

Project: Gas Production Unit	
SIL verification of Safety Instrumented Functions - Gas Production Unit	

Sample Report

Gas Production Unit

SIL verification report

1	01/02/2019	Second review for client comments	AHT	FG	JB
0	17/10/2017	First review	AHT	AHT	JB
Rev.	Date	Description	Prepared	Reviewed	Approved

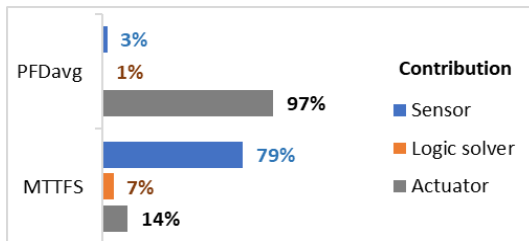
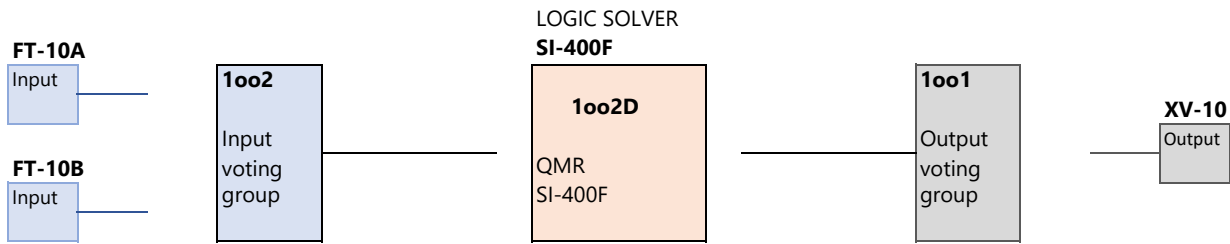
Project: Gas Production Unit	Rev.1 by JB dated February 1, 2019
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SIF: Unit 1 - PL-10

Required		Achieved	Achieved		Achieved		
SIL-1	10	SIL	PFDavg	SIL-1	sensor	PFDavg	MTTFS (years)
		SIL-1			SIL-1	4,25E-04	43
		RRF			SIL-3	7,65E-05	520
		PFDavg			actuator	1,39E-02	238
		1,44E-02					
		MTTFS (y)					
		34					

High High Air Flow on FT-10 (voting 1oo2) closes gas feed valve (Voting 1oo1). Total Designed Loop Response Time = 3 sec.

Life Time (LT) = 15 years
MTTRdd= 12 hours



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SIF: Unit 1 - PL-10

Subsystem	Tags	Logic	PFDavg	SIL (pfd)	HFT	SFF	SIL (arch)	MTTFS (y)
sensor	FT-10	1oo2	4,25E-04	3	1	82%	2	43
logicsolver	SI-400F	1oo2D	7,65E-05	4	1	95%	3	520
actuator	XV-10	1oo1	1,39E-02	1	0	50%	1	238

Subsystem	Tags	Logic	Cpt	TI (y)	LT (y)	Beta	MTRdd	MTTRs
sensor	FT-10	1oo2	90%	3,0	15	5%	12	24
logicsolver	SI-400F	1oo2D	90%	3,0	15	2%	12	24
actuator	XV-10	1oo1	70%	3,0	15	2%	12	24

Subsystem	Tags	Logic	SD	SU	DD	DU	Type	SC
sensor	FT-10	1oo2	700	670	550	420	B	1
logicsolver	SI-400F	1oo2D	912	100	912	100	B	3
actuator	XV-10	1oo1	0	480	0	480	A	3

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SIF: Unit 1 - PL-11

Subsystem	Tags	Logic	PFDavg	SIL (pfd)	HFT	SFF	SIL (arch)	MTTFS (y)
sensor	PT-11	2oo3	2,37E-04	3	1	98%	3	389
logicsolver	SI-400F	1oo2D	3,63E-05	4	1	98%	3	994
actuator	XV-11	1oo2	1,69E-03	2	1	50%	2	125
actuator	XV-R-11	1oo2	5,53E-06	4	1	99%	4	84

Subsystem	Tags	Logic	Cpt	TI (y)	LT (y)	Beta	MTRdd	MTTRs
sensor	PT-11	2oo3	90%	3,0	15	5%	12	24
logicsolver	SI-400F	1oo2D	90%	3,0	15	2%	12	24
actuator	XV-11	1oo2	60%	2,0	15	10%	12	24
actuator	XV-R-11	1oo2	90%	3,0	15	5%	12	24

Subsystem	Tags	Logic	SD	SU	DD	DU	Type	SC
sensor	PT-11	2oo3	3040	160	3040	160	B	3
logicsolver	SI-400F	1oo2D	912	48	912	48	B	3
actuator	XV-11	1oo2	0	480	0	480	A	3
actuator	(relay) XV-R-11	1oo2		700		6	A	3

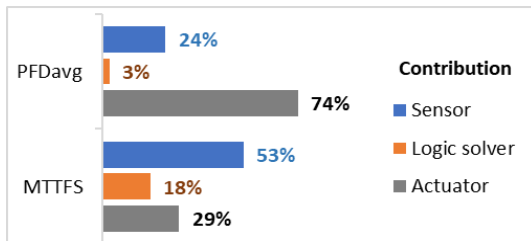
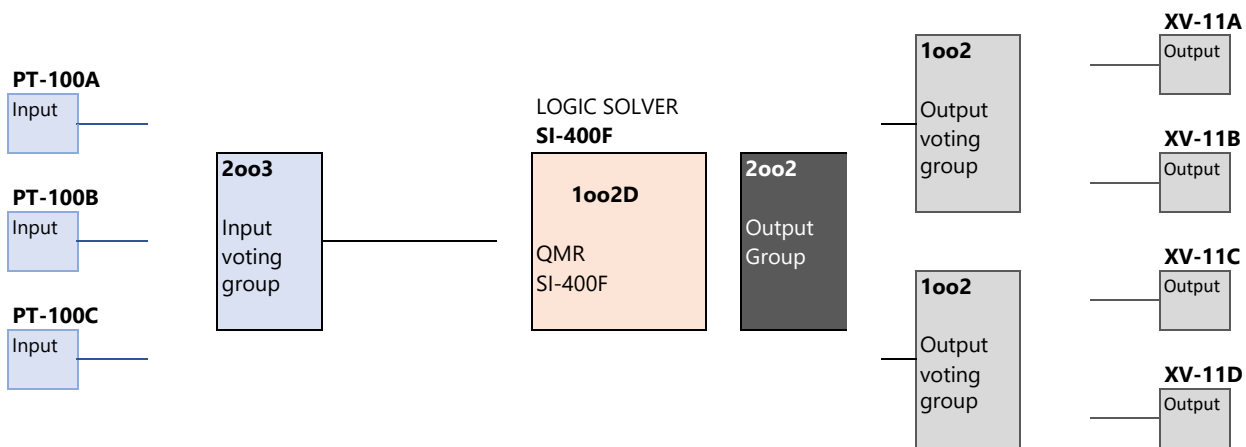
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SIF: Unit 1 - WH-100

Required		Achieved		Achieved		Achieved				
SIL-2	100	SIL	RRF	PFDavg	Arch. C.	SC	sensor	logic solver	actuator	
SIL-2	100	SIL-2	RRF	PFDavg	SIL-2	SC	SIL-2	SIL-2	SIL-3	SIL-3
		SIL-2	739	1,35E-03				3,22E-04	3,63E-05	9,95E-04
			MTTFS (y)	180				340	994	624

High High Pressure on PT-100 (voting 2oo3; Isolator per AI) closes gas feed valve (Voting 2oo2 of 2 x 1oo2; Safety Relay per DO). Total Designed Loop Response Time = 4 sec

Life Time (LT) = 15 years
MTTRdd= 12 hours



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SIF: Unit 1 - WH-100

Subsystem	Tags	Logic	PFDavg	SIL (pfd)	HFT	SFF	SIL (arch)	MTTFS (y)
sensor	PT-100	2oo3	2,37E-04	3	1	98%	3	389
sensor	PT-ISO-100 (isolator)	2oo3	8,50E-05	4	1	86%	2	2.736
logicsolver	SI-400F	1oo2D	3,63E-05	4	1	98%	3	994
actuator	XV-11	1oo2R	9,90E-04	3	1	60%	3	1.436
actuator	XV-R-11	1oo2R	5,53E-06	4	1	99%	4	1.103

Subsystem	Tags	Logic	Cpt	TI (y)	LT (y)	Beta	MTRdd	MTTRs
sensor	PT-100	2oo3	90%	3,0	15	5%	12	24
sensor	PT-ISO-100 (isolator)	2oo3	90%	3,0	15	5%	12	24
logicsolver	SI-400F	1oo2D	90%	3,0	15	2%	12	24
actuator	XV-11	1oo2R	70%	1,0	15	10%	12	24
actuator	XV-R-11	1oo2R	90%	3,0	15	5%	12	24

Subsystem	Tags	Logic	SD	SU	DD	DU	Type	SC
sensor	PT-100	2oo3	3040	160	3040	160	B	3
sensor	PT-ISO-100 (isolator)	2oo3		370		60	B	
logicsolver	SI-400F	1oo2D	912	48	912	48	B	3
actuator	XV-11	1oo2R	80	400	100	380	A	3
actuator	XV-R-11	1oo2R		700		6	A	3

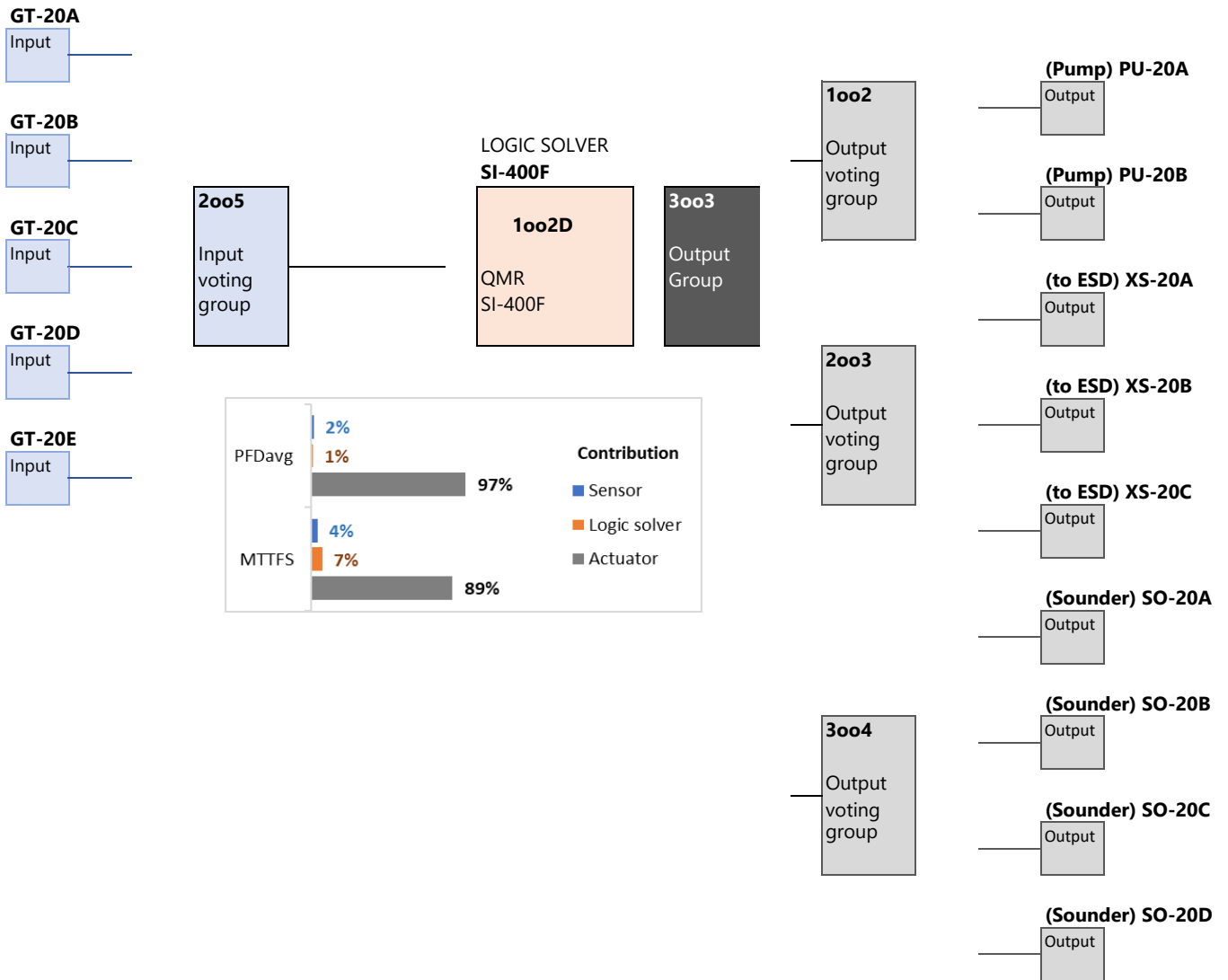
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SIF: Unit 1- FG-20

Required	Achieved	Achieved	Achieved	PFDavg	MTTFS (years)			
SIL-1	SIL	SIL-1	PFDavg	SIL-2	sensor	SIL-3	5,89E-05	1784
10	RRF	308	Arch. C.	SIL-1	logic solver	SIL-3	3,63E-05	994
	PFDavg	3,25E-03	SC	SIL-3	actuator	SIL-1	3,15E-03	81
	MTTFS (y)	72						

Gas Detection on GT-20 (voting 2oo5) starts Pump System (voting 1oo2), send signal to ESD to stop building ventilation (voting 2oo3) and activate Sounders (voting 3oo4). See details on next page.

Life Time (LT) = 15 years
MTRRdd= 12 hours



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SIF: Unit 1- FG-20

Subsystem	Tags	Logic	PFDavg	SIL (pfd)	HFT	SFF	SIL (arch)	MTTFS (y)
sensor	GT-20	2oo5	5,89E-05	4	2	98%	4	1.784
logicsolver	SI-400F	1oo2D	3,63E-05	4	1	98%	3	994
actuator	see next pages	3oo3	3,15E-03	2	0	64%	1	81

Subsystem	Tags	Logic	Cpt	TI (y)	LT (y)	Beta	MTRdd	MTRs
sensor	GT-20	2oo5	90%	3,0	15	5%	12	24
logicsolver	SI-400F	1oo2D	90%	3,0	15	2%	12	24
actuator	see next pages	3oo3						

Subsystem	Tags	Logic	SD	SU	DD	DU	Type	SC
sensor	GT-20	2oo5	3040	160	3040	160	B	3
logicsolver	SI-400F	1oo2D	912	48	912	48	B	3
actuator	see next pages	3oo3					B	

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SIF tag: Unit 1 - FG-20 (Actuator)

Subsystem: actuator			
Group 1	1oo2	(Pump) PU-20	
Group 2	2oo3	(to ESD) XS-20	
Group 3	3oo4	(Sounder) SO-20	
Group 4			
Group 5			
	Logic	PFDavg	MTTFS
Combined	3oo3	3,15E-03	81

Actuator Subsystem of SIF "Unit 1 - FG-20" (combined group 3oo3): Pump System (voting 1oo2), send signal to ESD to stop building ventilation (voting 2oo3) and activate Sounders (voting 3oo4).

Achieved : SIL-2

Subsystem	Tags	Logic	PFDavg	MTTFS (y)	TI (y)	LT (y)
actuator	(Pump) PU-20	1oo2	2,44E-03	86	1	15
actuator	(to ESD) XS-20	2oo3	1,90E-06	2.239	1	15
actuator	(Sounder) SO-20	3oo4	7,10E-04	3.785	1	15
Combined		3oo3	3,15E-03	81	1	15

Subsystem	Tags	Logic	Cpt	Beta	MTTRdd	MTTRs
actuator	(Pump) PU-20	1oo2	60%	10%	12	24
actuator	(to ESD) XS-20	2oo3	90%	2%	12	24
actuator	(Sounder) SO-20	3oo4	60%	5%	12	24
Combined		3oo3				

Subsystem	Tags	Logic	SD	SU	DD	DU
actuator	(Pump) PU-20	1oo2	0	700	0	700
actuator	(to ESD) XS-20	2oo3	0	700	0	6
actuator	(Sounder) SO-20	3oo4	0	200	0	200
Combined		3oo3				