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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 |