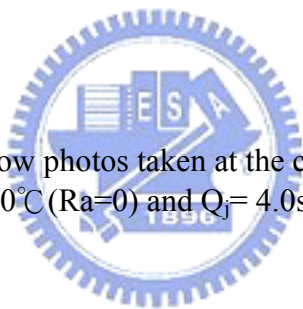


Fig. 4.21 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 0^\circ\text{C}$ ($Ra = 0$) and $Q_j = 4.0 \text{ slpm}$ ($Re_j = 541$).



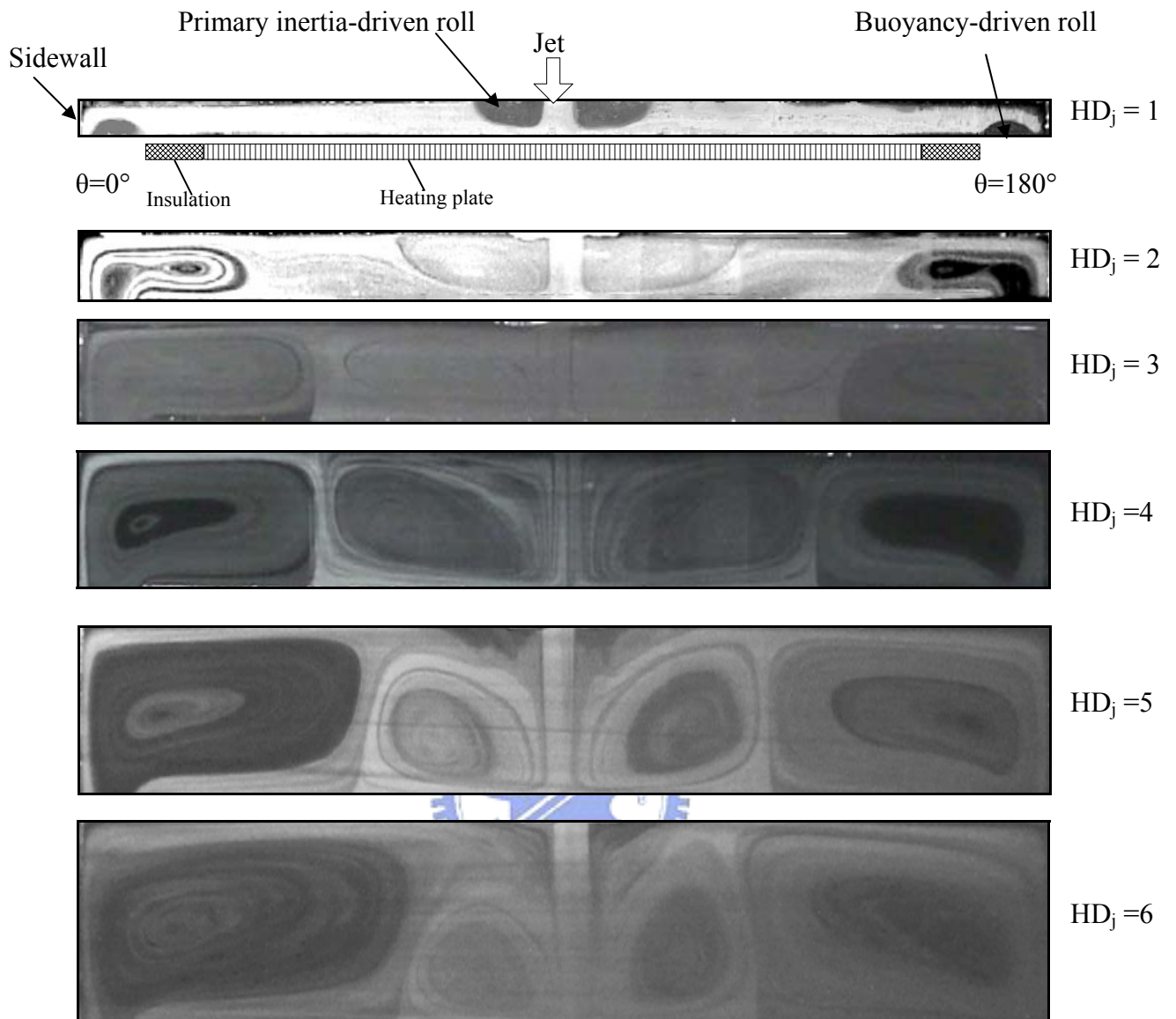


Fig. 4.22 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 5^\circ\text{C}$ and $Q_j = 1.0$ slpm ($Re_j = 135$).

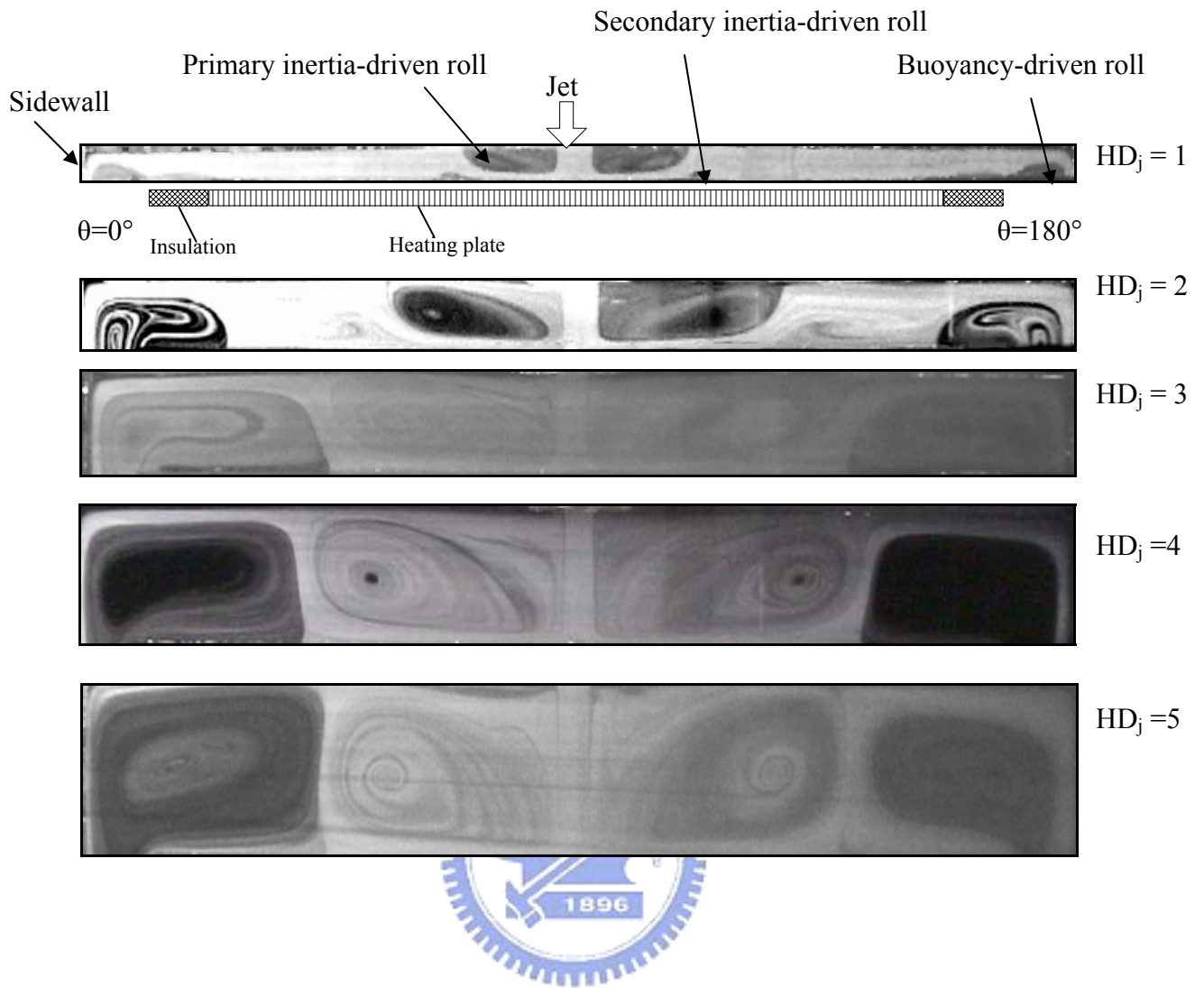


Fig. 4.23 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 5^\circ\text{C}$ and $Q_j = 2.0$ slpm ($Re_j = 270$).

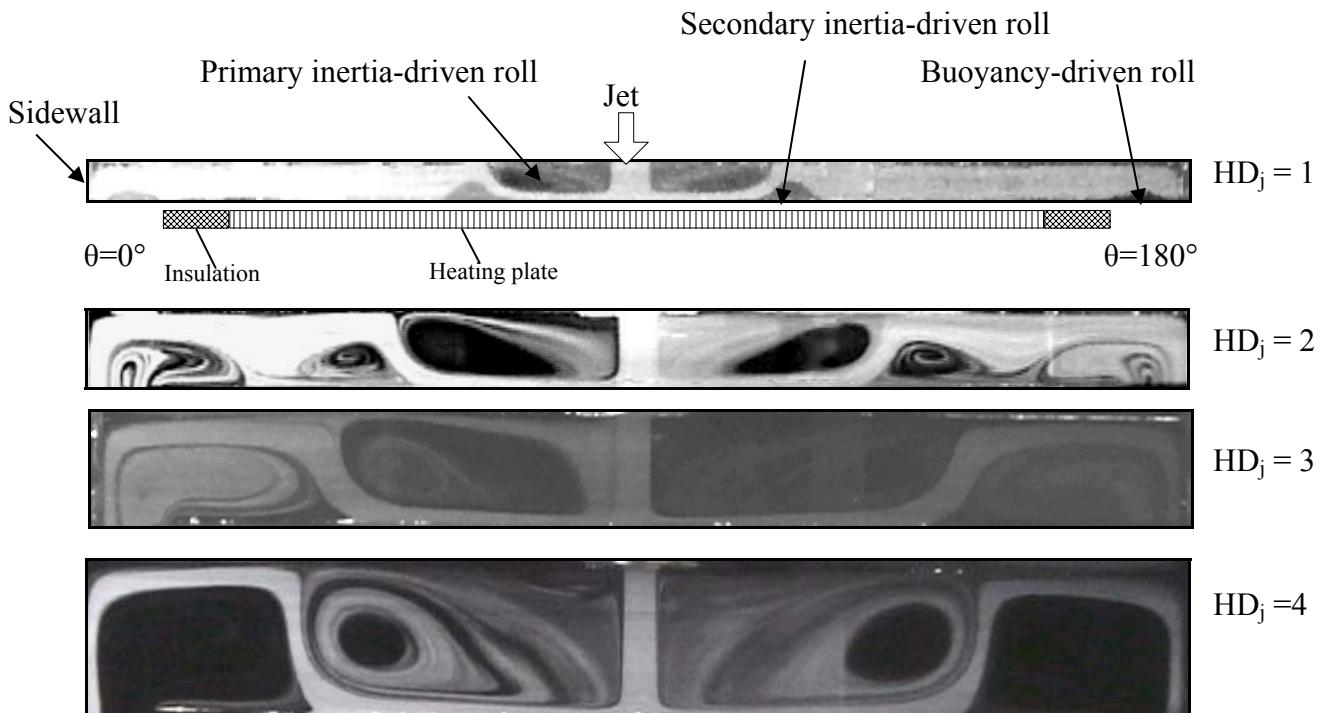
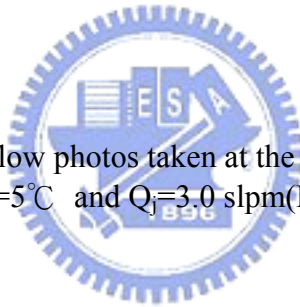


Fig. 4.24 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 5^\circ\text{C}$ and $Q_j = 3.0$ slpm ($Re_j = 406$).



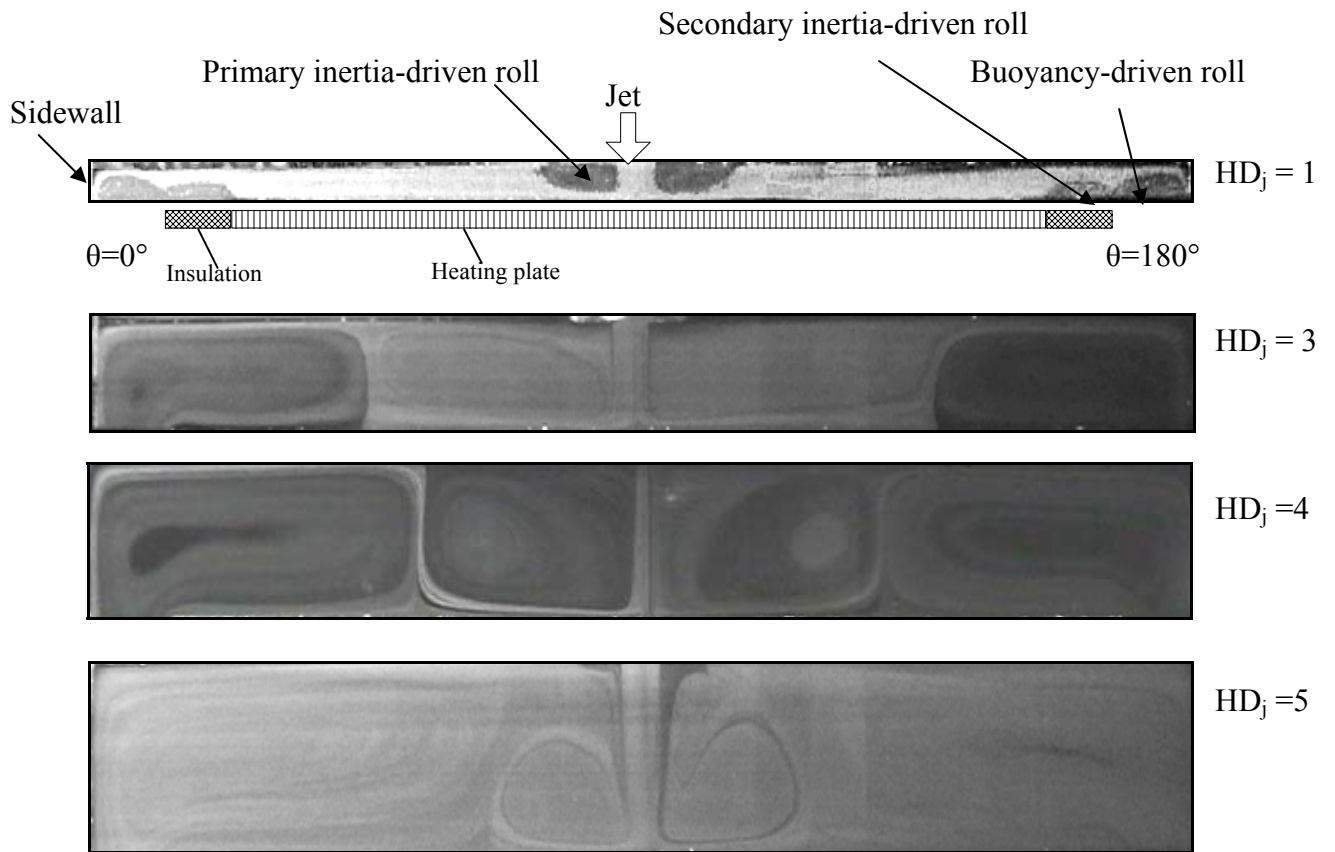


Fig. 4.25 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 10^\circ\text{C}$ and $Q_j = 1.0 \text{ slpm}$ ($Re_j = 135$).

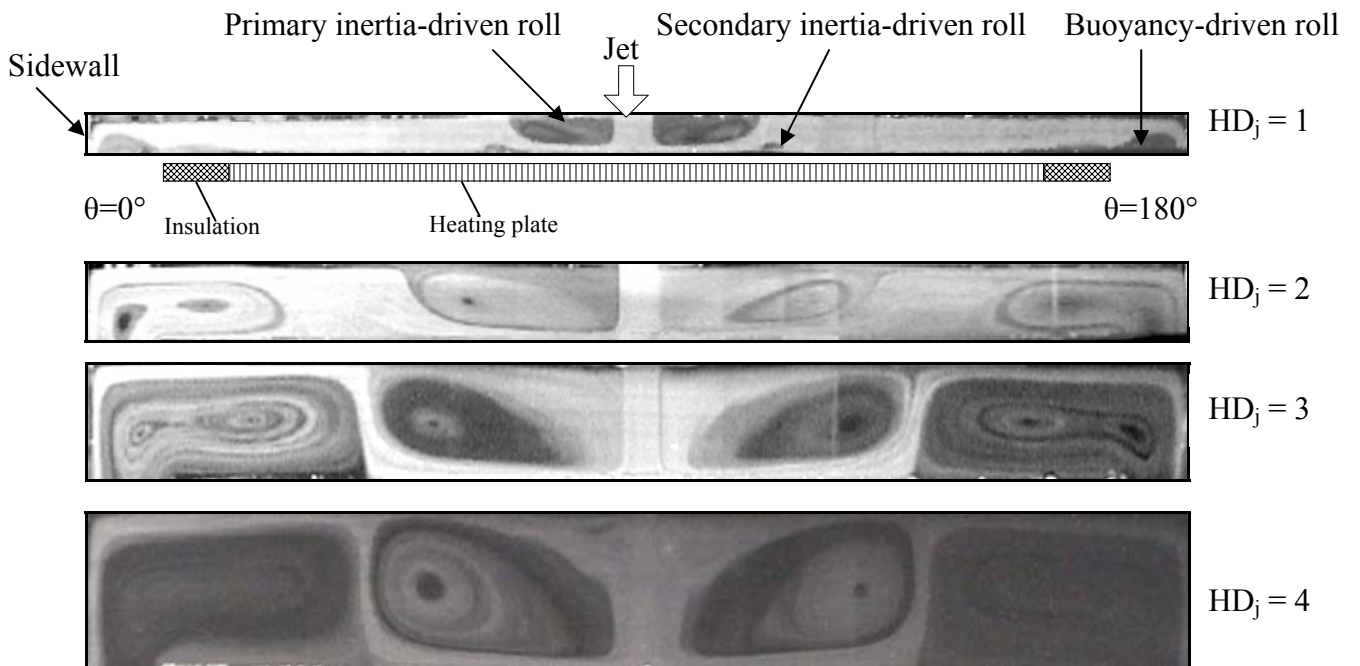


Fig. 4.26 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 10^\circ\text{C}$ and $Q_j = 2.0$ slpm ($Re_j = 270$).



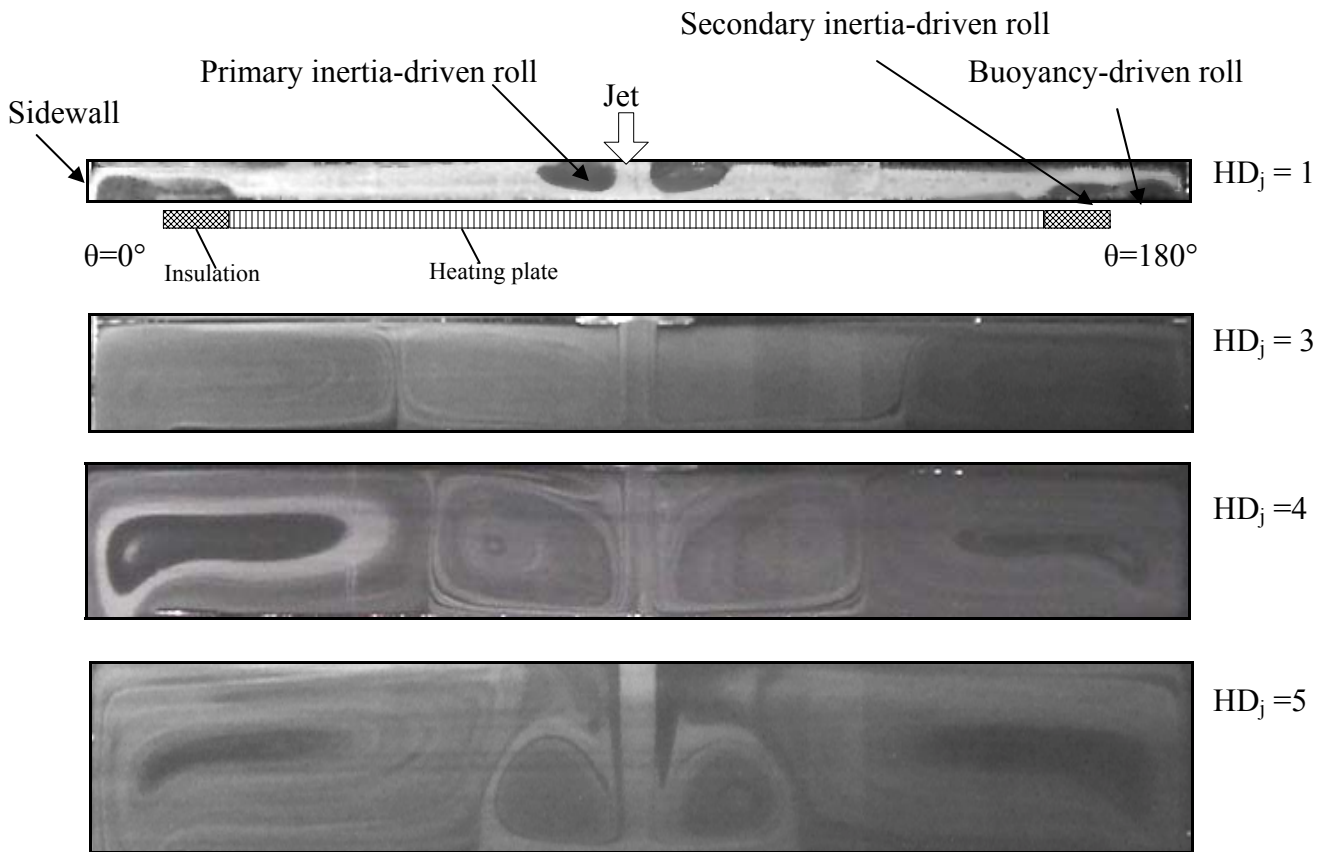


Fig. 4.27 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 15^\circ\text{C}$ and $Q_j = 1.0 \text{ slpm}$ ($Re_j = 135$).

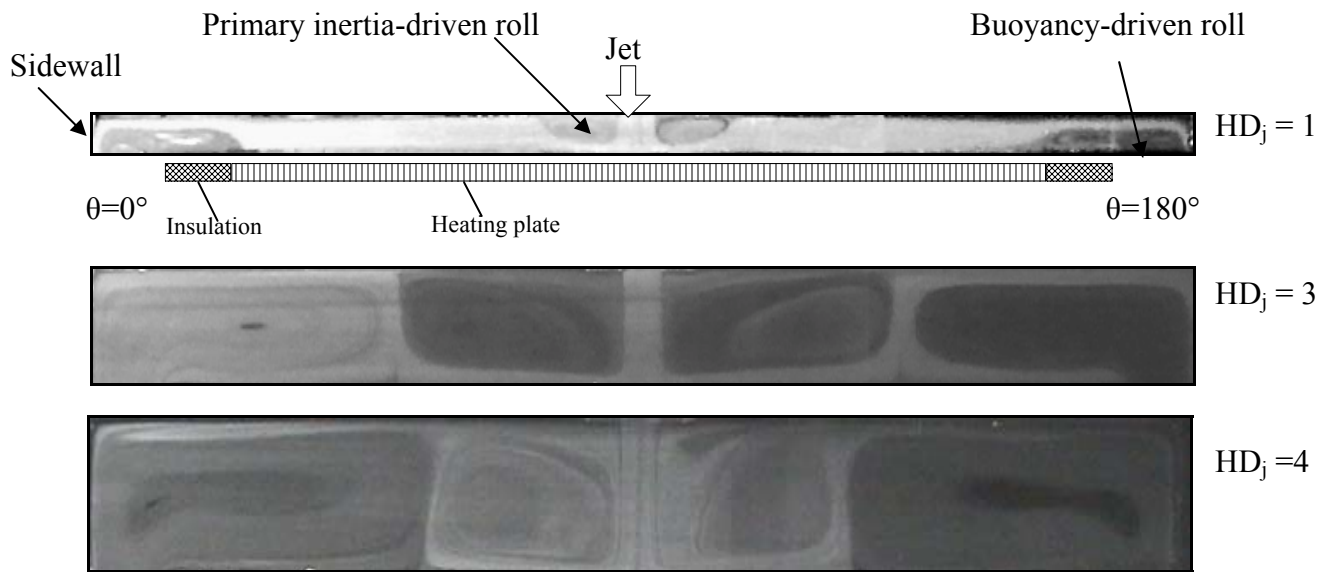
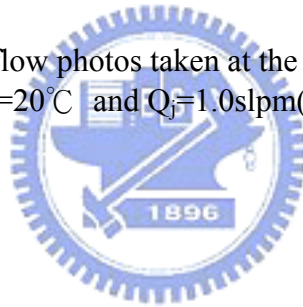


Fig. 4.28 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 20^\circ\text{C}$ and $Q_j = 1.0 \text{ slpm}$ ($Re_j = 135$).



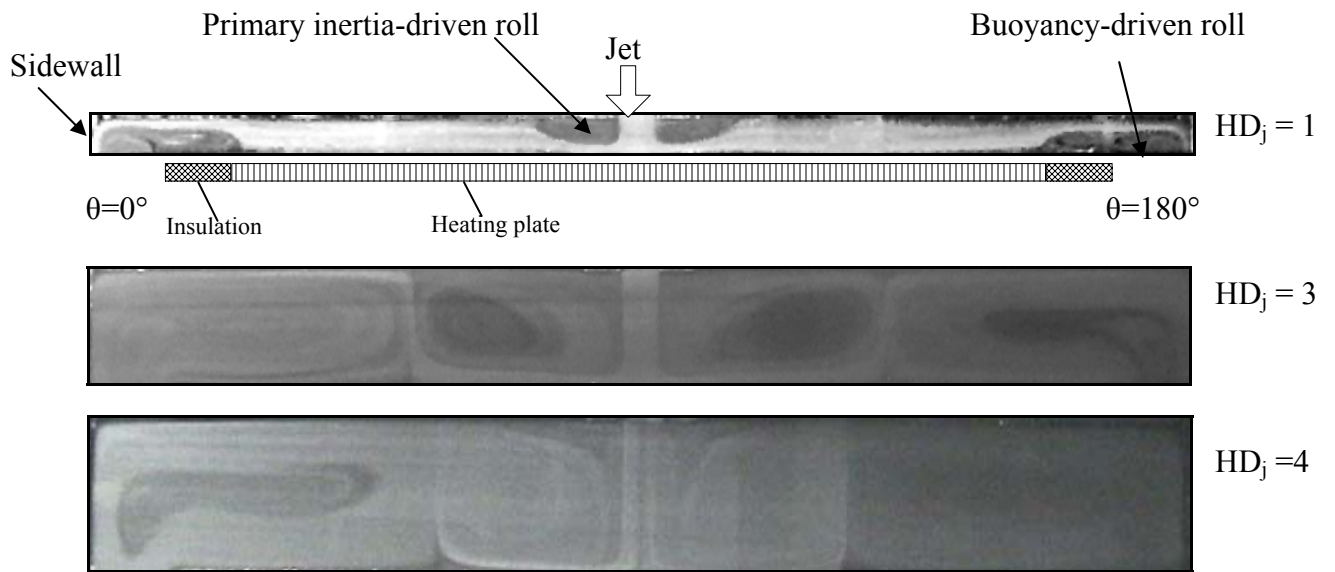
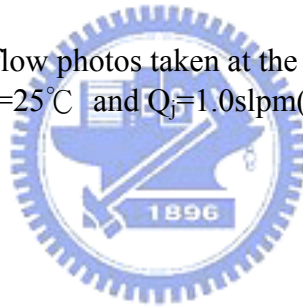
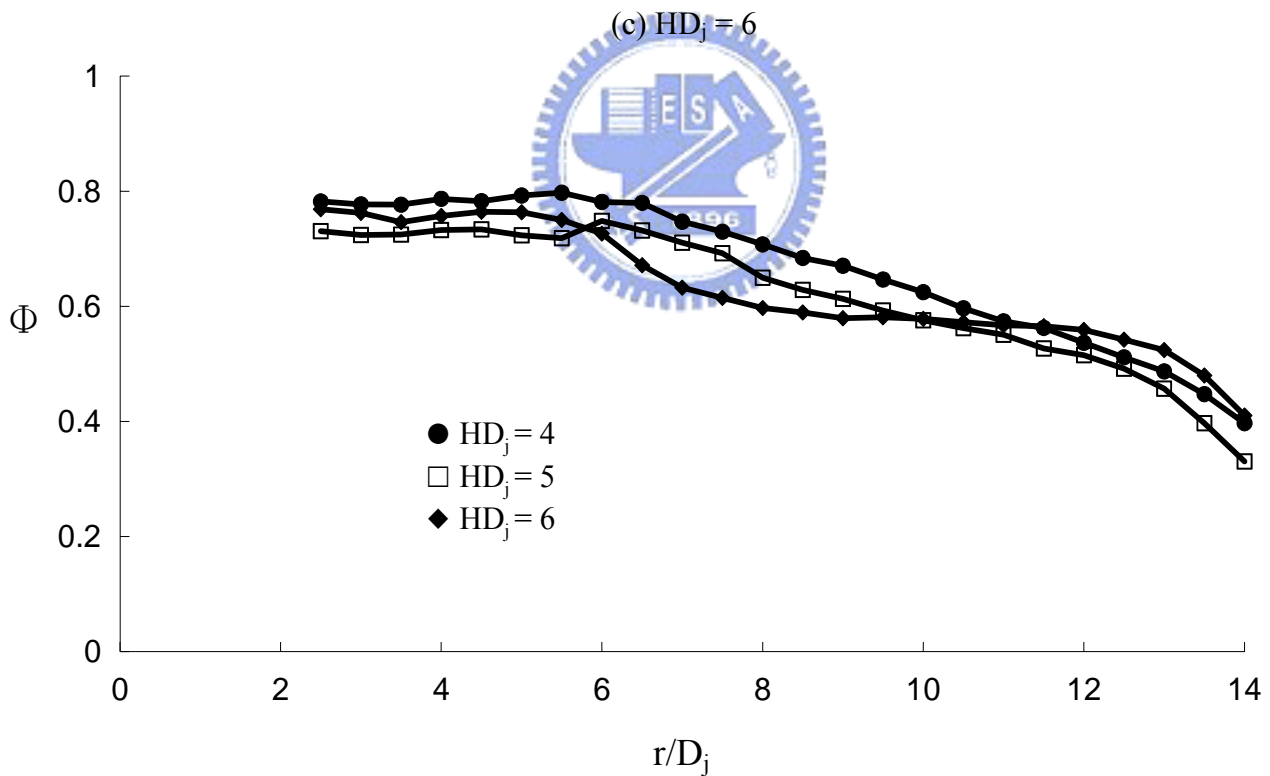
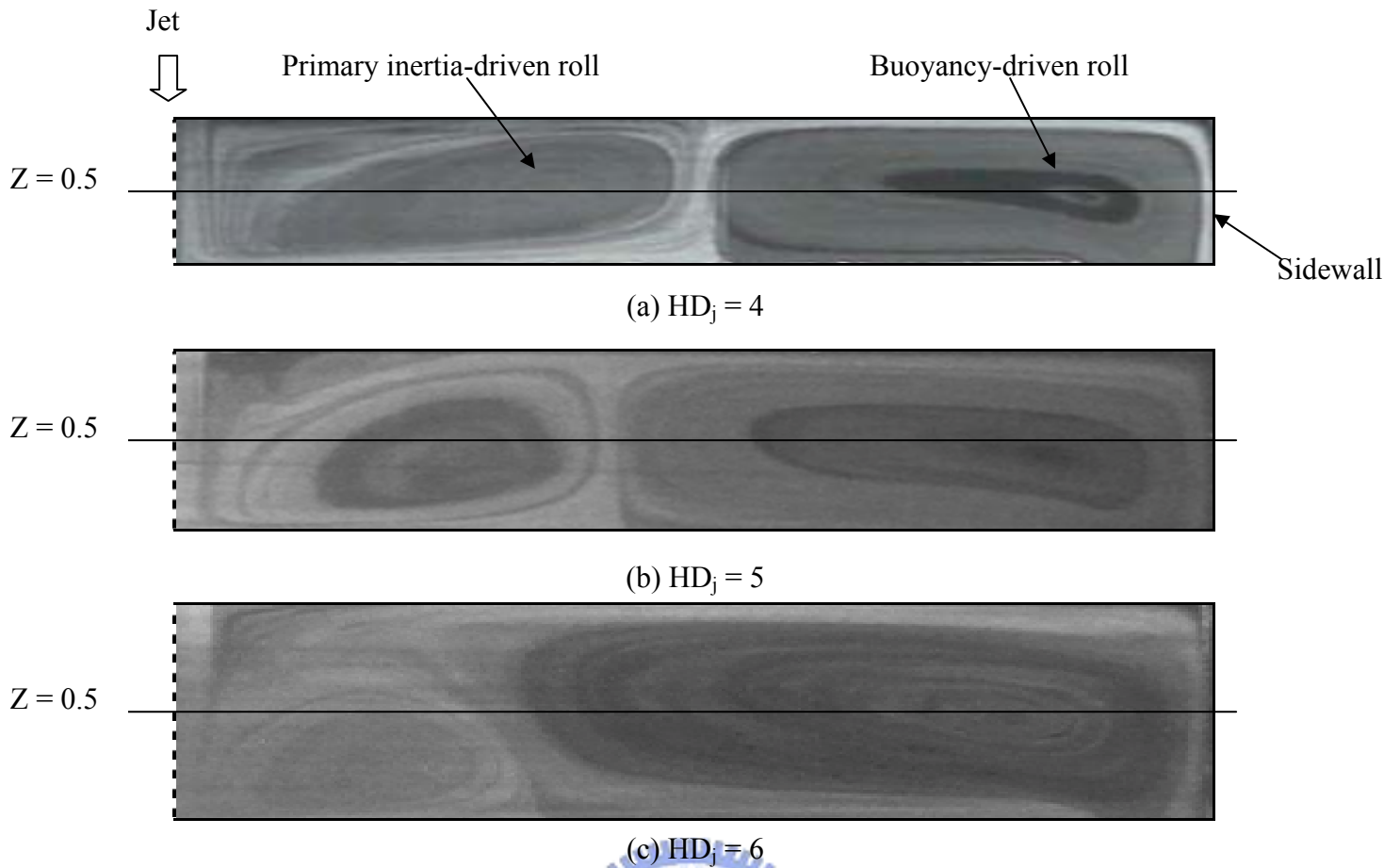


Fig. 4.29 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various HD_j at $\Delta T = 25^\circ\text{C}$ and $Q_j = 1.0 \text{ slpm}$ ($Re_j = 135$).





(d) radial variation in non-dimensional steady air temperature

Fig. 4.30 Radial variation in non-dimensional steady air temperature with $Re_j = 135$ ($Q_j = 1.0$ slpm) and $\Delta T = 5.0^\circ\text{C}$ at $Z = 0.5$ on the vertical plane $\theta = 0^\circ$ for $HD_j = 4, 5$, and 6 .

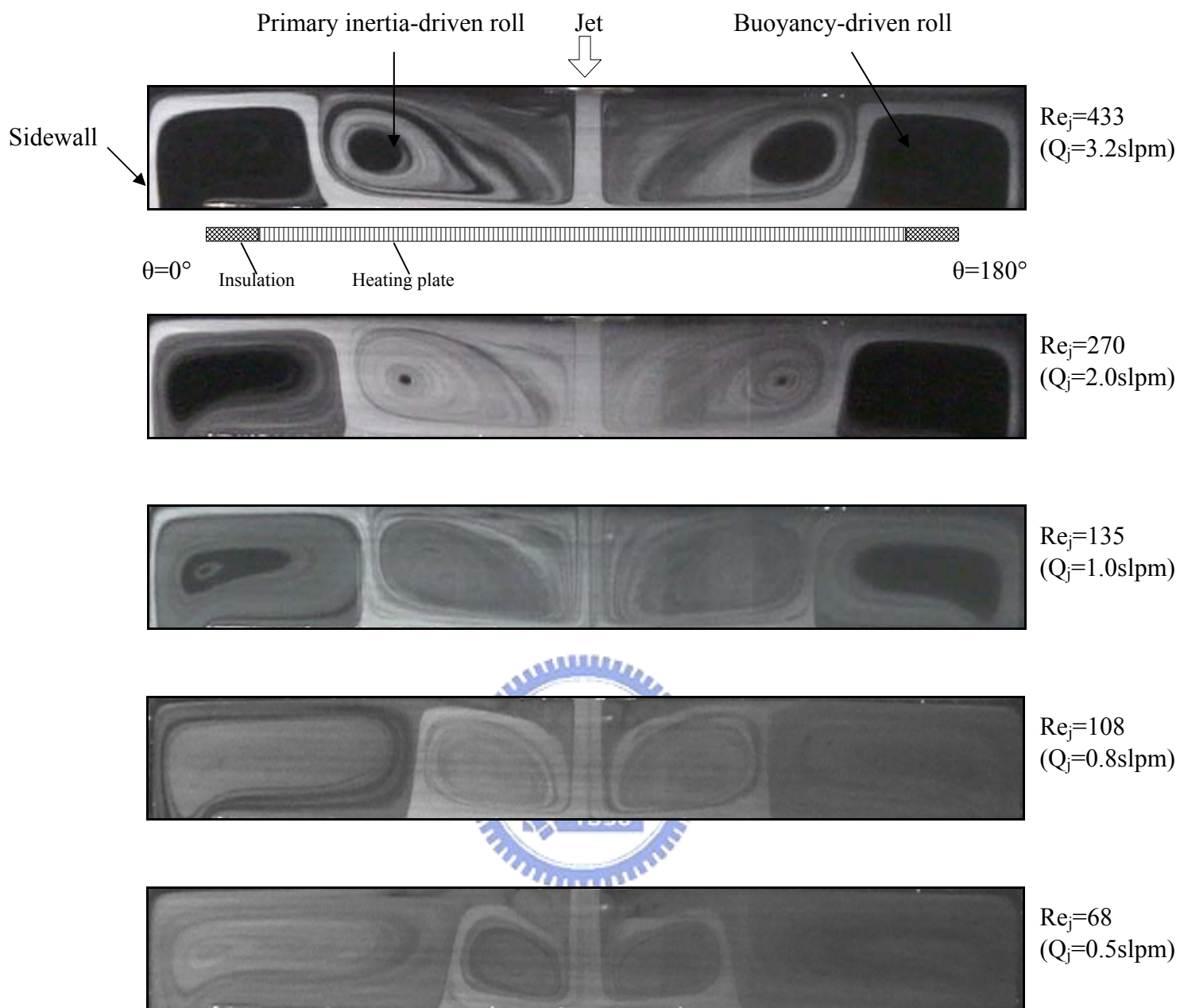


Fig. 4.31 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=30,065$ ($\Delta T=5^\circ\text{C}$) for $H = 40.0$ mm.

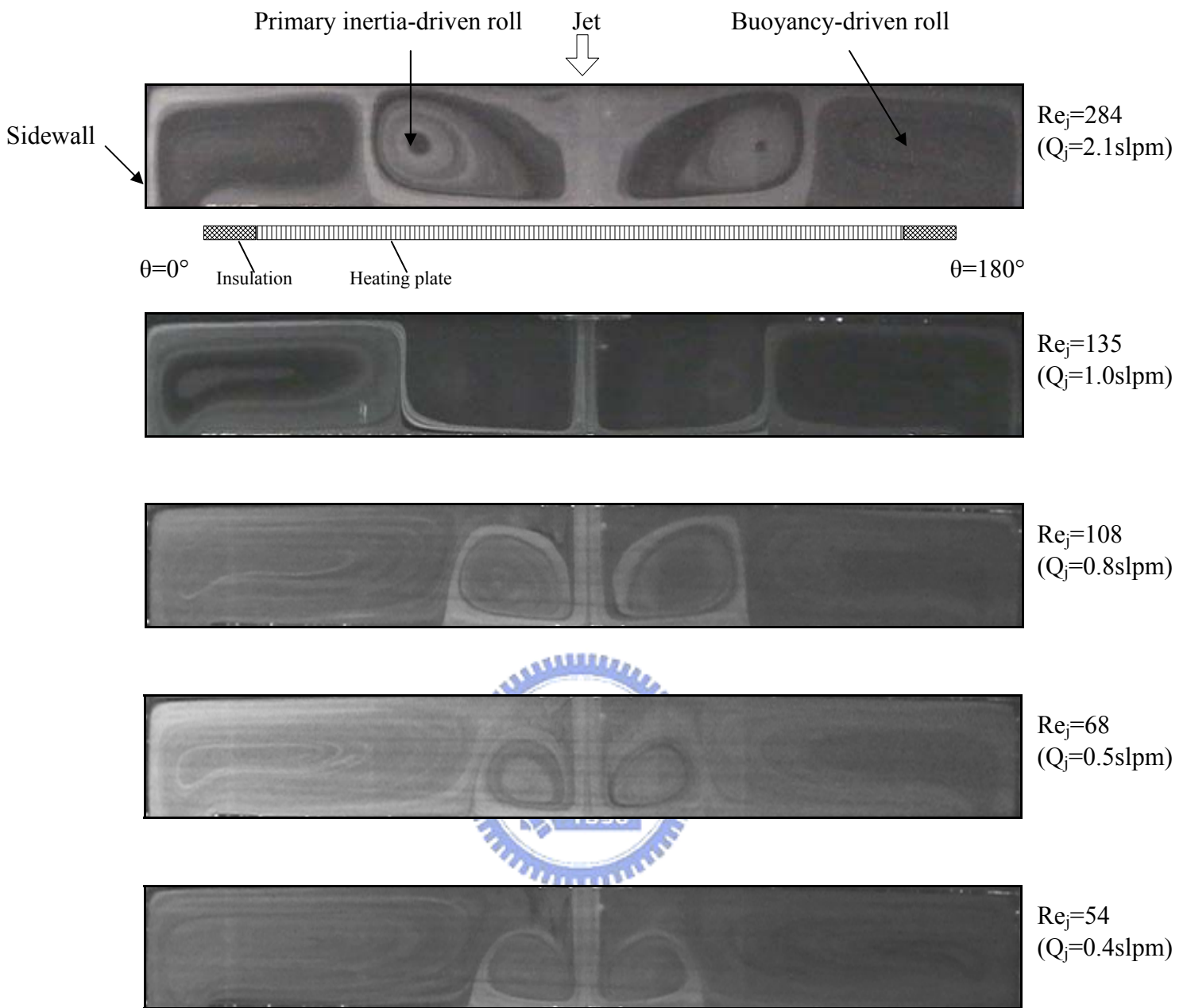


Fig. 4.32 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=60,130$ ($\Delta T=10^\circ\text{C}$) for $H = 40.0$ mm.

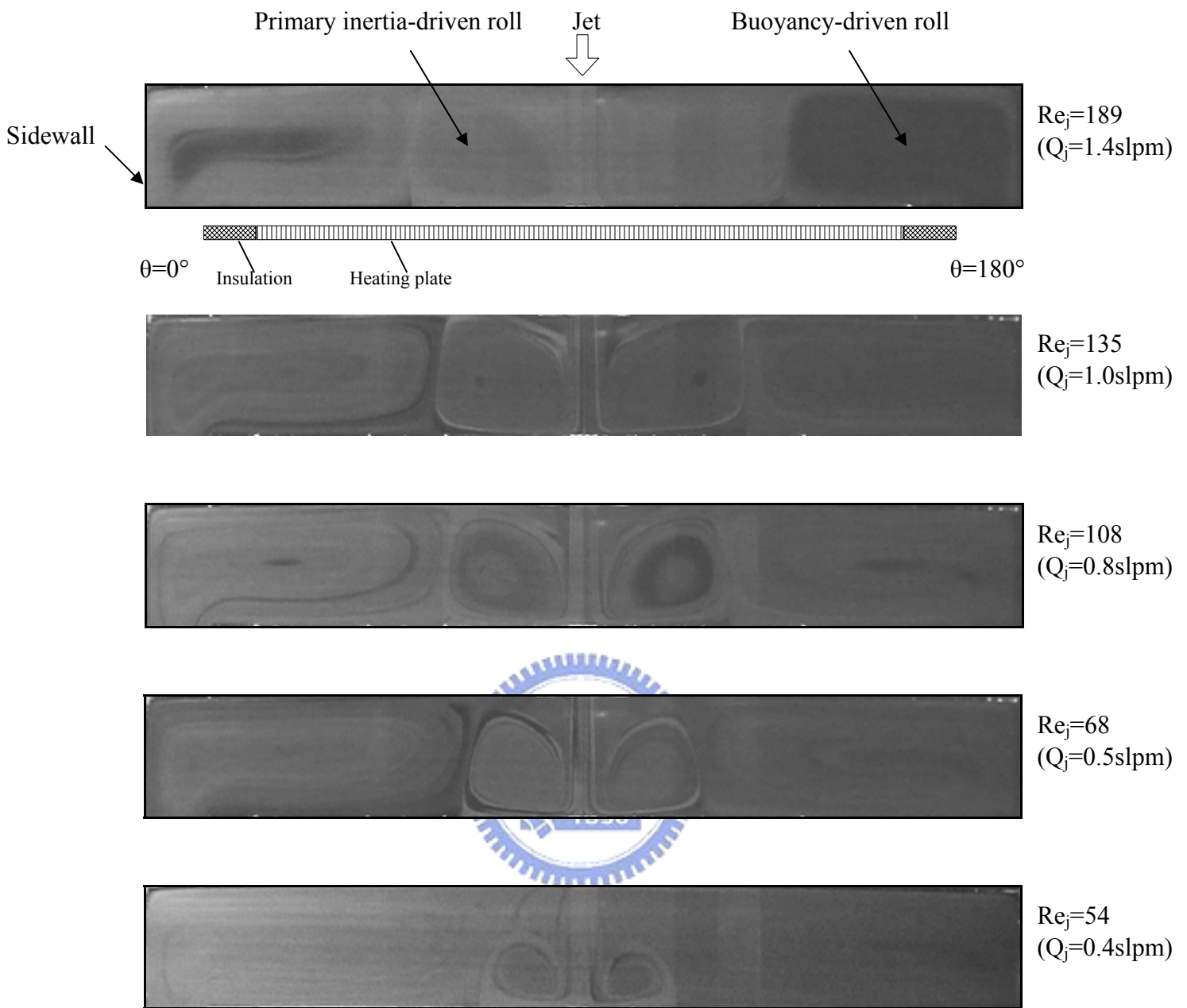


Fig. 4.33 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=90,195$ ($\Delta T=15^\circ\text{C}$) for $H = 40.0$ mm.

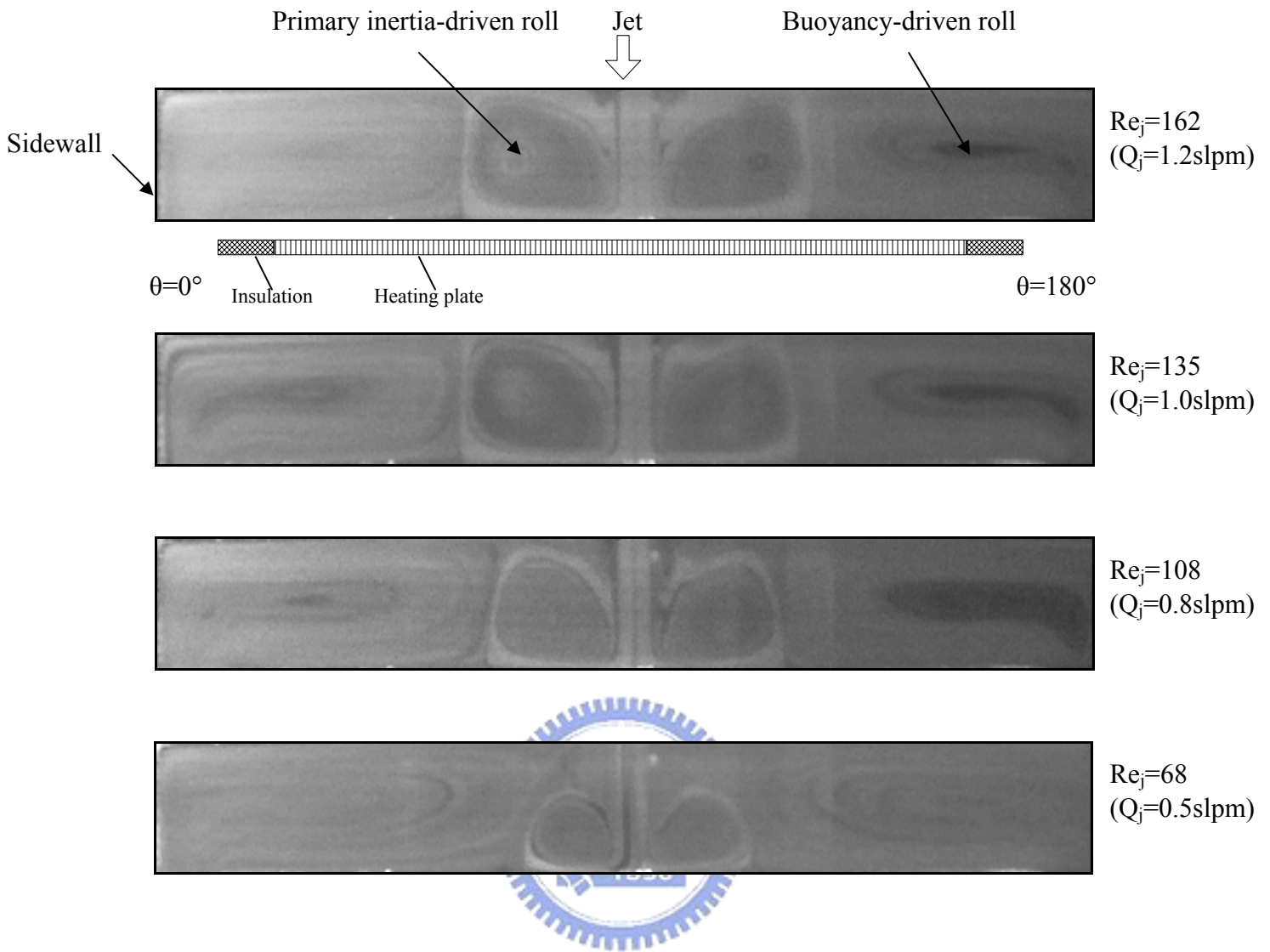


Fig. 4.34 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=120,260$ ($\Delta T=20^\circ\text{C}$) for $H = 40.0$ mm.

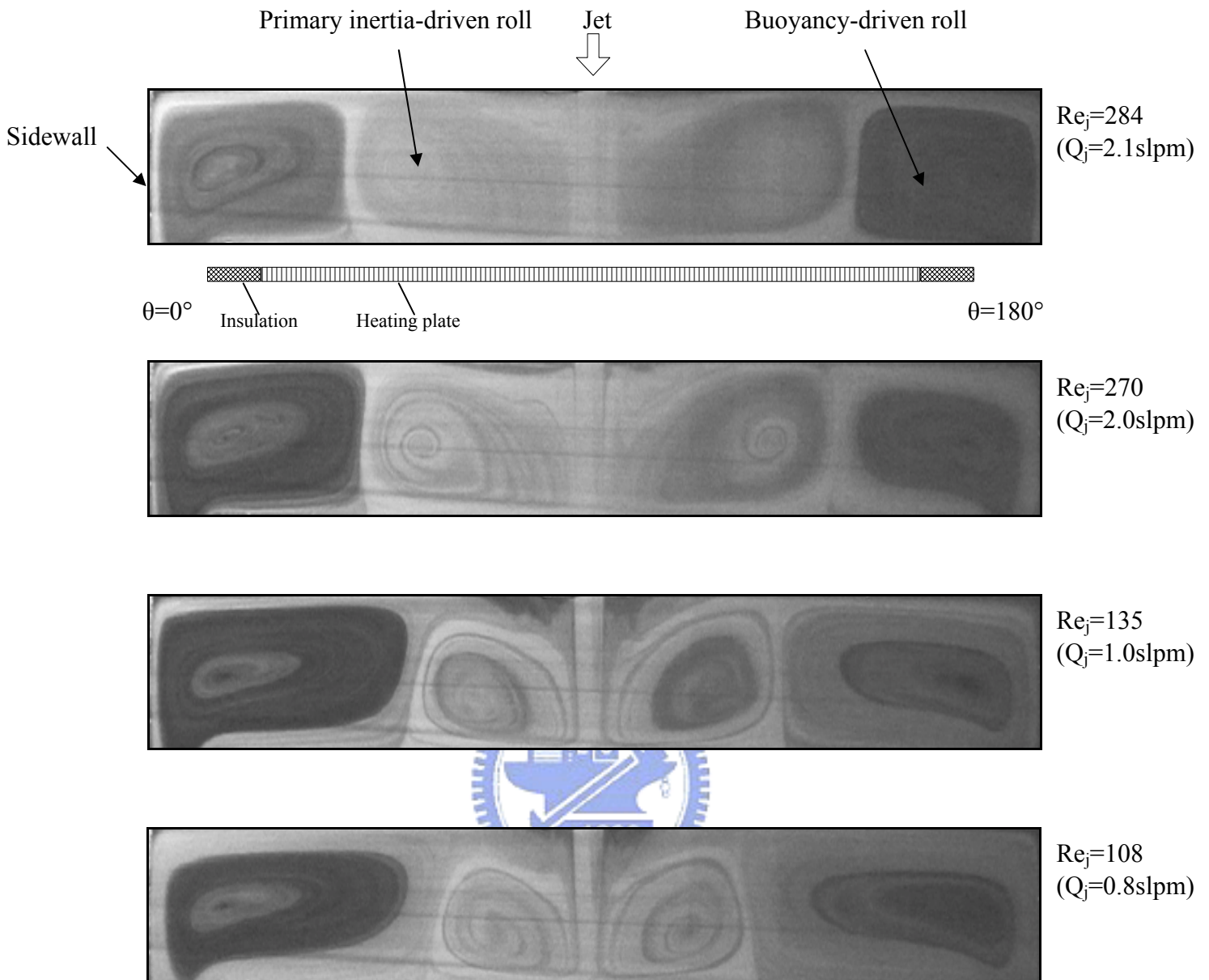


Fig. 4.35 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=58,721$ ($\Delta T=5^\circ\text{C}$) for $H = 50.0$ mm.

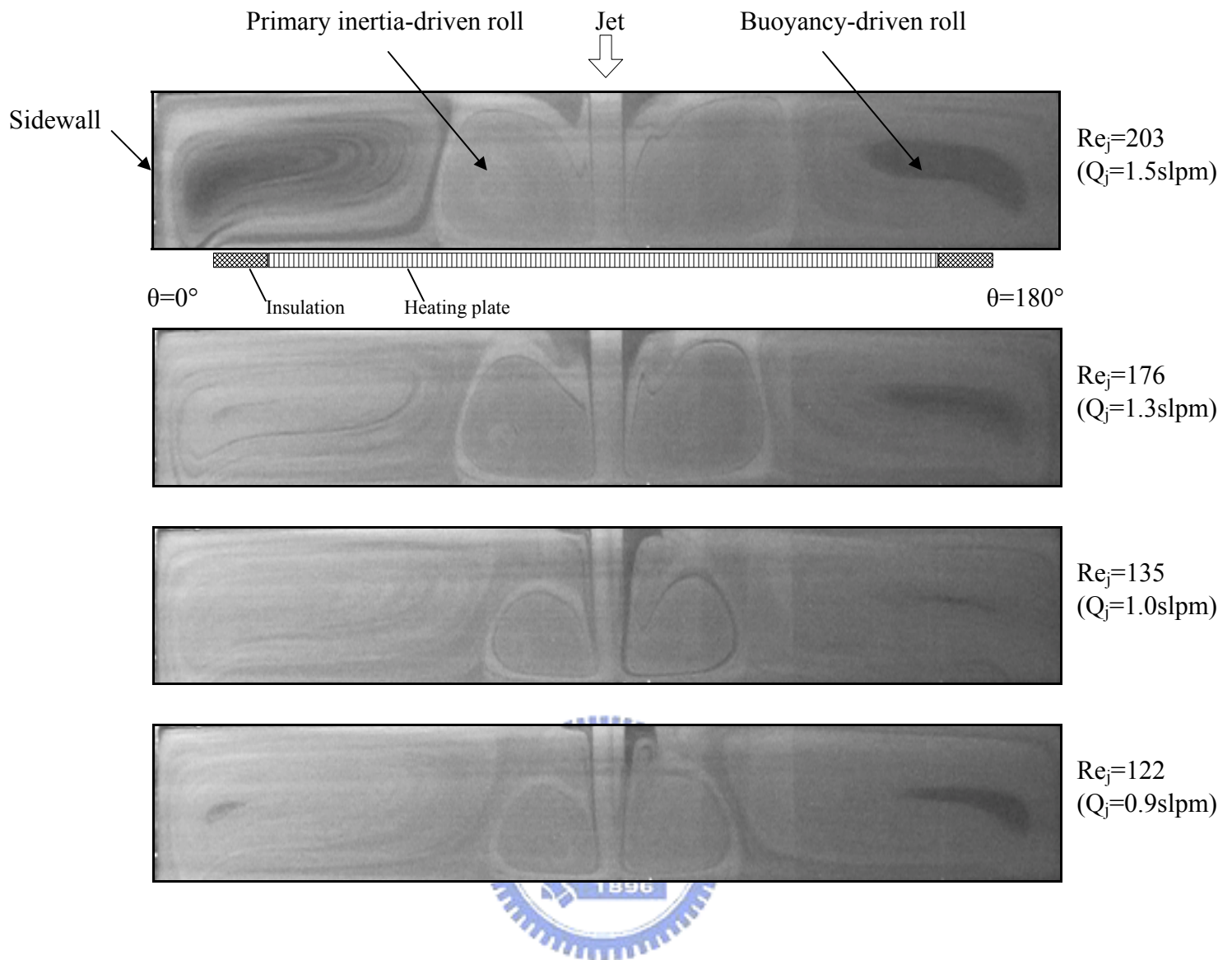


Fig. 4.36 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=117,442$ ($\Delta T=10^\circ\text{C}$) for $H=50.0\text{ mm}$.

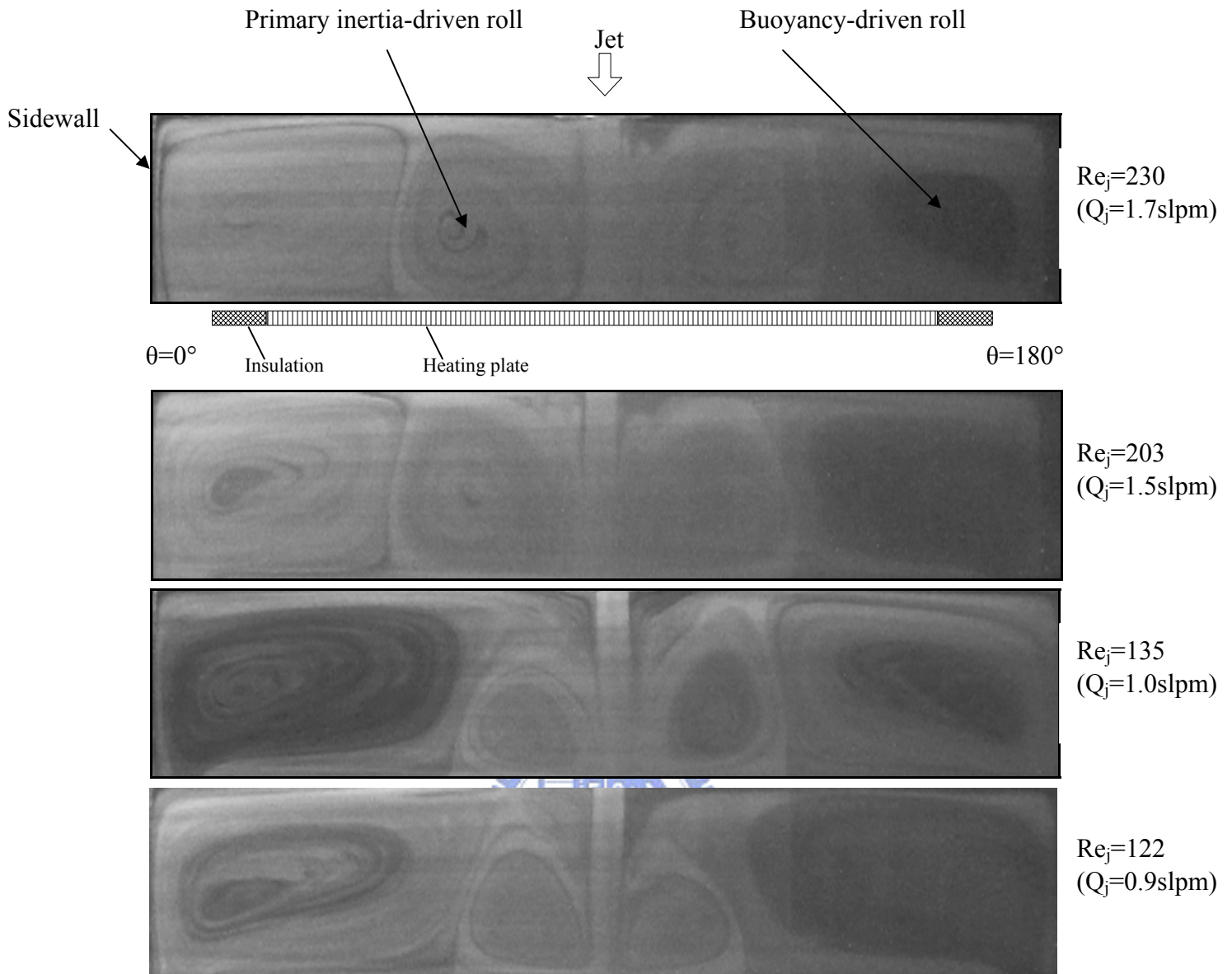


Fig. 4.37 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=101,470$ ($\Delta T=5^\circ\text{C}$) for $H = 60.0$ mm.

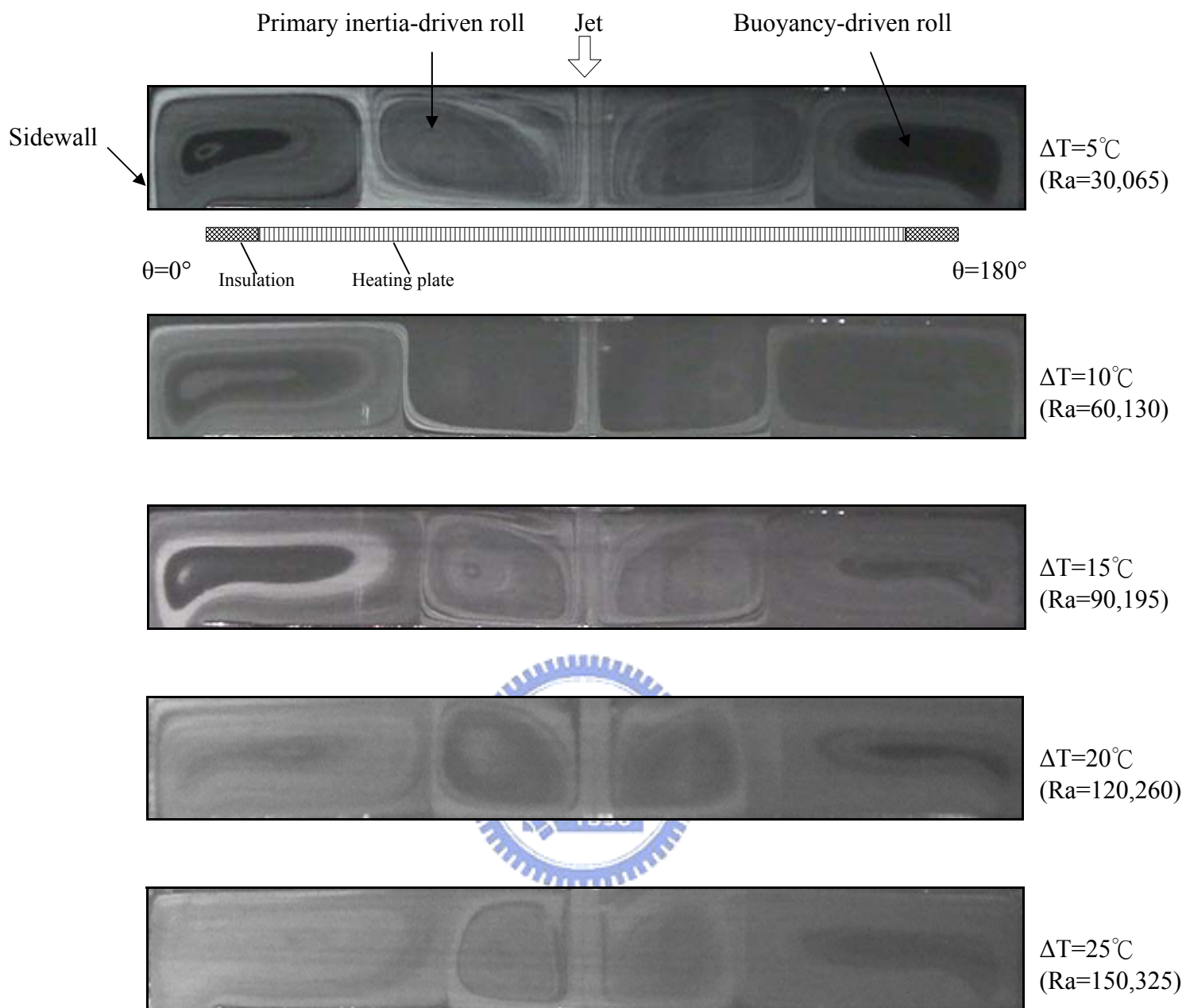


Fig. 4.38 Steady side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various temperature difference at $Re_j=135$ ($Q_j=1.0\text{slpm}$) and $H = 40.0$ mm.

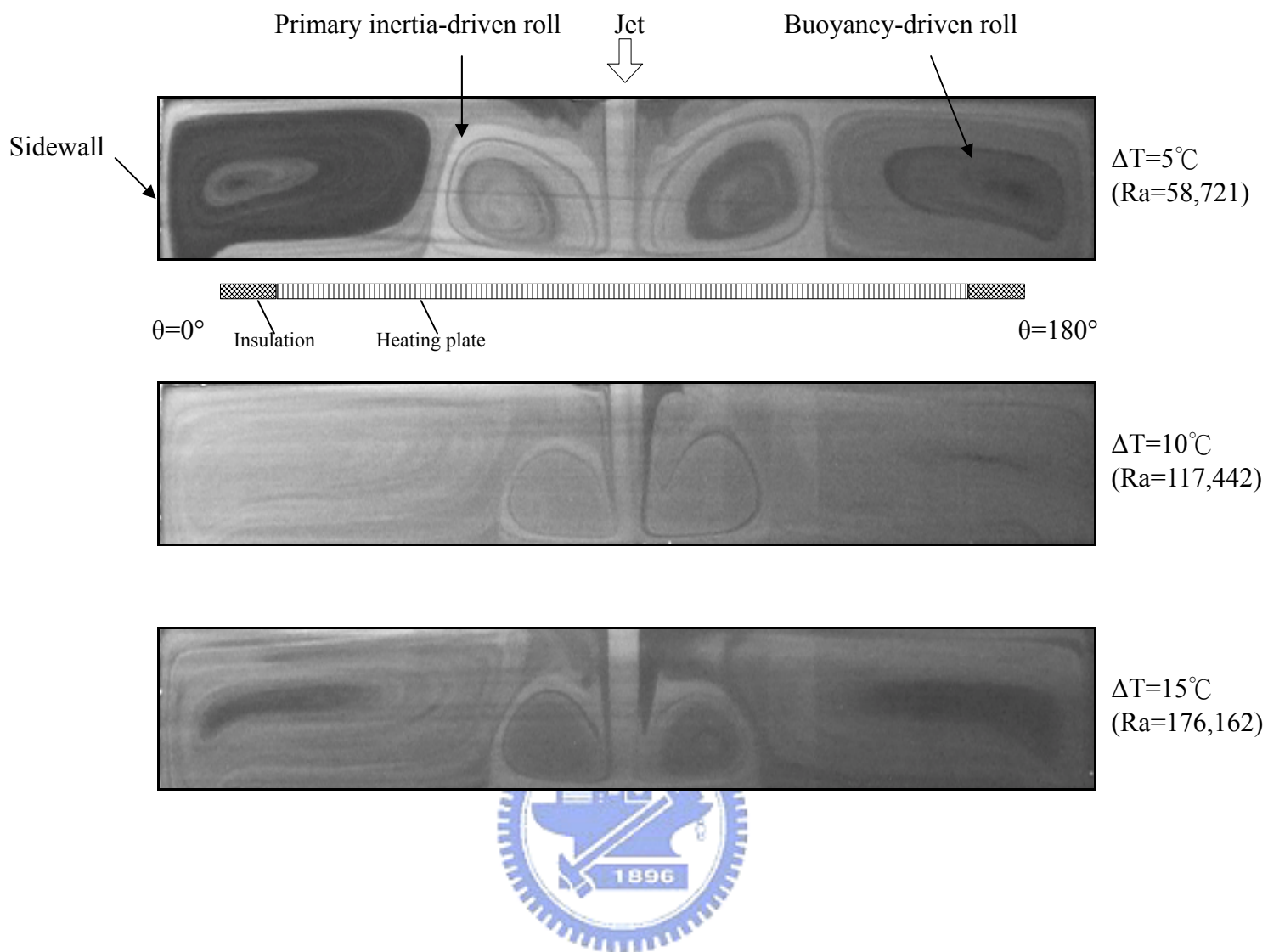


Fig. 4.39 Steady side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various temperature difference at $Re_j = 135$ ($Q_j = 1.0 \text{ slpm}$) and $H = 50.0 \text{ mm}$.

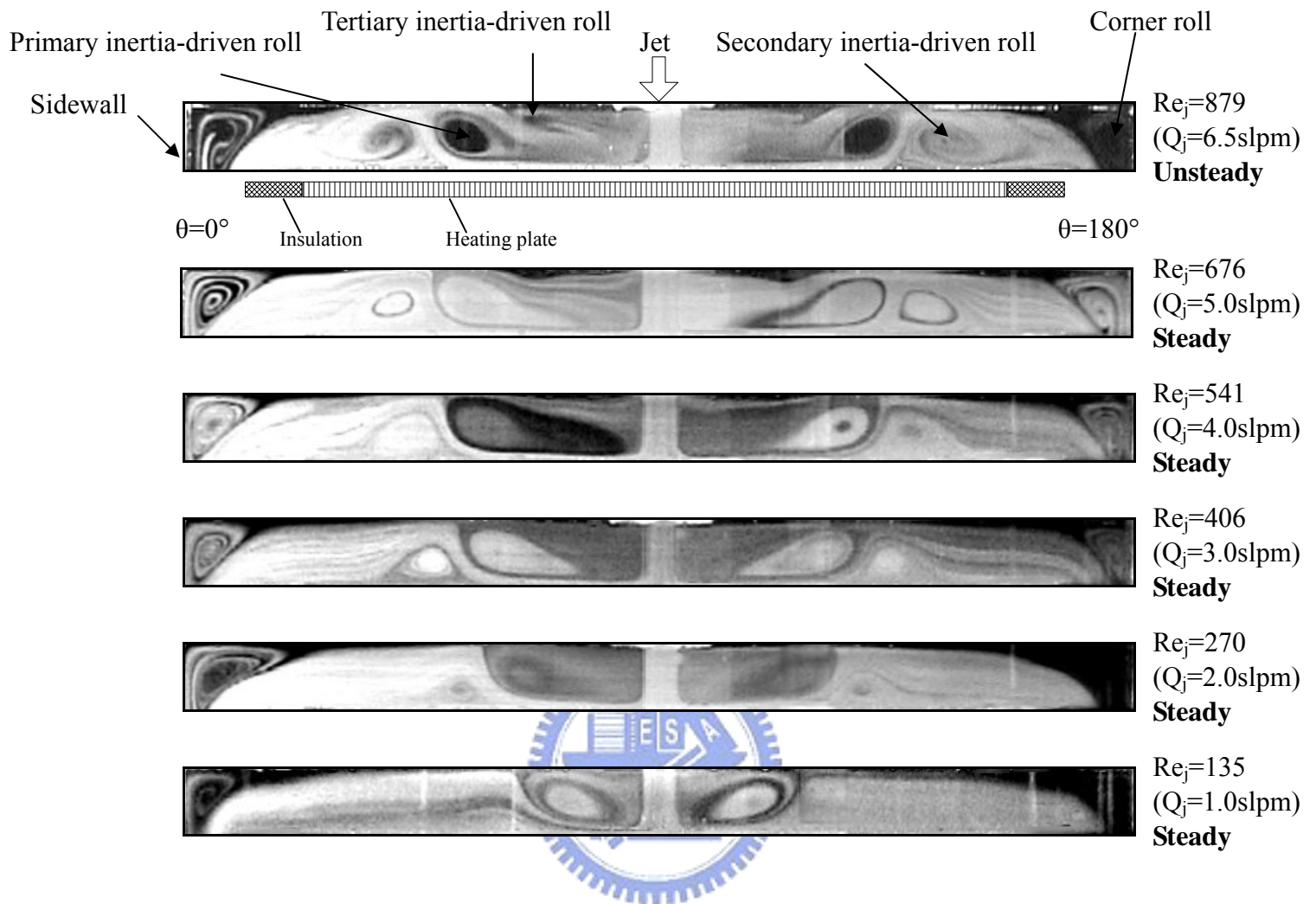


Fig. 4.40 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various jet Reynolds numbers at $Ra=0$ ($\Delta T=0^\circ\text{C}$) and $H = 20.0$ mm.

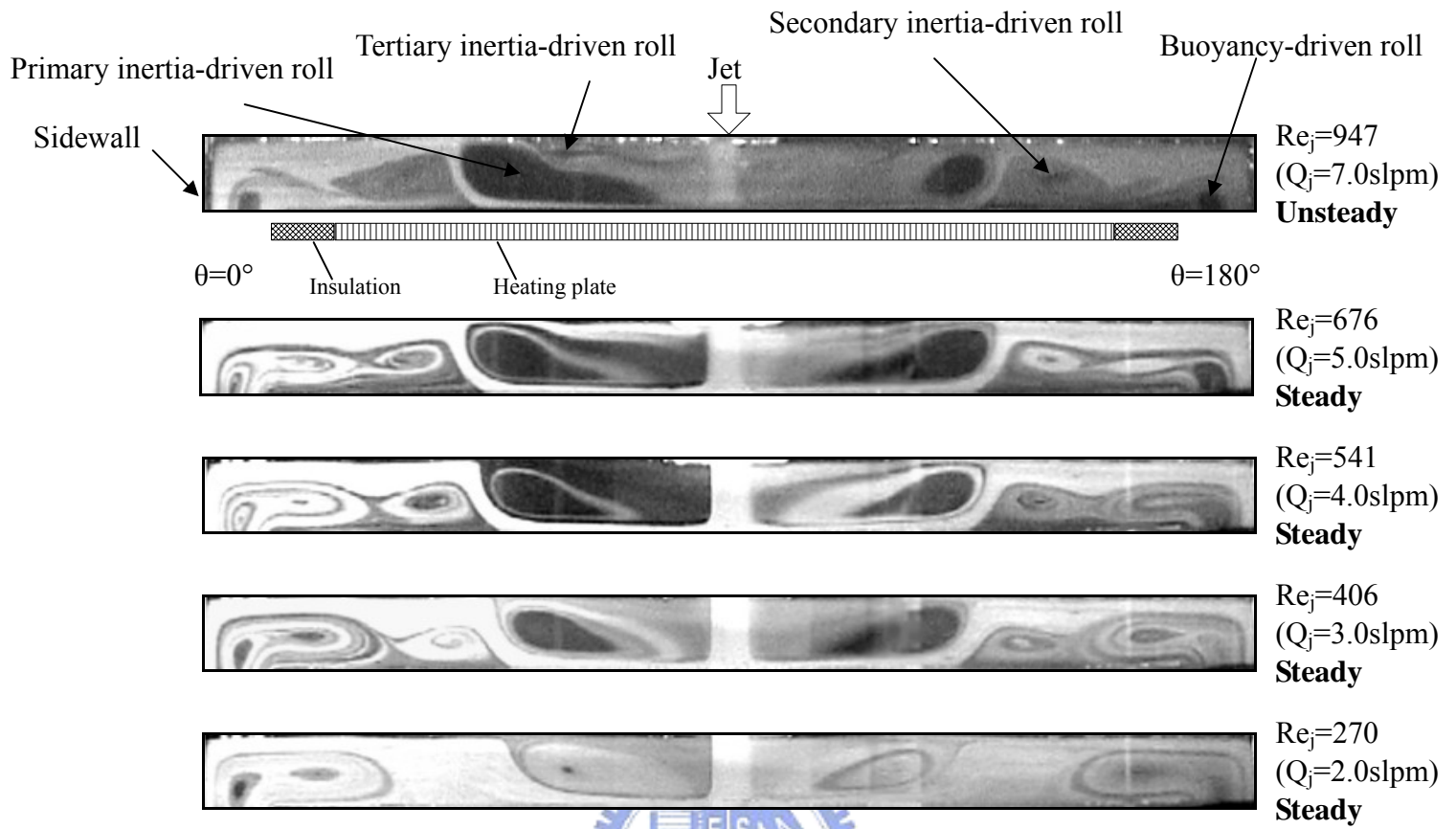


Fig. 4.41 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various jet Reynolds numbers at $Ra=7,520$ ($\Delta T=10^\circ C$) and $H = 20.0$ mm.

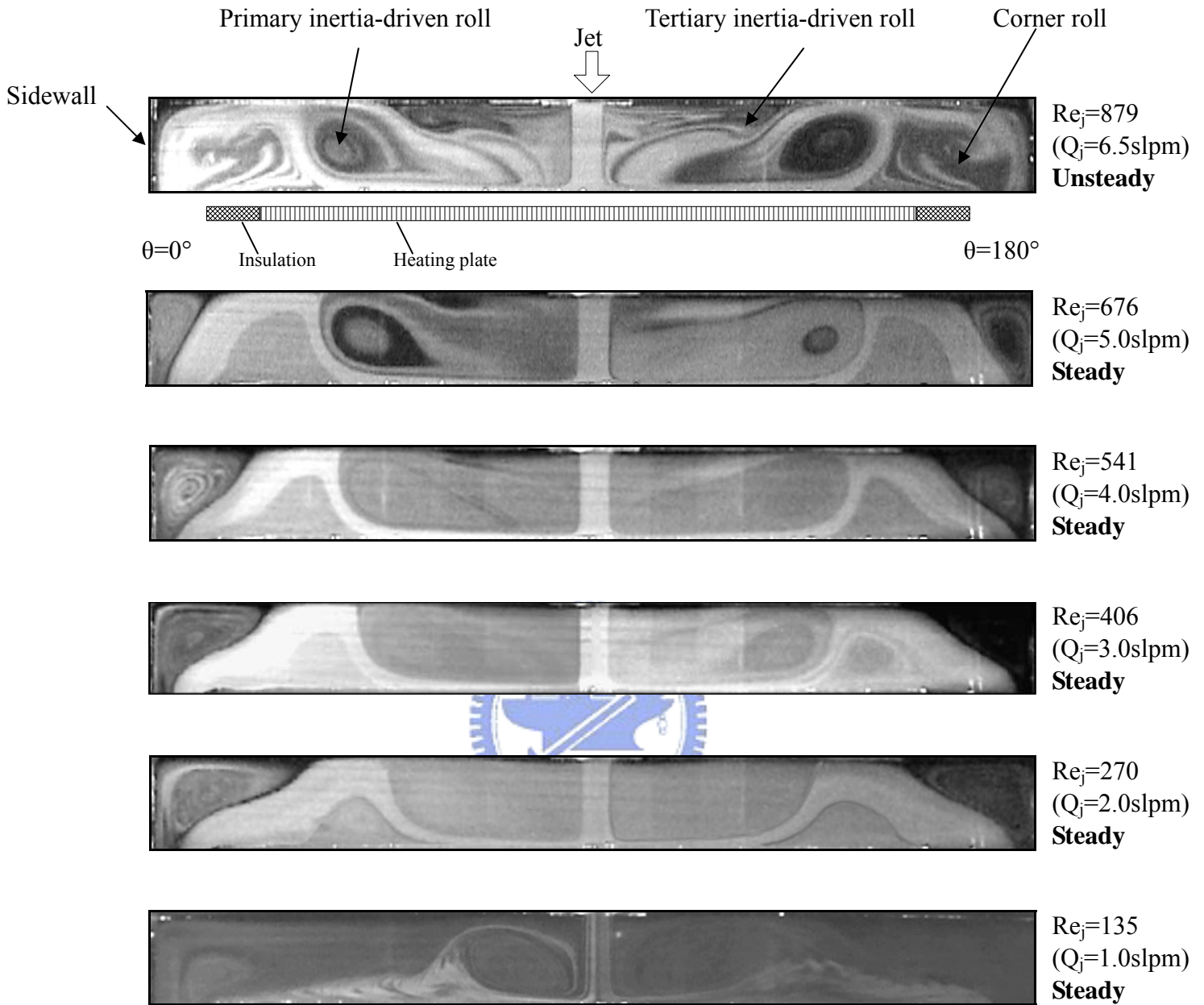


Fig. 4.42 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various jet Reynolds numbers at $Ra=0$ ($\Delta T=0^\circ\text{C}$) and $H = 30.0$ mm.

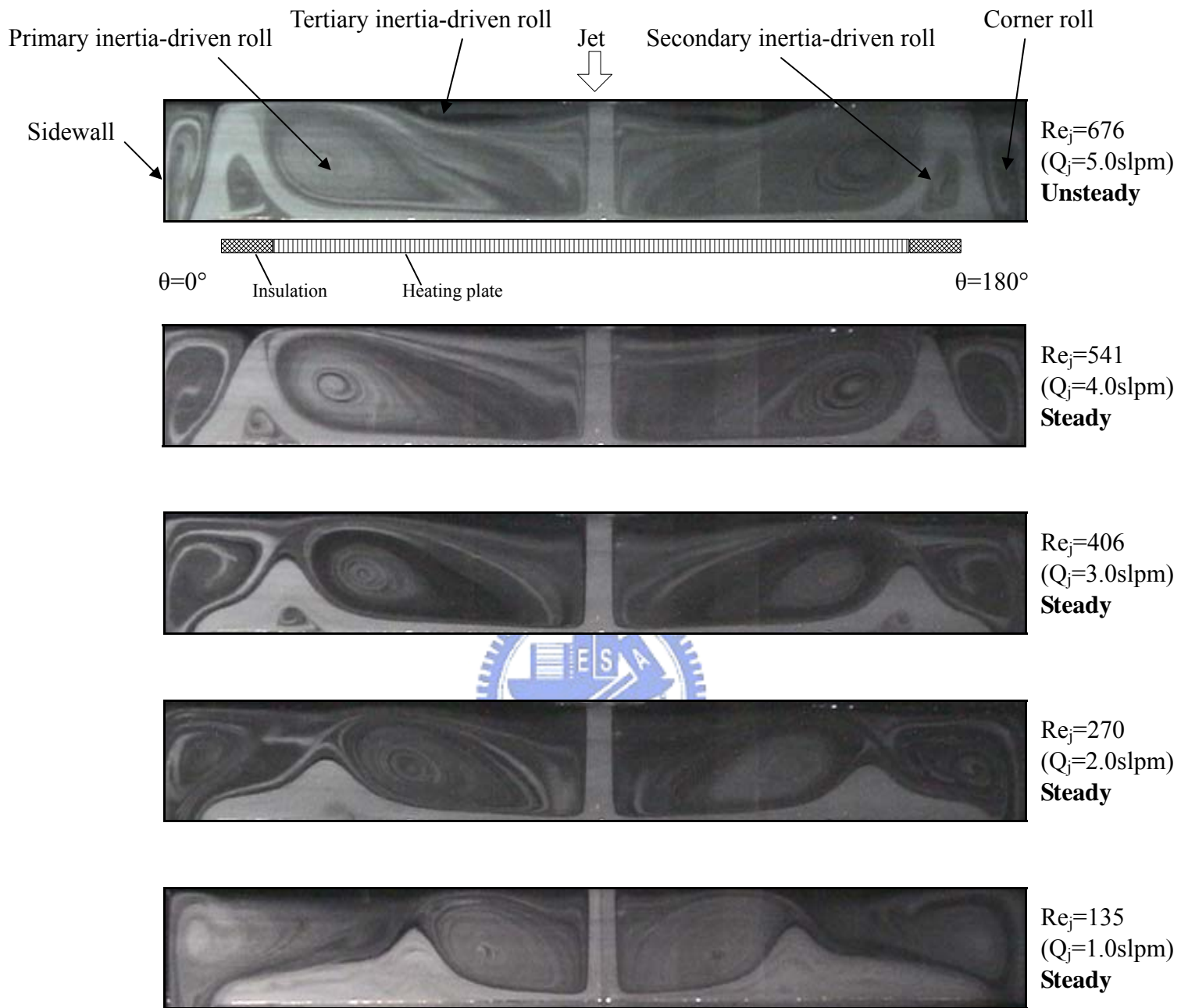


Fig. 4.43 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various jet Reynolds numbers at $Ra=0$ ($\Delta T=0^\circ\text{C}$) and $H = 40.0$ mm.

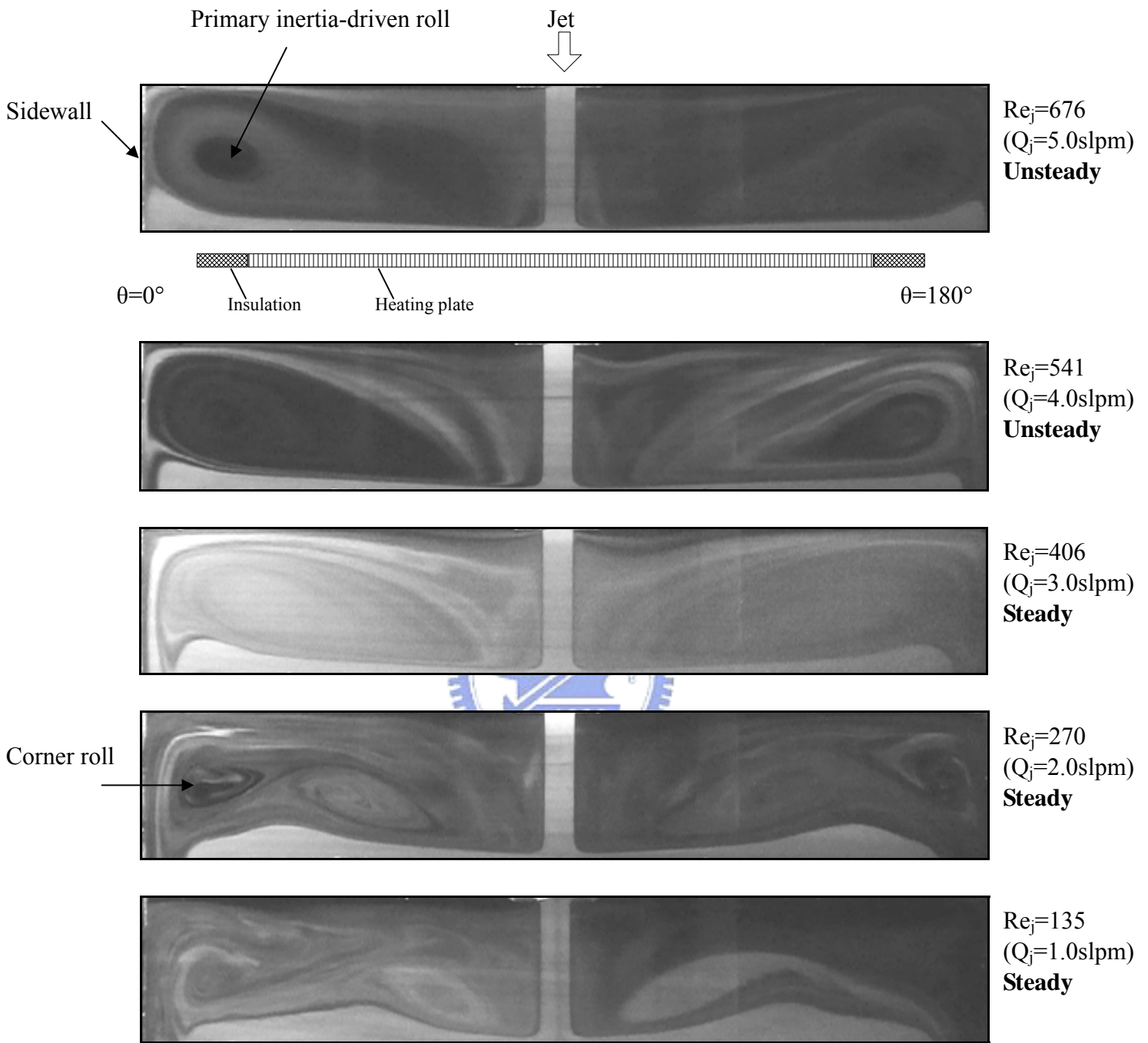


Fig. 4.44 Side view flow photos taken at the cross plane $\theta = 0^\circ$ & 180° for various jet Reynolds numbers at $Ra=0$ ($\Delta T=0^\circ\text{C}$) and $H = 50.0$ mm.

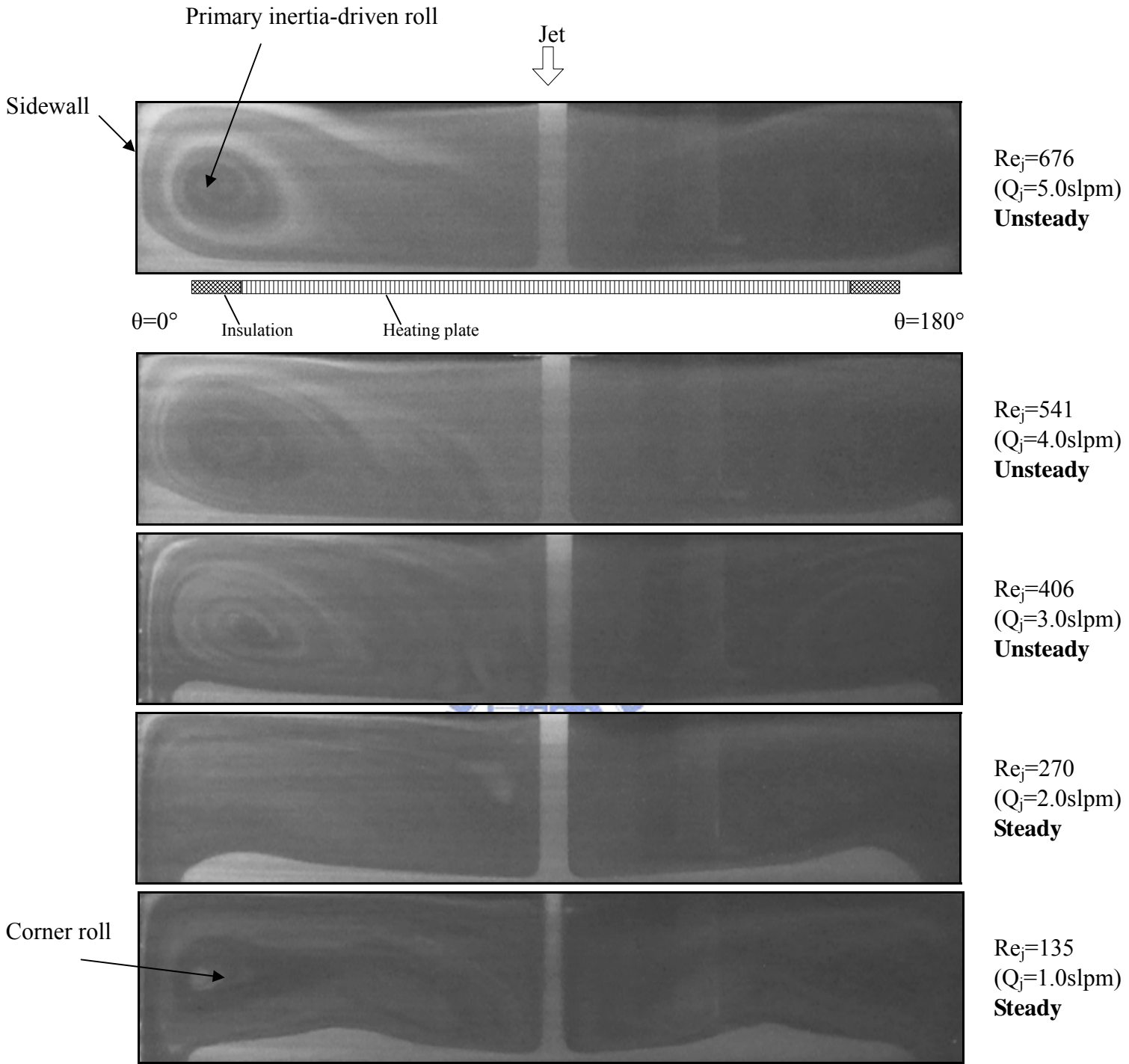


Fig. 4.45 Side view flow photos taken at the cross plane $\theta=0^\circ$ & 180° for various jet Reynolds numbers at $Ra=0$ ($\Delta T=0^\circ\text{C}$) for $H=60.0\text{ mm}$.