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| **TABLE 1—MODEL DATA PARAMETERS** |
| Parameter | Symbol | Value |
| Inlet-flow rate, gas (kg/s)  | *wG*,in | 0.0075\* |
| Inlet-flow rate, water (kg/s)  | *wL*,in | 1.644\* |
| Valve opening  | *z* | 0.12\*\* |
| Inlet pressure (barg)  | *P*1,*stasj* | 0.9\*\* |
| Topside pressure (barg)  | *P*2,*stasj* | 0.3\*\* |
| Separator pressure (barg)  | *P*0 | 0\* |
| Liquid level upstream low point (m)  | *h*1,*stasj* | 0.05\*\* |
| Upstream gas volume (m3)  | *VG*1 | 0.2654 |
| Feed-pipe inclination (rad)  | *θ* | 0.05 |
| Riser height (m)  | *H*2 | 10 |
| Length of horizontal top section (m)  | *L*3 | 0.1 |
| Pipe radius (m)  | *r* | 0.0381 |
| Exponent in friction expression  | *n* | 2.15 |
| Choke valve constant (m–2)  | *K*1 | 0.0042 |
| Internal gas-flow constant  | *K*2 | 1.83 |
| Friction parameter (s2/m2)  | *K*3 | 72.37 |

\* Nominal value

\*\* Value at bifurcation point (onset of severe slugging)

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| **TABLE 2—MEAN VALUES JUST BEFORE INSTABILITY USING DIFFERENT CASCADE CONTROLLERS\*** |
|  | Outer-Loop *z* | Outer-Loop *P*2 |
| Inner loop | *P*1 | *ρ* | *FQ*/*Cv* | *P*1 | *ρ* | *FQ*/*Cv* |
| *P*1 (barg)  | 0.71  | 0.68  | 0.68  | 0.72  | 0.72  | 0.67  |
| *P*2 (barg)  | 0.146  | 0.123  | 0.119  | 0.132  | 0.142  | 0.079  |
| *ρ* (kg/m3)  | 425  | 433  | 403  | 424  | 433  | 417  |
| *FQ*/Cv  | 1.18  | 0.98  | 1.18  | 1.28  | 1.094  | 0.997  |
| *z* (%)  | 20.9  | 19.5  | 22.8  | 23.8  | 19.3  | 23.9  |
| *FW* (kg/h)  | 7.24  | 7.55  | 7.6  | 7.54  | 7.60  | 7.55  |
| *FQ* (m3/h)  | 7.53  | 10.07  | 9.2  | 8.17  | 8.56  | 11.05  |
| Figure  | B-1a  | B-1b  | B-1c  | B-1d  | B-1e  | B-1f  |
| \* Based on data plotted in Figure B-1. |

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| **TABLE A-1—CONTROL LIMITATION DATA FOR VALVE OPENING OF 15%(UNSTABLE POLES AT *p* = 0.0062 ± 0.060*i)*** |
|  |  |  | Minimum Bounds |
| Measurement | Unstable (RHP) Zeros | Stationary gain|*G*(0)| | |*S*| | |*SG*| | |*KS*| | |*SGd*| | |*KSGd*| |
| *P*1 (bar)  | – | 22.9  | 1.00  | 0.00  | 0.16  | 0.00  | 0.042  |
| *P*2 (bar)  | 1.00, 0.09  | 20.5  | 1.21  | 15.6  | 0.017  | 0.054  | 0.040  |
| *ρ* (kg/m3)  | 0.051  | 33.1  | 1.22  | 33.4  | 0.011  | 1.02  | 0.042  |
| *FW* (kg/s)  | – | 0.00  | 1.00  | 0.00  | 0.006  | 0.00  | 0.042  |
| *FQ* (m3/s)  | – | 8.3  | 1.00  | 0.00  | 0.013  | 1.02  | 0.040  |

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| **TABLE A-2—CONTROL LIMITATION DATA FOR VALVE OPENING OF 20%(UNSTABLE POLES AT *p* = 0.019 ± 0.073*i)*** |
|  |  |  | Minimum Bounds |
| Measurement | Unstable (RHP) Zeros | Stationary Gain|*G*(0)| | |*S*| | |*SG*| | |*KS*| | |*SGd*| | |*KSGd*| |
| *P*1 (bar) | – | 10.1  | 1.00  | 0.00  | 0.082  | 0.00  | 0.090  |
| *P*2 (bar) | 1.08, 0.089  | 8.94  | 1.66  | 10.7  | 0.10  | 0.055  | 0.070  |
| *ρ* (kg/m3) | 0.050  | 2.87  | 1.60  | 19.6  | 0.048  | 1.27  | 0.080  |
| *FW* (kg/s) | – | 0.00  | 1.00  | 0.00  | 0.021  | 0.00  | 0.070  |
| *FQ* (m3/s) | – | 4.16  | 1.00  | 0.00  | 0.047  | 0.00  | 0.070  |