

APPENDIX B

EXPERIMENTAL AND CFD RESULTS

Table B.1 Experimental and CFD results for R141b ejector.

Operating Condition		Ejector Geometries (based on data provided in Table 3.2)					Entrainment Ratio	
Primary Fluid Saturated Temperature (T_P), °C	Secondary Fluid Saturated Temperature (T_S), °C	Ejector downstream pressure (P_c), bar	Primary Nozzle No.	Mixing Chamber No.	Throat No.	NXP	Experiment	CFD
Case 1								
100	5	0.785	1	1	3	30	0.272	0.290
100	5	0.942	1	1	3	30	0.277	0.290
100	5	0.976	1	1	3	30	0.275	0.290
100	5	1.011	1	1	3	30	0.269	0.290
100	5	1.047	1	1	3	30	0.270	0.290
100	5	1.084	1	1	3	30	0.273	0.290
100	5	1.103	1	1	3	30	0.270	0.290
100	5	1.122	1	1	3	30	0.268*	0.290
100	5	1.142	1	1	3	30	0.200	0.290**
100	5	1.161	1	1	3	30	0.145	0.210
100	5	1.181	1	1	3	30	0.100	0.130
100	5	1.201	1	1	3	30	0.045	0
100	5	1.222	1	1	3	30	0	0
100	5	1.243	1	1	3	30	0	0
100	5	1.285	1	1	3	30	0	0
100	5	1.307	1	1	3	30	0	0
100	5	1.329	1	1	3	30	0	0
100	5	1.351	1	1	3	30	0	0
Case 2								
110	5	0.785	1	1	3	30	0.230	0.242
110	5	0.942	1	1	3	30	0.225	0.242
110	5	0.976	1	1	3	30	0.229	0.242
110	5	1.011	1	1	3	30	0.232	0.242
110	5	1.047	1	1	3	30	0.230	0.242
110	5	1.084	1	1	3	30	0.234	0.242
110	5	1.122	1	1	3	30	0.230	0.242
110	5	1.161	1	1	3	30	0.229	0.242
110	5	1.201	1	1	3	30	0.232	0.242
110	5	1.243	1	1	3	30	0.230	0.242
110	5	1.285	1	1	3	30	0.225	0.242
110	5	1.307	1	1	3	30	0.230*	0.242
110	5	1.329	1	1	3	30	0.200	0.242**
110	5	1.351	1	1	3	30	0.145	0.180
110	5	1.373	1	1	3	30	0.086	0.090
110	5	1.396	1	1	3	30	0.040	0
110	5	1.419	1	1	3	30	0	0

Table B.1 Experimental and CFD results for R141b ejector (continue).

Operating Condition (°C)		Ejector Geometries (based on data provided in Table 3.2)					Entrainment Ratio	
Primary Fluid Saturated Temperature (T _p), °C	Secondary Fluid Saturated Temperature (T _s), °C	Ejector downstream pressure (P _e), bar	Primary Nozzle No.	Mixing Chamber No.	Throat No.	NXP	Experiment	CFD
Case 3								
110	0	0.785	1	1	3	30	0.118	0.140
110	0	0.942	1	1	3	30	0.122	0.140
110	0	0.976	1	1	3	30	0.120	0.140
110	0	1.011	1	1	3	30	0.120	0.140
110	0	1.047	1	1	3	30	0.124	0.140
110	0	1.084	1	1	3	30	0.119	0.140
110	0	1.103	1	1	3	30	0.119*	0.140
110	0	1.122	1	1	3	30	0.072	0.140**
110	0	1.142	1	1	3	30	0.024	0.090
110	0	1.161	1	1	3	30	0	0
110	0	1.181	1	1	3	30	0	0
110	0	1.201	1	1	3	30	0	0
Case 4								
110	5	0.785	3	1	3	30	0.118	0.130
110	5	0.942	3	1	3	30	0.120	0.130
110	5	0.976	3	1	3	30	0.115	0.130
110	5	1.047	3	1	3	30	0.118	0.130
110	5	1.103	3	1	3	30	0.122	0.130
110	5	1.142	3	1	3	30	0.115	0.130
110	5	1.201	3	1	3	30	0.120	0.130
110	5	1.285	3	1	3	30	0.118	0.130
110	5	1.329	3	1	3	30	0.118	0.130
110	5	1.396	3	1	3	30	0.117	0.130
110	5	1.419	3	1	3	30	0.120	0.130
110	5	1.564	3	1	3	30	0.118	0.130
110	5	1.614	3	1	3	30	0.115*	0.130
110	5	1.64	3	1	3	30	0.060	0.130**
110	5	1.666	3	1	3	30	0	0
Case 5								
110	5	0.785	2	1	3	30	0.273	0.297
110	5	0.942	2	1	3	30	0.269	0.297
110	5	0.976	2	1	3	30	0.274	0.297
110	5	1.011	2	1	3	30	0.275	0.297
110	5	1.047	2	1	3	30	0.28	0.297
110	5	1.084	2	1	3	30	0.273	0.297
110	5	1.103	2	1	3	30	0.273*	0.297
110	5	1.122	2	1	3	30	0.194	0.297**
110	5	1.142	2	1	3	30	0.145	0.230
110	5	1.161	2	1	3	30	0.054	0.156
110	5	1.181	2	1	3	30	0	0.07
110	5	1.201	2	1	3	30	0	0

Table B.1 Experimental and CFD results for R141b ejector (continue).

Operating Condition (°C)			Ejector Geometries (based on data provided in Table 3.2)				Entrainment Ratio	
Primary Fluid Saturated Temperature (T_P), °C	Secondary Fluid Saturated Temperature (T_S), °C	Ejector downstream pressure (P_e), bar	Primary Nozzle No.	Mixing Chamber No.	Throat No.	NXP	Experiment	CFD
Case 6								
100	5	0.785	1	3	3	30	0.272	0.285
100	5	0.942	1	3	3	30	0.272	0.285
100	5	0.976	1	3	3	30	0.270	0.285
100	5	1.011	1	3	3	30	0.272	0.285
100	5	1.047	1	3	3	30	0.271	0.285
100	5	1.084	1	3	3	30	0.271	0.285
100	5	1.103	1	3	3	30	0.271*	0.285
100	5	1.122	1	3	3	30	0.221	0.285**
100	5	1.142	1	3	3	30	0.114	0.2
100	5	1.161	1	3	3	30	0	0
100	5	1.181	1	3	3	30	0	0
Case 7								
100	5	0.785	1	2	3	30	0.269	0.280
100	5	0.942	1	2	3	30	0.270	0.280
100	5	1.103	1	2	3	30	0.268	0.280
100	5	1.122	1	2	3	30	0.270*	0.280
100	5	1.142	1	2	3	30	0.12	0.280**
100	5	1.161	1	2	3	30	0	0.200
100	5	1.181	1	2	3	30	0	0
Case 8								
100	5	0.785	1	1	1	30	0.273	0.290
100	5	0.942	1	1	1	30	0.276	0.290
100	5	0.976	1	1	1	30	0.269	0.290
100	5	1.011	1	1	1	30	0.272	0.290
100	5	1.047	1	1	1	30	0.265	0.290
100	5	1.084	1	1	1	30	0.269*	0.290
100	5	1.103	1	1	1	30	0.220	0.290**
100	5	1.122	1	1	1	30	0.160	0.200
100	5	1.142	1	1	1	30	0.080	0.120
100	5	1.161	1	1	1	30	0.022	0.021
100	5	1.181	1	1	1	30	0	0
100	5	1.201	1	1	1	30	0	0
Case 9								
100	5	0.785	1	1	4	30	0.270	0.290
100	5	0.942	1	1	4	30	0.274	0.290
100	5	0.976	1	1	4	30	0.270	0.290
100	5	1.011	1	1	4	30	0.272	0.290
100	5	1.047	1	1	4	30	0.269	0.290
100	5	1.084	1	1	4	30	0.273	0.290
100	5	1.103	1	1	4	30	0.270	0.290
100	5	1.122	1	1	4	30	0.272	0.290
100	5	1.142	1	1	4	30	0.270*	0.290
100	5	1.161	1	1	4	30	0.200	0.290**
100	5	1.181	1	1	4	30	0.120	0.170
100	5	1.201	1	1	4	30	0	0

Table B.1 Experimental and CFD results for R141b ejector (continue).

Operating Condition (°C)		Ejector Geometries (based on data provided in Table 3.2)					Entrainment Ratio	
Primary Fluid Saturated Temperature (T_p), °C	Secondary Fluid Saturated Temperature (T_s), °C	Ejector downstream pressure (P_e), bar	Primary Nozzle No.	Mixing Chamber No.	Throat No.	NXP	Experiment	CFD
Case 10								
100	5	0.785	1	1	3	20	0.202	0.230
100	5	0.942	1	1	3	20	0.203*	0.230
100	5	0.976	1	1	3	20	0.160	0.230**
100	5	1.011	1	1	3	20	0.070	0
100	5	1.047	1	1	3	20	0	0
100	5	1.084	1	1	3	20	0	0
Case 11								
100	5	0.785	1	1	3	40	0.279	0.300
100	5	0.942	1	1	3	40	0.280	0.300
100	5	0.976	1	1	3	40	0.277	0.300
100	5	1.011	1	1	3	40	0.276	0.300
100	5	1.047	1	1	3	40	0.270	0.300
100	5	1.084	1	1	3	40	0.278	0.300
100	5	1.103	1	1	3	40	0.280	0.300
100	5	1.122	1	1	3	40	0.280	0.300
100	5	1.142	1	1	3	40	0.279	0.300
100	5	1.161	1	1	3	40	0.276	0.300
100	5	1.181	1	1	3	40	0.280	0.300
100	5	1.201	1	1	3	40	0.281	0.300
100	5	1.222	1	1	3	40	0.276	0.300**
100	5	1.243	1	1	3	40	0.282*	0.242
100	5	1.285	1	1	3	40	0	0
100	5	1.307	1	1	3	40	0	0

*Experiment's entrainment ratio at critical back pressure

**CFD's entrainment ratio at predicted critical back pressure

Table B.2 Comparison of ejector performance from experimental measurement and CFD prediction (at critical point).

Operating Condition (°C)		Ejector Geometries (based on data provided in Table 1)				Entrainment Ratio			Critical back pressure (bar)		
Primary Fluid Saturated Temperature (T _p)	Secondary Fluid Saturated Temperature (T _s)	Primary Nozzle No.	Mixing Chamber No.	Throat No.	NXP	Experiment	CFD	^a Error (%)	Experiment	CFD	^b Error (%)
Effect of Primary Fluid and Secondary Fluid Saturated Temperature (Saturated Vapour-Generator Temperature and Saturated Evaporator Temperature)											
100	5	1	1	3	30	0.272	0.290	6.618	1.122	1.142	1.783
110	5	1	1	3	30	0.229	0.242	5.677	1.307	1.329	1.683
110	0	1	1	3	30	0.120	0.140	16.667	1.103	1.122	1.723
Effect of Primary Nozzle Throat Diameter											
110	5	1	1	3	30	0.229	0.242	5.677	1.307	1.329	1.683
110	5	2	1	3	30	0.274	0.297	8.394	1.103	1.122	1.723
110	5	3	1	3	30	0.120	0.130	8.333	1.614	1.64	1.611
Effect of Mixing Chamber Inlet Diameter											
100	5	1	1	3	30	0.272	0.290	6.618	1.122	1.142	1.783
100	5	1	2	3	30	0.270	0.280	3.704	1.122	1.142	1.783
100	5	1	3	3	30	0.271	0.285	5.166	1.103	1.122	1.723
Effect of Throat Length											
100	5	1	1	1	30	0.271	0.290	7.011	1.084	1.103	1.753
100	5	1	1	3	30	0.272	0.290	6.618	1.122	1.142	1.783
100	5	1	1	4	30	0.269	0.290	7.807	1.142	1.161	1.664
Effect of Nozzle Exit position											
100	5	1	1	3	20	0.203	0.230	13.300	0.942	0.976	3.609
100	5	1	1	3	30	0.272	0.290	6.618	1.122	1.142	1.783
100	5	1	1	3	40	0.278	0.300	7.914	1.243	1.222	-1.689
Average								7.741			1.626

^aError (%) = 100 x (CFD's entrainment ratio - Experiment's entrainment ratio) / Experiment's entrainment ratio

^bError (%) = 100 x (CFD's critical back pressure - Experiment's critical back pressure) / Experiment's critical back pressure