

Hall D Liquid H2 Target FMECA

Process/Function	Requirement	Failure Mode	Effect	Severity	Cause	Occurrence probability	Control	Detection probability	RPN	Prevention	Corrected occurrence probability	Mitigation	Corrected Severity	Final RPN
Vacuum System	IV < 10 ⁻⁵ torr	Cell burst	Rapid OVC pressure rise possible OVC failure Potential damage to compressor cell overpressure	9	Cell overpressure poor maintenance	3	Target control system (TCS)	1	27	careful design, testing, maintenance finite cell lifetime est.		2 Relief of OVC through check to H2 vent Power trip compressor with OVC vac switch Proper size relief on target cell	6	12
		Breach of OVC	Rapid OVC pressure rise Potential damage to compressor cell overpressure	9	Human error	3	TCS	1	27	Procedures/training/ make OVC hard to access		2 Power trip compressor with OVC vac switch Proper size relief on target cell	7	14
			Slow OVC pressure rise cell overpressure	8	Human error	2	TCS	1	16	Procedures/training/ make OVC hard to access		2 Power trip compressor with OVC vac switch Proper size relief on target cell	2	4
		OVC failure	Rapid OVC pressure rise Potential damage to compressor cell overpressure	9	mechanical fail/design fail/ poor maintenance	1	TCS	1	9	careful design, testing, maintenance finite OVC window lifetime est.		1 Power trip compressor with OVC vac switch Proper size relief on target cell	6	6
		Pump failure	Slow OVC pressure rise cell overpressure	8	poor maintenance/mech fail electronic fail	4	TCS	1	32	Maintain pumps		3 Power trip compressor with OVC vac switch Proper size relief on target cell	2	6
		Power failure	Slow OVC pressure rise cell overpressure	8	storm/breaker fail/etc	6	TCS	1	48	None		6 Power trip compressor with OVC vac switch Proper size relief on target cell	2	12
H2 System	Cell pressure < 30 psia or cell overpressure	Rapid OVC pressure rise	Rapid pressure rise in cell cell burst	9	Breach of OVC by foreign object OVC failure Human error	3	TCS	1	27	Procedures/training/ make OVC hard to access		2 Redundant relief paths Proper size relief	2	4
		Blocked relief path	Rapid overpressure of cell during warm up or loss of IV; cell will burst	9	Human error/mech fail breach of H2 piping system sub atm operation contamination in system H2 freeze in condenser	3	TCS	4	108	Procedures/training/ Purification of system prior to ops positive (>16 psia) op pressure		2 Redundant relief paths	2	16
		Fill pressure high	over pressure of cell	9	Human error	5	TCS	1	45	Procedures/training/		2 Redundant relief paths	1	2
	Storage tank pressure < 50 psia	Prolonged exposure to fire	Overpressure of tank tank failure	10	human error/mech electric failure etc	4	TCS	1	40	Limit flammable material smoke and fire detection		1 Fire suppression	9	9
LCW	Supply cooling water at proper flow rate, pressure, and temperature	Low or no LCW flow	Possible compressor damage target warm up cell overpressure	9	human error	4	flow/pressure switch compressor ctr TCS	3	108	Procedures/training/design		4 Flow switch trips compressor power Proper size relief on target cell	2	24
				9	power failure	6	flow/pressure switch compressor ctr TCS	3	162	None		6 Flow switch trips compressor power Proper size relief on target cell	2	36
				9	system breach	2	flow/pressure switch compressor ctr TCS	3	54	procedures/training/design		2 Flow switch trips compressor power Proper size relief on target cell	2	12
Refrigerator	Cool and maintain target at 20K	failure of compressor	Slow target warm up cell overpressure	9	power fail	6	compressor ctr TCS	1	54	None		6 Proper size relief on target cell	2	12
				9	system breach	2	compressor ctr TCS	1	18	protected lines		2 Proper size relief on target cell	6	12
				9	mech fail	3	compressor ctr TCS	2	54	maintenance/training		2 Proper size relief on target cell	7	28
		failure of cold head	target warm up cell overpressure	9	power fail	6	compressor ctr TCS	1	54	None		6 Proper size relief on target cell	2	12
				9	system breach	2	compressor ctr TCS	1	18	protected lines		2 Proper size relief on target cell	6	12
				9	mech fail	3	compressor ctr TCS	2	54	maintenance/training		2 Proper size relief on target cell	7	28
		LCW failure	target warm up cell overpressure	9		6	flow/pressure switch	3	162	Procedures/training/design		6 Flow switch trips compressor power Proper size relief on target cell	2	36