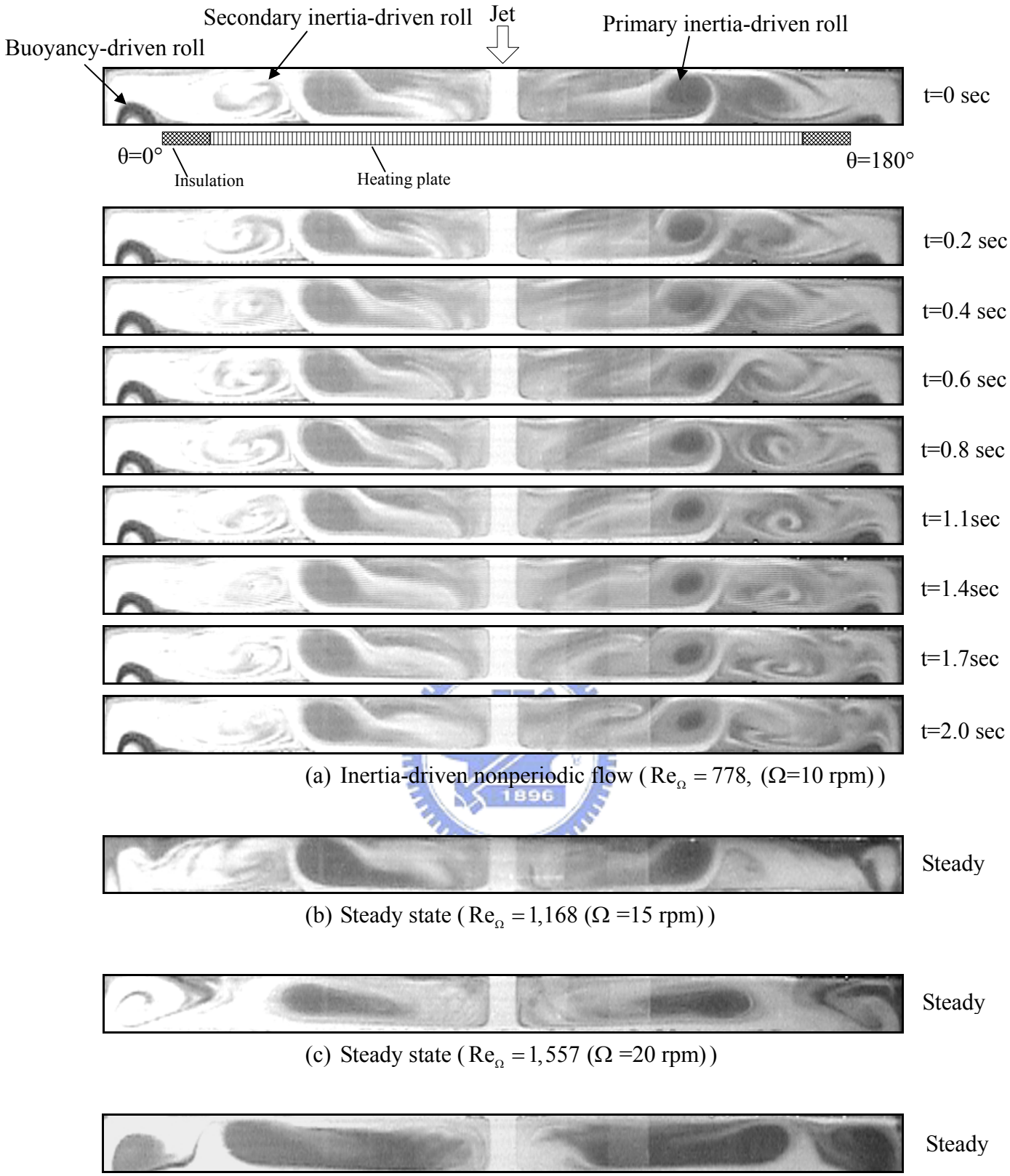


Fig. 4.48 Top view flow photos taken at middle horizontal plane at certain time instants in the steady or statistical state for Ra=0 (ΔT=0℃), Re_j=1,082 (Q=8.0 slpm), H=20.0 mm, and Re_Ω= (a)0, (b)778, (c)1,557, and (d)2,335.



(Inertia-driven nonperiodic flow)

Fig. 4.49 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° at selected time instants in the statistical state for D_j=10.0 mm at Ra=7,520 (ΔT=10.0 ℃), Re_j=1,190 (Q_j=8.8 slpm), and $Re_\Omega = 0$ ($\Omega = 0$ rpm).



(a) Inertia-driven nonperiodic flow ($Re_{\Omega} = 778$, (Ω=10 rpm))

(b) Steady state ($Re_{\Omega} = 1{,}168$ (Ω =15 rpm))

(c) Steady state ($Re_{\Omega} = 1{,}557$ (Ω =20 rpm))

(d) Steady state ($Re_{\Omega} = 2{,}335$ (Ω =30 rpm))

Fig. 4.50 Side view flow photos taken at the cross plane $\theta = 0^{\circ}$ & 180° at selected time instants in the steady or statistical state for D_j=10.0 mm at Ra=7,520 (ΔT=10.0 ℃), Re_j=1,190 (Q_j=8.8 slpm), and Re_{Ω} = (a)778, (b)1,168, (c)1,557, and (d)2,335.

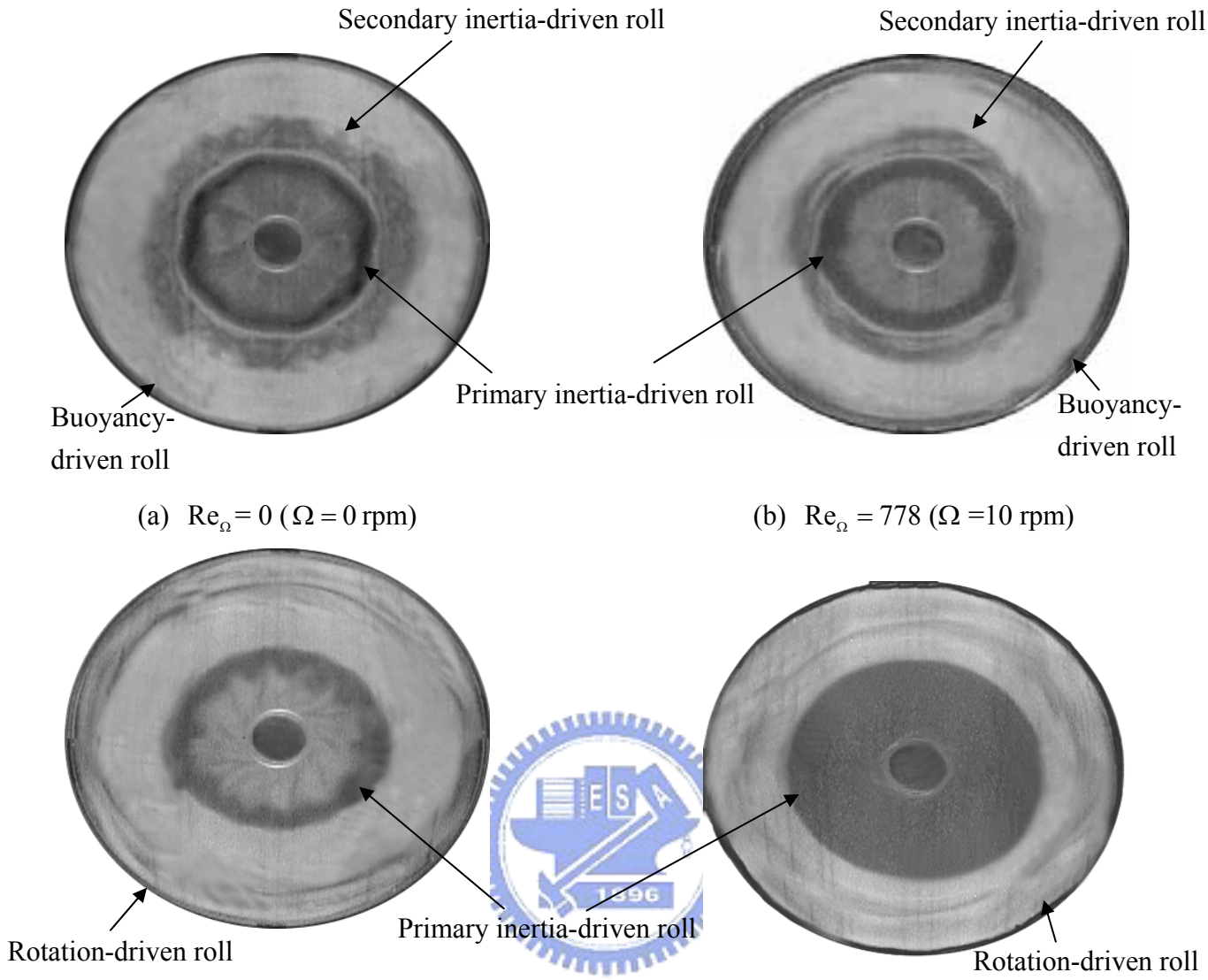
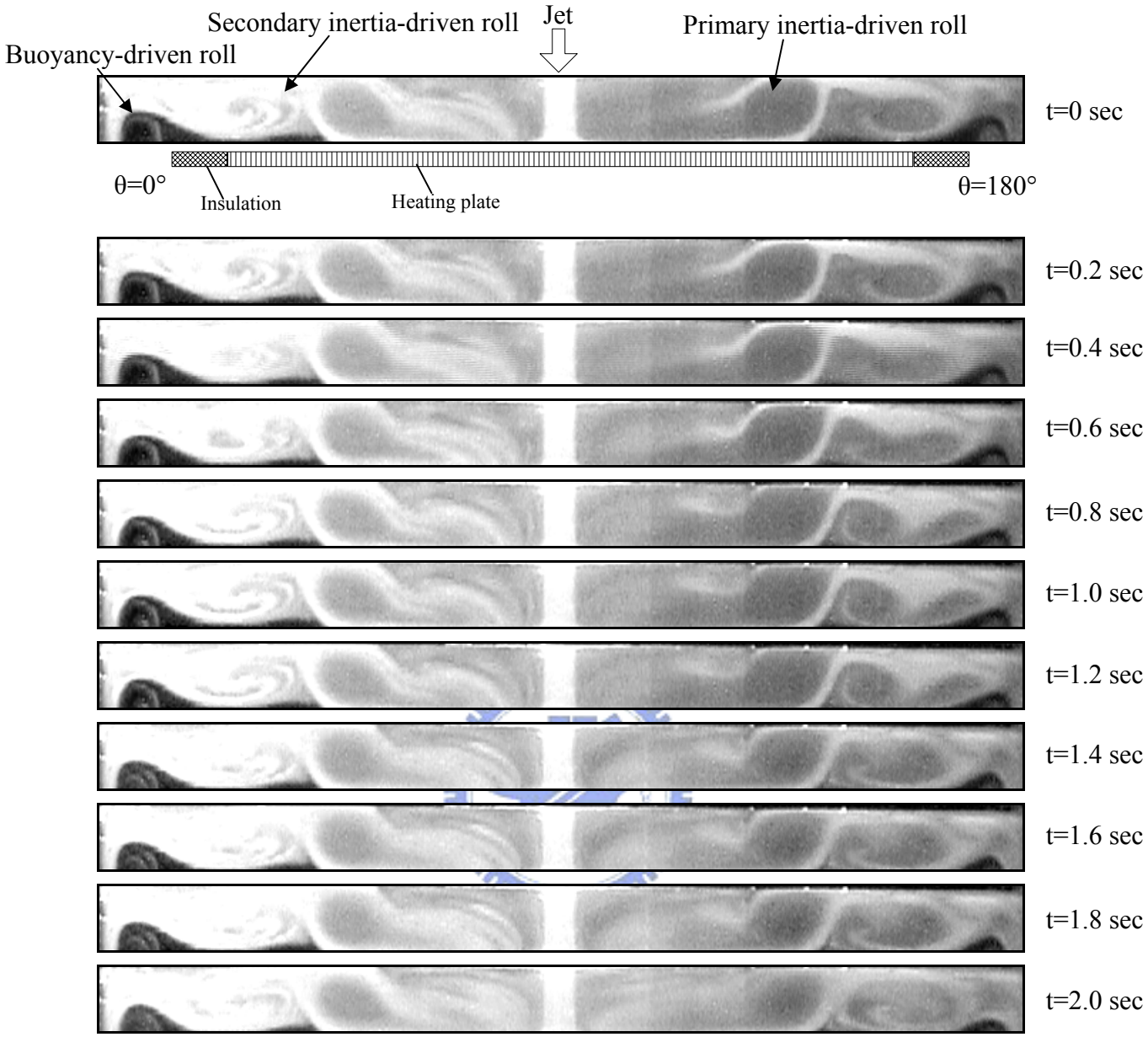
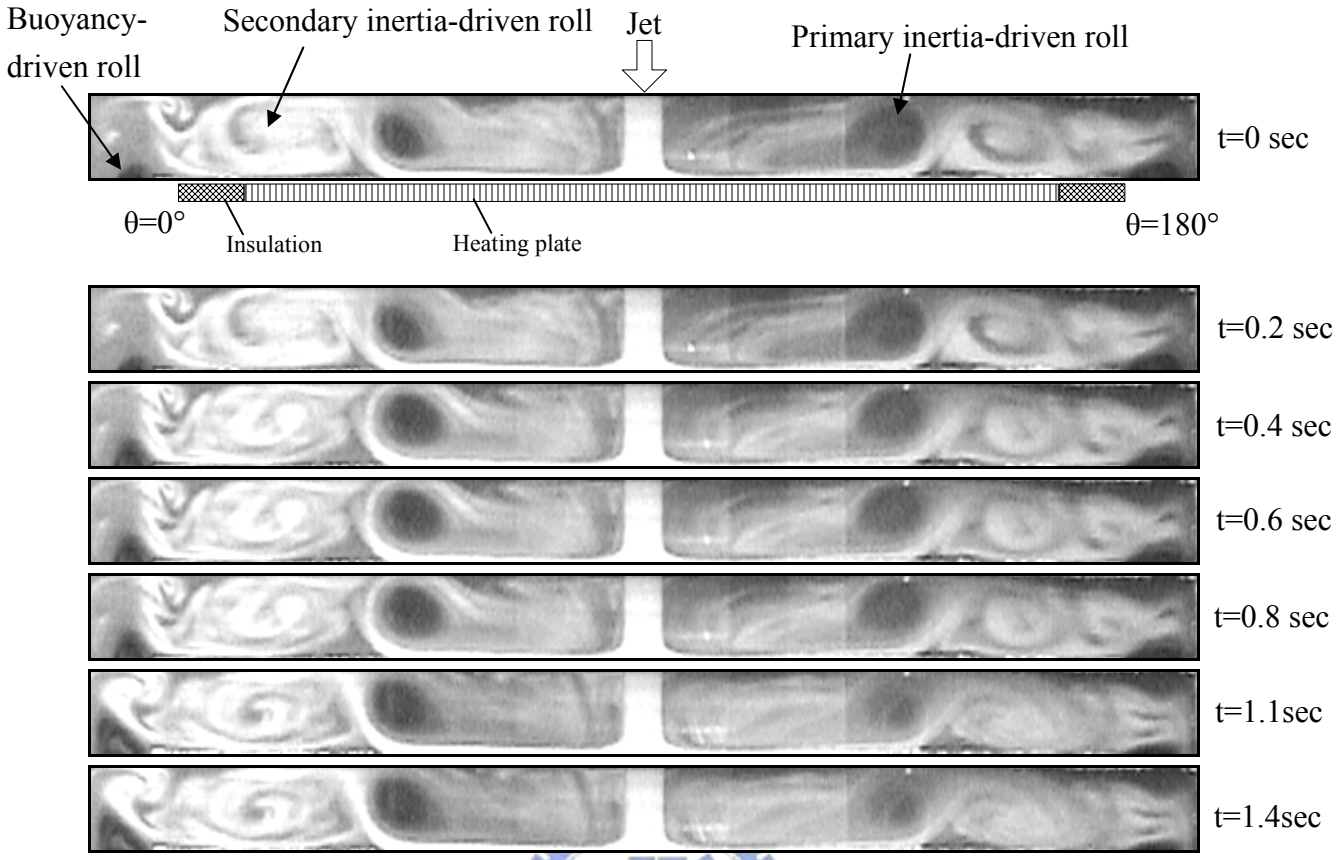


Fig. 4.51 Top view flow photos taken at middle horizontal plane at certain time instants in the steady or statistical state for Ra=7,520 (ΔT=10.0℃), Re_j=1,190 (Q=8.8 slpm), H=20.0 mm, and Re_Ω = (a)0, (b)778, (c)1,557, and (d)2,335.



Inertia-driven nonperiodic flow

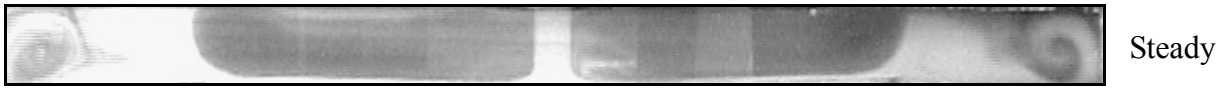
Fig. 4.52 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° at selected time instants in the statistical state for D_j=10.0 mm at Ra=15,030 (ΔT=20.0 ℃), Re_j=1,244 (Q_j=9.2 slpm), and $Re_\Omega = 0$ ($\Omega = 0$ rpm).



(a) Inertia-driven nonperiodic flow (Re_{Ω} = 778 (Ω=10 rpm))

(b) Steady state (Re_{Ω} = 1,168 (Ω=15 rpm))

(c) Steady state (Re_{Ω} = 1,557 (Ω =20 rpm))



(d) Steady state (Re_{Ω} = 2,335 (Ω =30 rpm))

Fig. 4.53 Side view flow photos taken at the cross plane $\theta = 0^{\circ}$ & 180° at certain time instants in the steady or statistical state for D_j=10.0 mm at Ra=15,030 (ΔT=20.0 ℃), Re_j=1,244 (Q_j=9.2 slpm), and Re_{Ω} = (a)778, (b)1,168, (c)1,557, and (d)2,335.

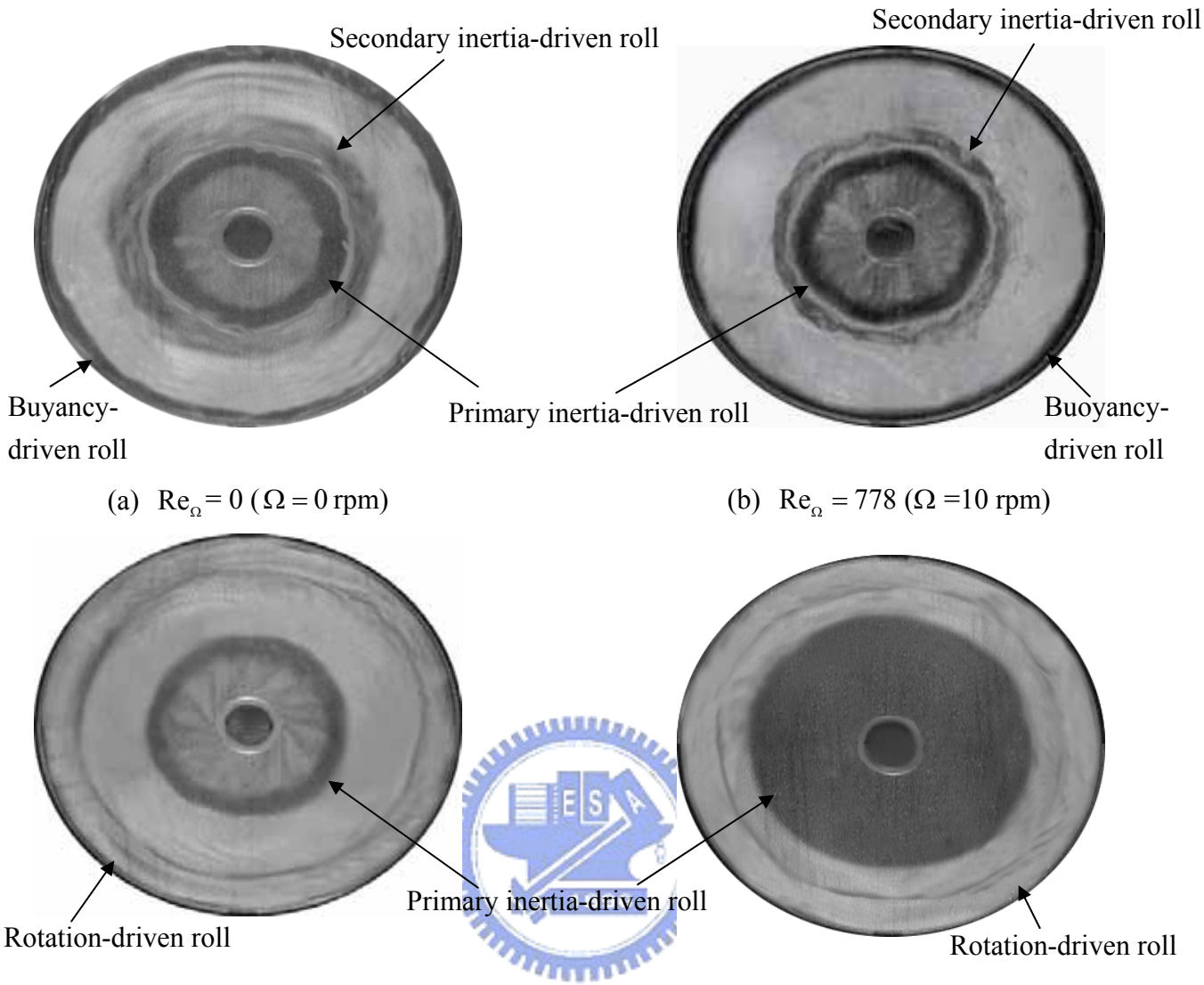


Fig. 4.54 Top view flow photos taken at middle horizontal plane at certain time instants in steady or statistical state for Ra=15,030 (ΔT=20.0℃), Re_j=1,244 (Q_j=9.2 slpm), H=20.0 mm, and Re_Ω = (a)0, (b)778, (c)1,557, and (d)2,335.

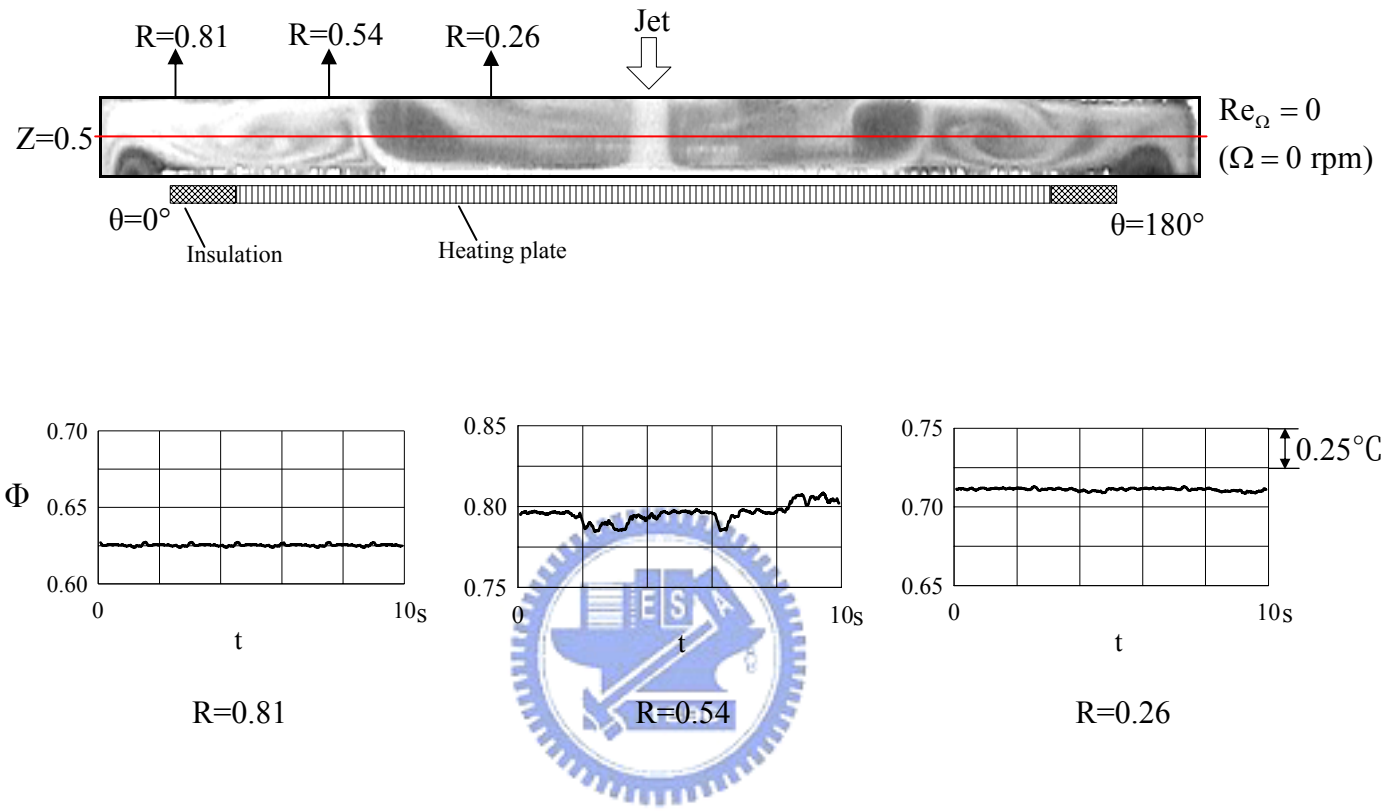


Fig. 4.55 Side view flow photo taken at the cross plane $\theta = 0^\circ$ & 180° at certain time instant in the statistical state and time records of air temperature at selected locations in middle horizontal plane Z=0.5 with H=20.0 mm for Re_j=1,190 (Q=8.8 slpm), Ra=7,520 (ΔT=10.0℃), D_j=10.0 mm and $Re_\Omega = 0$ (nonperiodic flow).

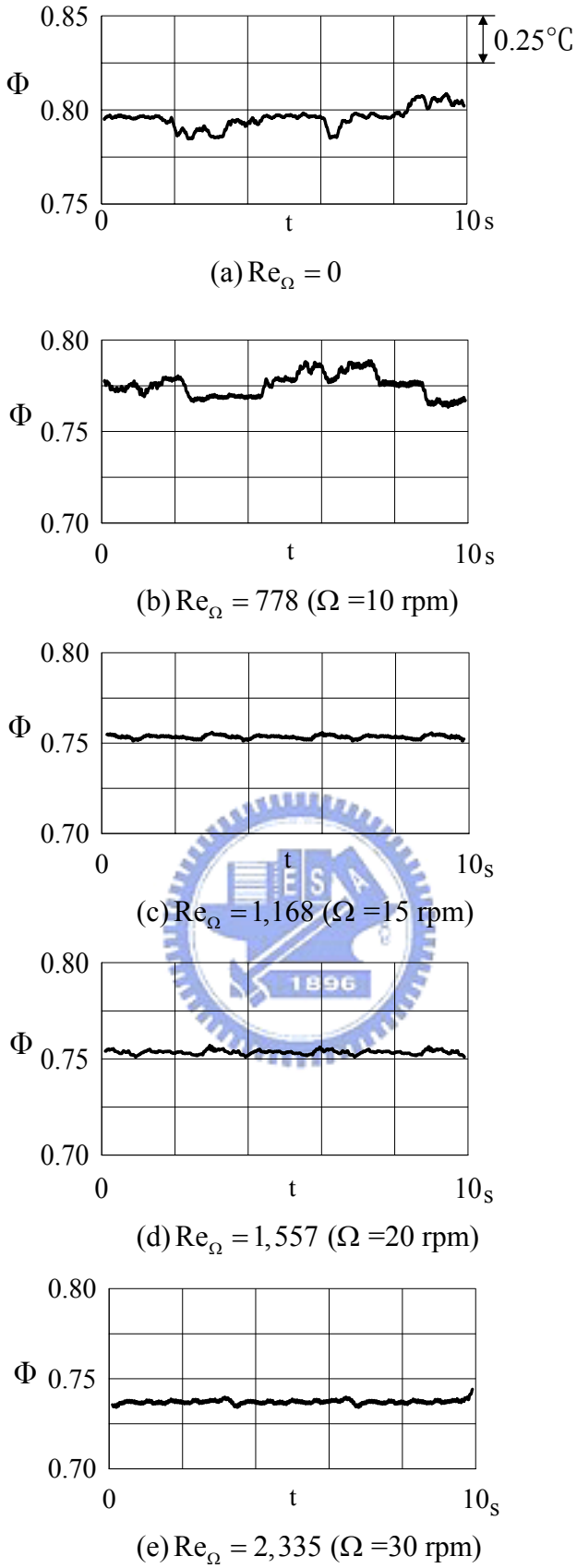


Fig. 4.56 The time records of non-dimensional air temperature for Re_j=1,190 (Q=8.8 slpm), and Ra=7,520 (ΔT=10.0℃) at location (R, Z) = (0.54, 0.5) on the cross plane $\theta = 0^\circ$ with H=20.0 mm for Re_Ω = (a)0, (b)778, (c)1,668,(d)1,557, and (e)2,335.

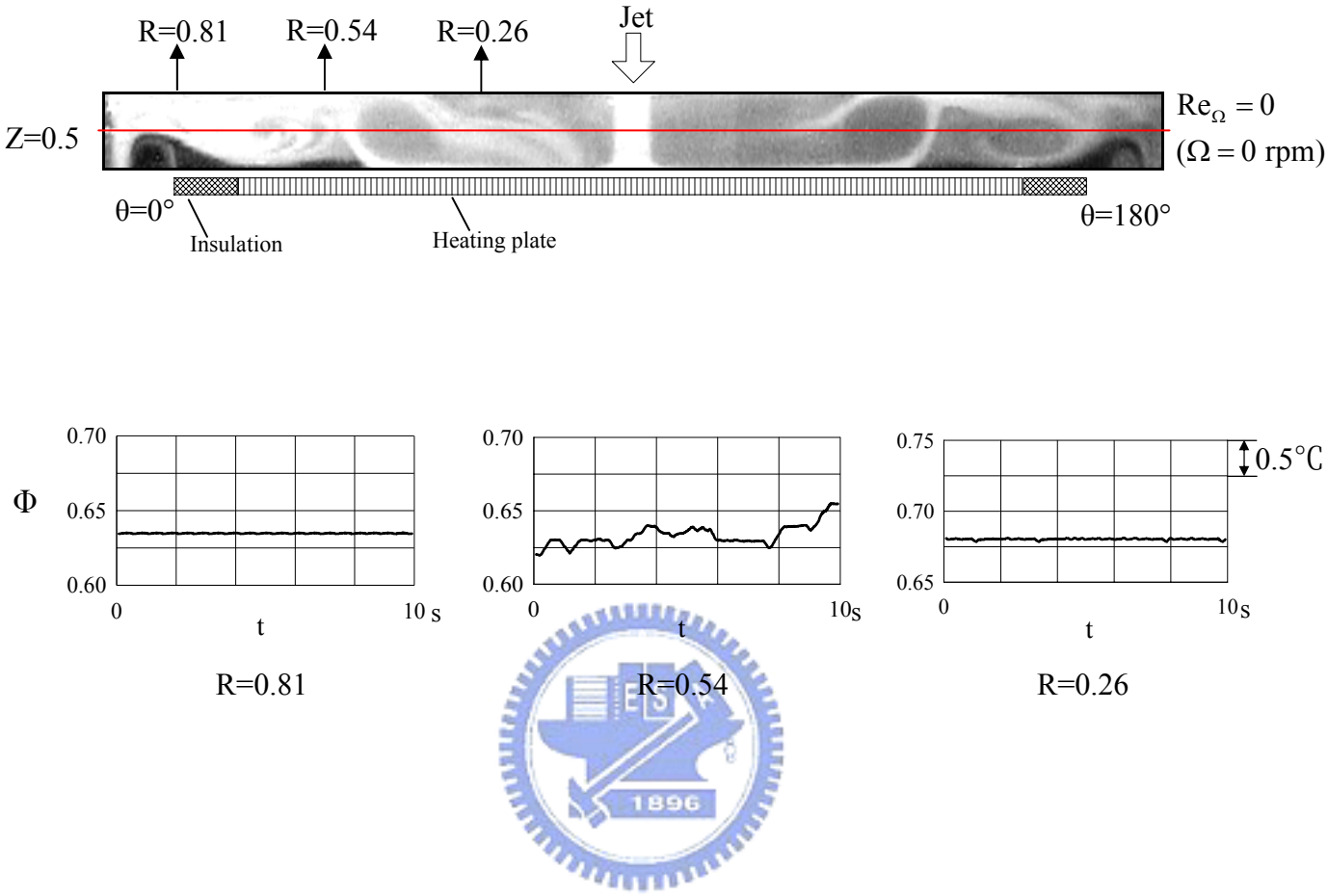
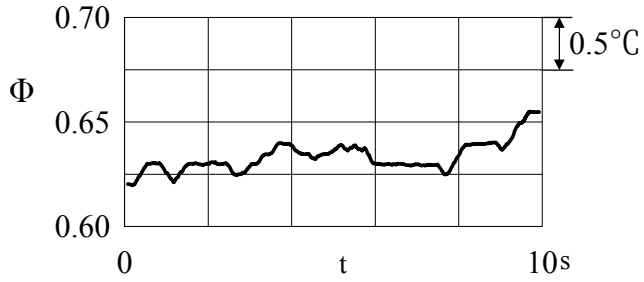
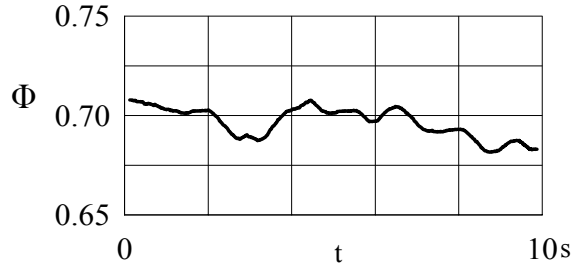


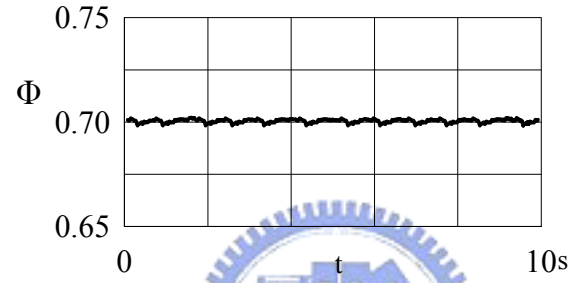
Fig.4.57 Side view flow photo taken at the cross plane $\theta = 0^\circ$ & 180° at certain time instant in the statistical state and time records of non-dimensional air temperature at selected locations in the middle horizontal plane Z=0.5 with H=20.0 mm for Re_j=1,244 (Q=9.2 slpm), Ra=15,030 (ΔT=20.0℃), D_j=10.0 mm and $Re_\Omega = 0$ (nonperiodic flow).



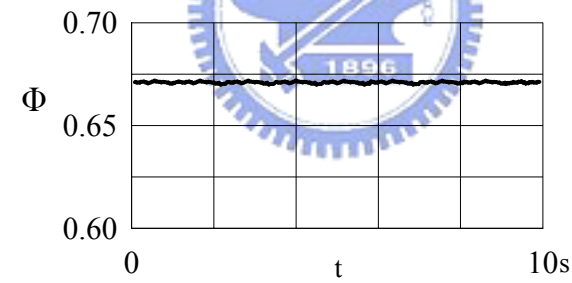
(a) $Re_{\Omega} = 0$



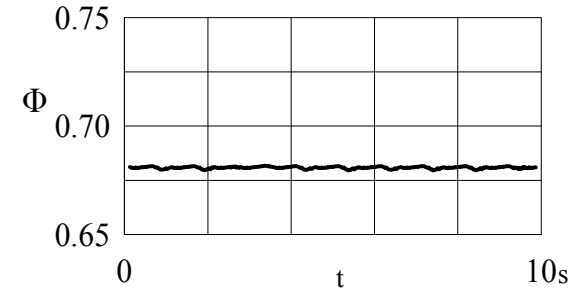
(b) $Re_{\Omega} = 778$ (Ω =10 rpm)



(c) $Re_{\Omega} = 1{,}168$ (Ω =20 rpm)



(d) $Re_{\Omega} = 1{,}557$ (Ω =20 rpm)



(e) $Re_{\Omega} = 2{,}335$ (Ω =30 rpm)

Fig. 4.58 The time records of non-dimensional air temperature for Re_j=1,244 (Q=9.2 slpm), and Ra=15,030 (ΔT=20.0℃) at location (R, Z) = (0.54, 0.5) on the cross plane $\theta = 0^{\circ}$ with H=20.0 mm for Re_{Ω} = (a)0, (b)778, (c)1,168,(d)1,557, and (e)2,335.