

Table 1. Process Variables & Corresponding Alarm Thresholds

Tag	Description	Unit	Steady-State Value	Low-Alarm	High-Alarm	Low-Low Alarm	High-High Alarm
LIR100	Reactor catalyst level	lb	98,096.15	95,500.00 ^a	98,500.00 ^a	94,500.00 ^b	–
LIR120	Accumulator level	kmol	70.00	60.00 ^a	75.00 ^a	55.00 ^b	–
PIR110	Regenerator pressure	psig	28.00	27.50 ^a	29.20 ^b	–	29.70 ^a
PIR120	Fractionator overhead pressure	psig	24.90	24.60 ^a	26.00 ^a	–	–
TIR100	Preheater outlet temperature	°F	616.00	615.00 ^a	625.00 ^a	609.00 ^b	629.00 ^b
TIR101	Reactor riser temperature	°F	969.00	962.00 ^a	975.00 ^a	–	–
TIR110	Regenerator temperature	°F	1,250.00	1,242.00 ^a	1,256.00 ^a	–	–
TIR120	Fractionator overhead temperature	°F	245.93	242.33 ^a	253.13 ^a	–	–
TIR121	Fractionator HN 98% cut point	°F	530.30	523.13 ^a	541.13 ^a	520.00 ^b	542.00 ^b
TIR122	Fractionator LCO 98% cut point	°F	755.30	742.73 ^a	760.73 ^a	740.00 ^b	761.00 ^b
FIR100	Preheater fuel inlet flow	scf/min	1,990.00	1,791.00 ^c	2,189.00 ^c	–	–
FIR101	Preheater VGO inlet flow	lb/min	9,900.00	8,910.00 ^c	10,890.00 ^c	–	–
FIR110	Regenerator air inlet flow	lb/min	3,735.00	3,361.50 ^c	4,108.50 ^c	–	–
FIR111	Regenerator regenerated catalyst outlet flow	lb/min	49,580.00	44,622.00 ^c	54,538.00 ^c	–	–
FIR112	Regenerator spent catalyst inlet flow	lb/min	49,580.00	44,622.00 ^c	54,538.00 ^c	–	–
FIR113	Regenerator flue gas outlet flow	mol/min	160.80	144.72 ^c	176.88 ^c	–	–
FIR120	Fractionator reflux inlet flow	lb/min	2,945.00	2,650.50 ^c	3,239.50 ^c	–	–
FIR121	Fractionator LPG outlet flow	kmol/min	29.34	26.40 ^c	35.20 ^d	–	–
FIR122	Fractionator LN outlet flow	lb/min	4,023.00	3,218.40 ^d	4,425.30 ^c	–	–
FIR123	Fractionator HN outlet flow	lb/min	707.10	636.39 ^c	777.81 ^c	–	–
FIR124	Fractionator LCO outlet flow	lb/min	1,643.00	1,478.70 ^c	1,807.30 ^c	–	–
FIR125	Fractionator Slurry outlet flow	lb/min	214.00	192.60 ^c	235.40 ^c	–	–
IIR110	CAB amperage	A	277.70	249.93 ^c	305.47 ^c	–	–
IIR120	WGC amperage	A	198.70	178.83 ^c	238.44 ^d	–	–

^a Thresholds according to operating regions and equipment limitations from ?.

^b Thresholds according to operating regions and equipment limitations from ?.

^c Thresholds set at $\pm 10\%$ of the steady-state values, following ?.

^d Thresholds set at $\pm 20\%$ of the steady-state values, based on preliminary tests to minimize false alarms during normal operation.

Table 2. Parameter Ranges for Ambient & Operational Conditions & Disturbances

Description	Unit	Min	Max
Ambient & Operating Conditions			
Ambient Temperature	°F	68	96
Feed Quality	°API	18	25
Feed Temperature	°F	460.88	460.92
Condenser efficiency	%	68	96
Disturbances			
Cyclone Damage	%	130	200
Catalyst Deactivation	%	30	70
Preheater Increase	%	103	109
Preheater Shutdown	%	0	0
Valve V2 Low	%	35	40
Valve V2 High	%	50	55
Valve V3 Low	%	35	40
Valve V3 High	%	50	55
Valve V4 Low	%	30	35
Valve V4 High	%	55	60
Valve V6 Low	%	15	20
Valve V6 High	%	30	35
Valve V7 Low	%	45	50
Valve V7 High	%	60	65
Valve V8 Low	%	40	45
Valve V8 High	%	55	60