Interlock & Logic Diagram

Action performed in the IS are called IS-group (Interlock Safety) and actions performed in the DCS are called I-group (Interlock).

Due to a considerable higher cost of IS than DCS hardware, consideration has been given to define which actions (groups) are to be performed in the IS system and which actions are to be performed in the DCS. In order to establish guidelines for the distinction of those actions, the following rules are applied:

Trips in IS groups are generally based on 2-out-of-3 voting.

IS-groups must protect:

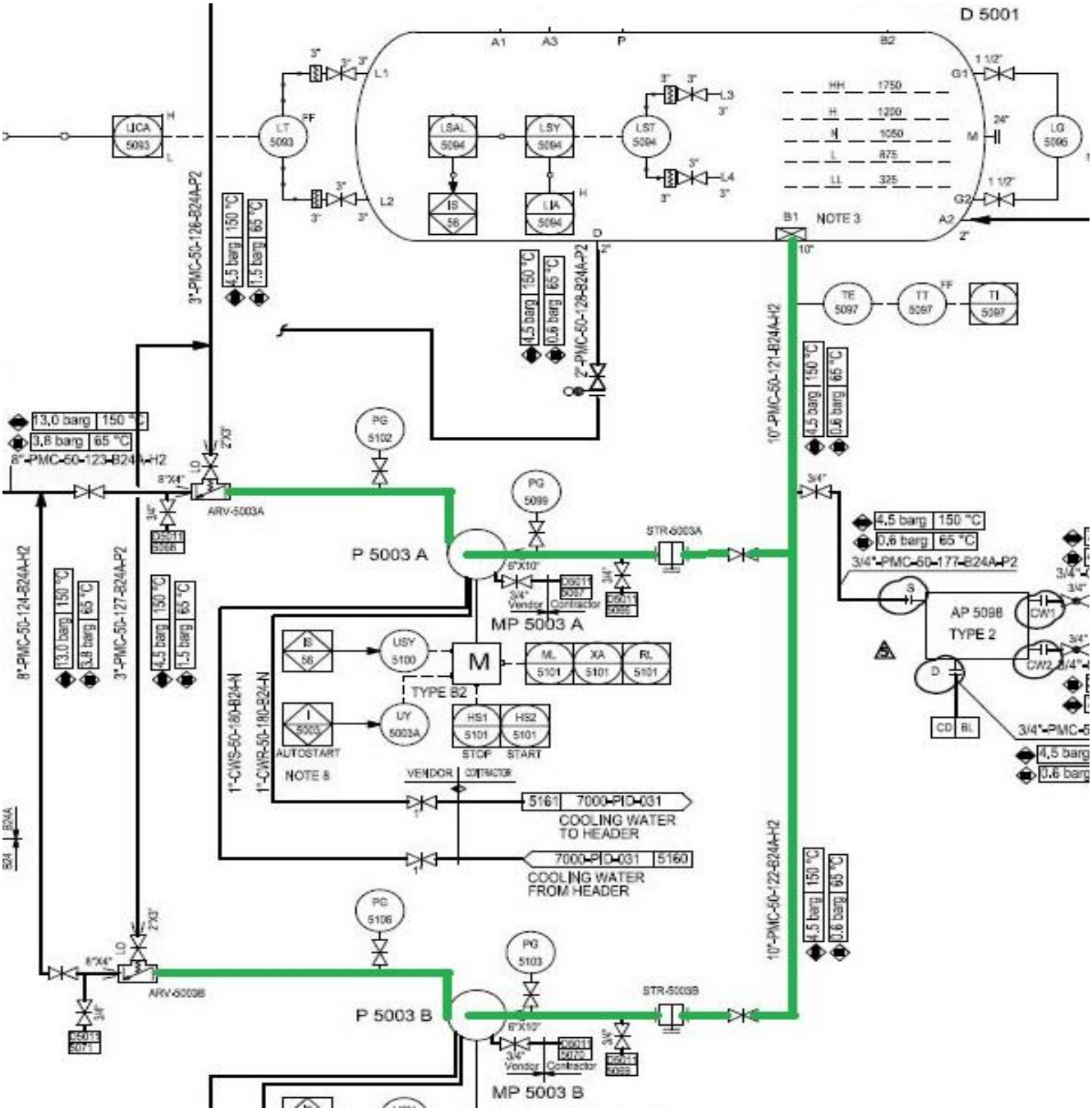
- personnel against safety hazards
- critical plant equipment
- unit trips which will result in a significant production loss when initiated

I-groups must protect:

- auto start and stop of motors
- avoidance of PSV relief
- switching of operating mode

Pumps

1.Typical pump



IS-56: Trip of stabilizer column reflux pumps, P 5003 A/B

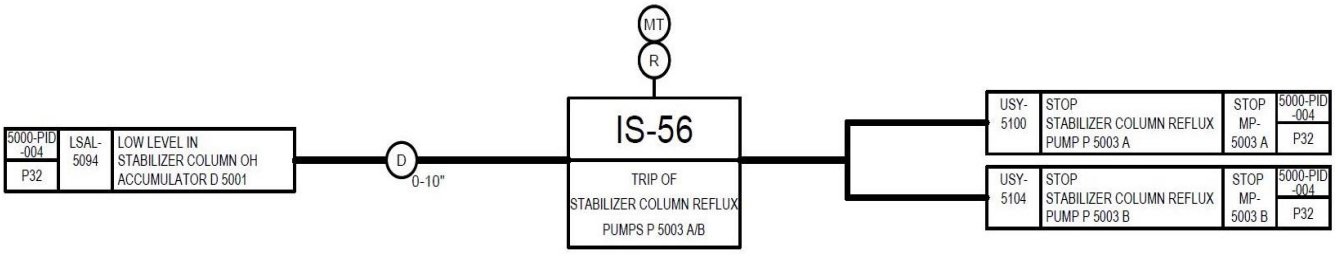
The causes for IS-56 trip are:

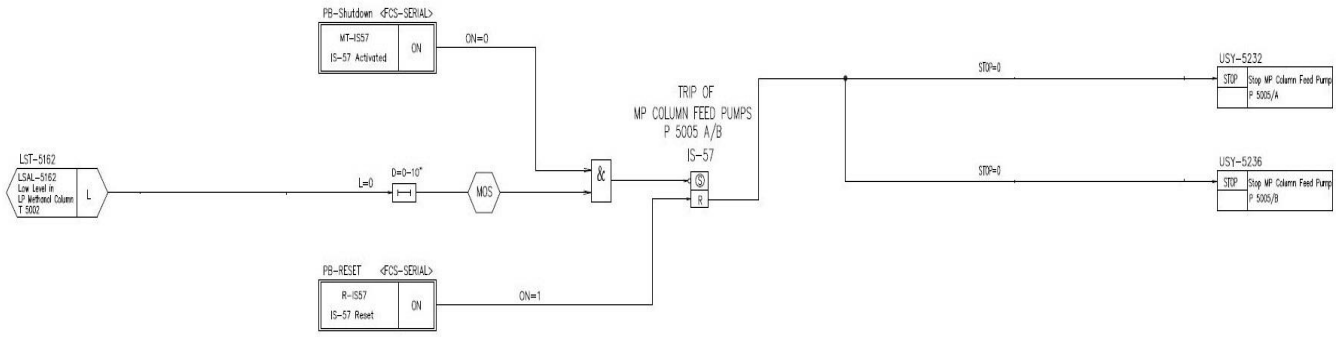
- Manual panel trip
- Low level in stabilizer column OH accumulator D 5001, LSAL-5094

The following actions are carried out automatically:

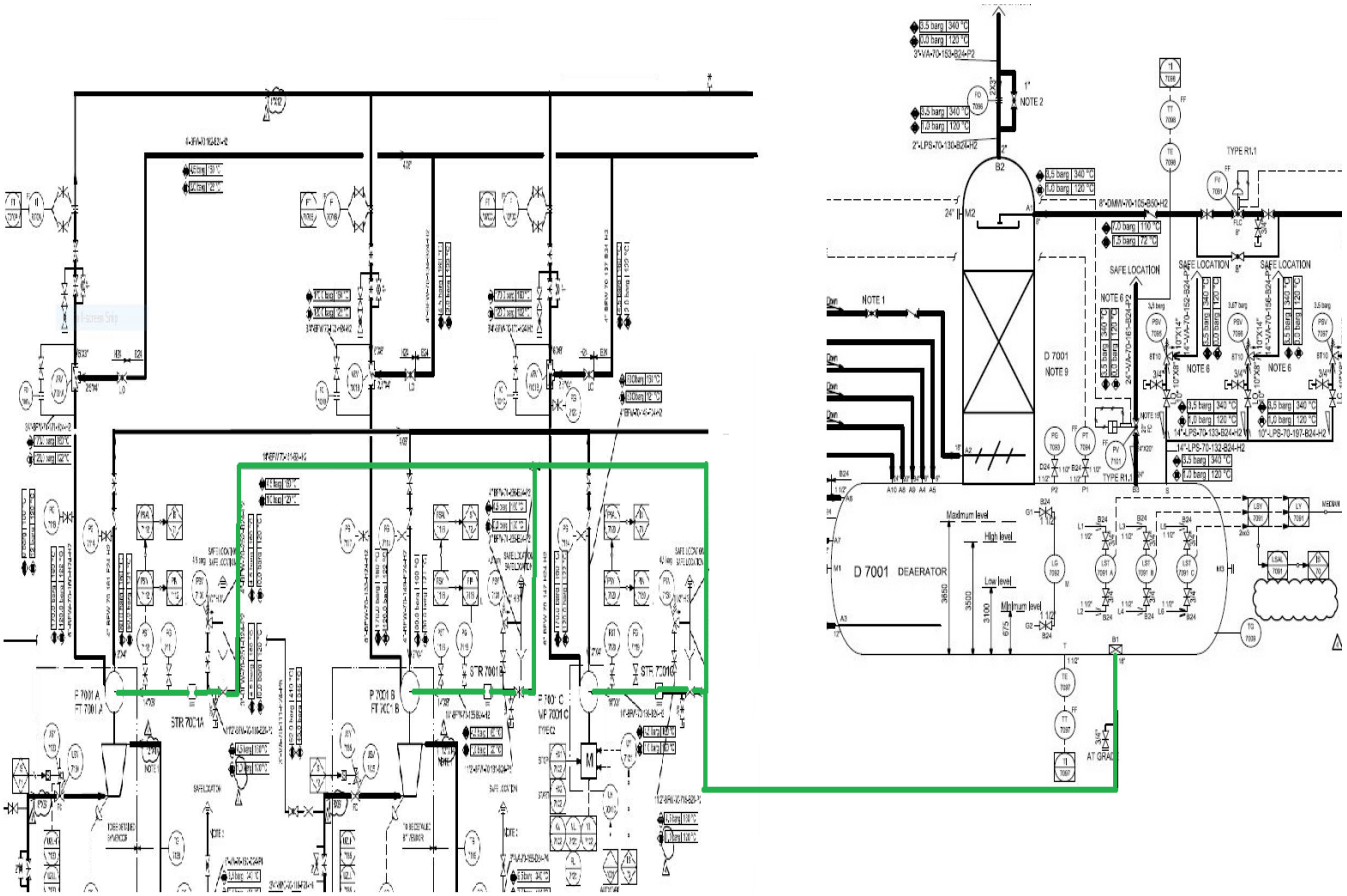
- Stop stabilizer column reflux pump P 5003 A, stop MP-5003 A
- Stop stabilizer column reflux pump P 5003 B, stop MP-5003 B

Interlock Diagram





2. BFW pump



IS-70: Trip of BFW pumps, P 7001 A/B/C

The causes for trip are:

- Manual panel trip
- Low level in deaerator D 7001, LSAL-7091

The following actions are carried out automatically:

- Stop BFW pump P 7001 A, IS-71
- Stop BFW pump P 7001 B, IS-72
- Stop BFW pump P 7001 C, IS-73

IS-71: Trip of HP BFW pump, P 7001 A

The causes for trip are:

- Manual panel trip
- Trip of BFW pumps P 7001 A/B/C, IS-70
- Low suction pressure of BFW pump P 7001 A, PSAL-7112

The following actions are carried out automatically:

- Stop steam to turbine FP 7001 A, close USV-7130

IS-72: Trip of HP BFW pump, P 7001 B

The causes for trip are:

- Manual panel trip
- Trip of BFW pumps P 7001 A/B/C, IS-70
- Low suction pressure of BFW pump P 7001 B, PSAL-7116

The following actions are carried out automatically:

- Stop steam to turbine FP 7001 B, close USV-7135

IS-73: Trip of HP BFW pump, P 7001 C

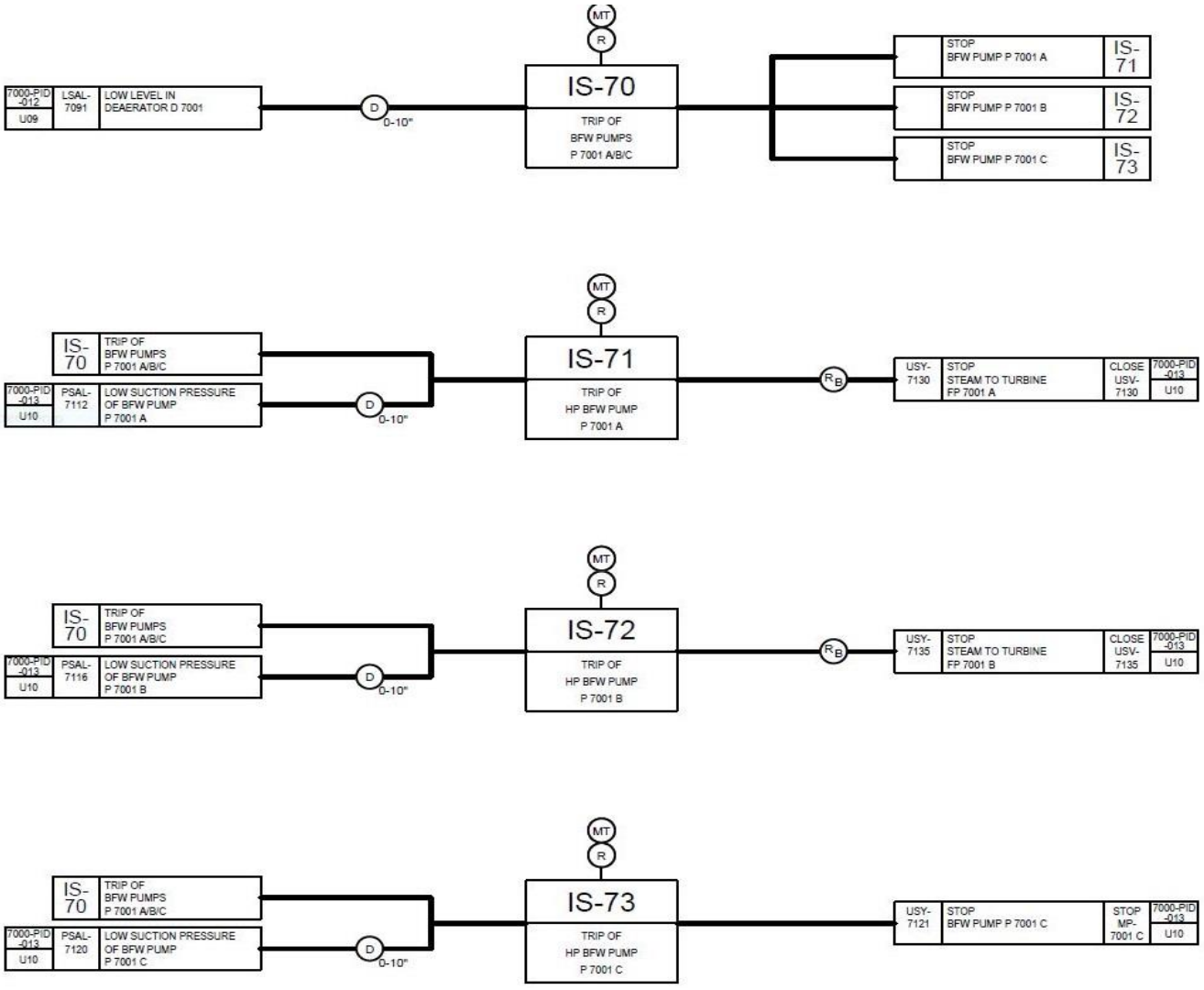
The causes for trip are:

- Manual panel trip
- Trip of BFW pumps P 7001 A/B/C, IS-70
- Low suction pressure of BFW pump P 7001 C, PSAL-7120

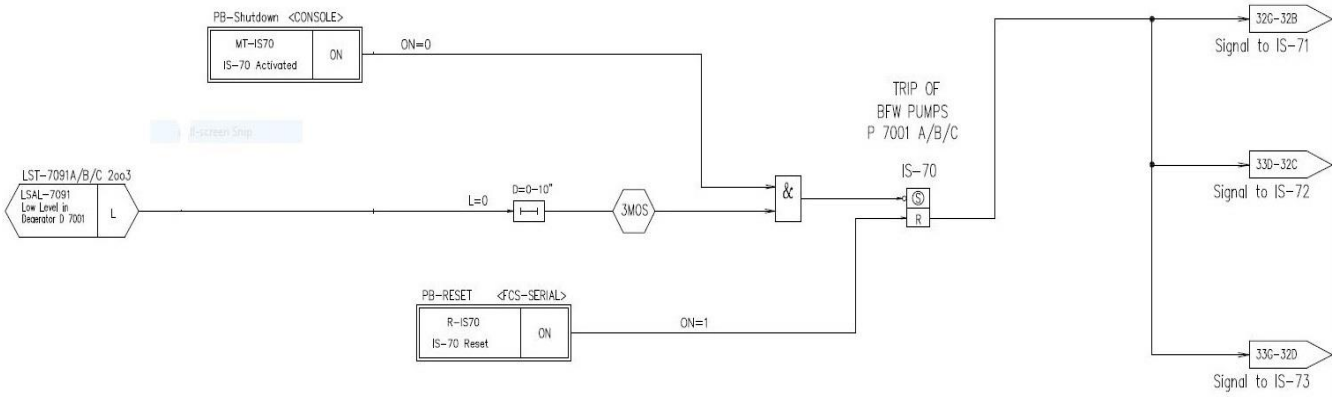
The following actions are carried out automatically:

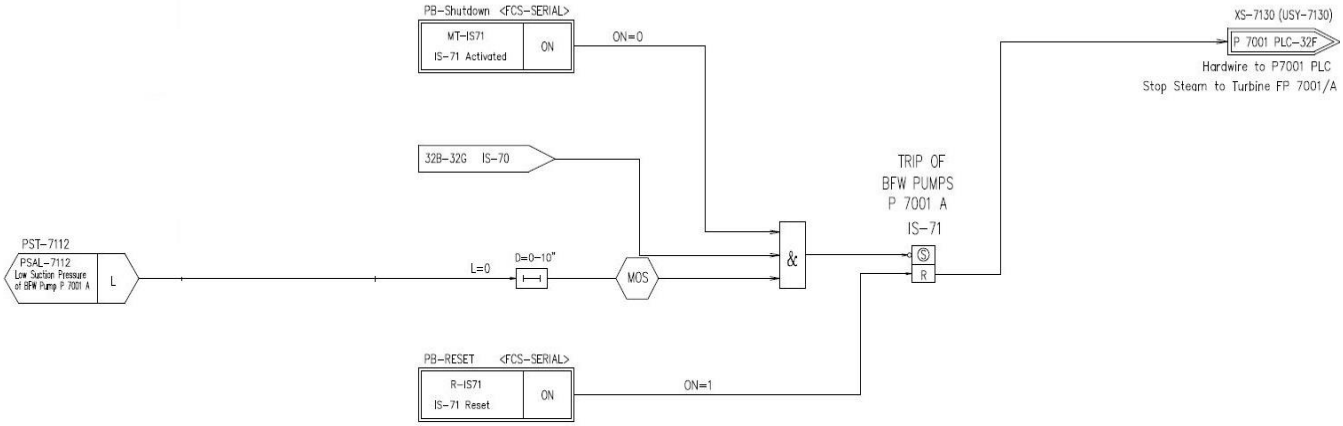
- Stop BFW pump P 7001 C, stop MP-7001C

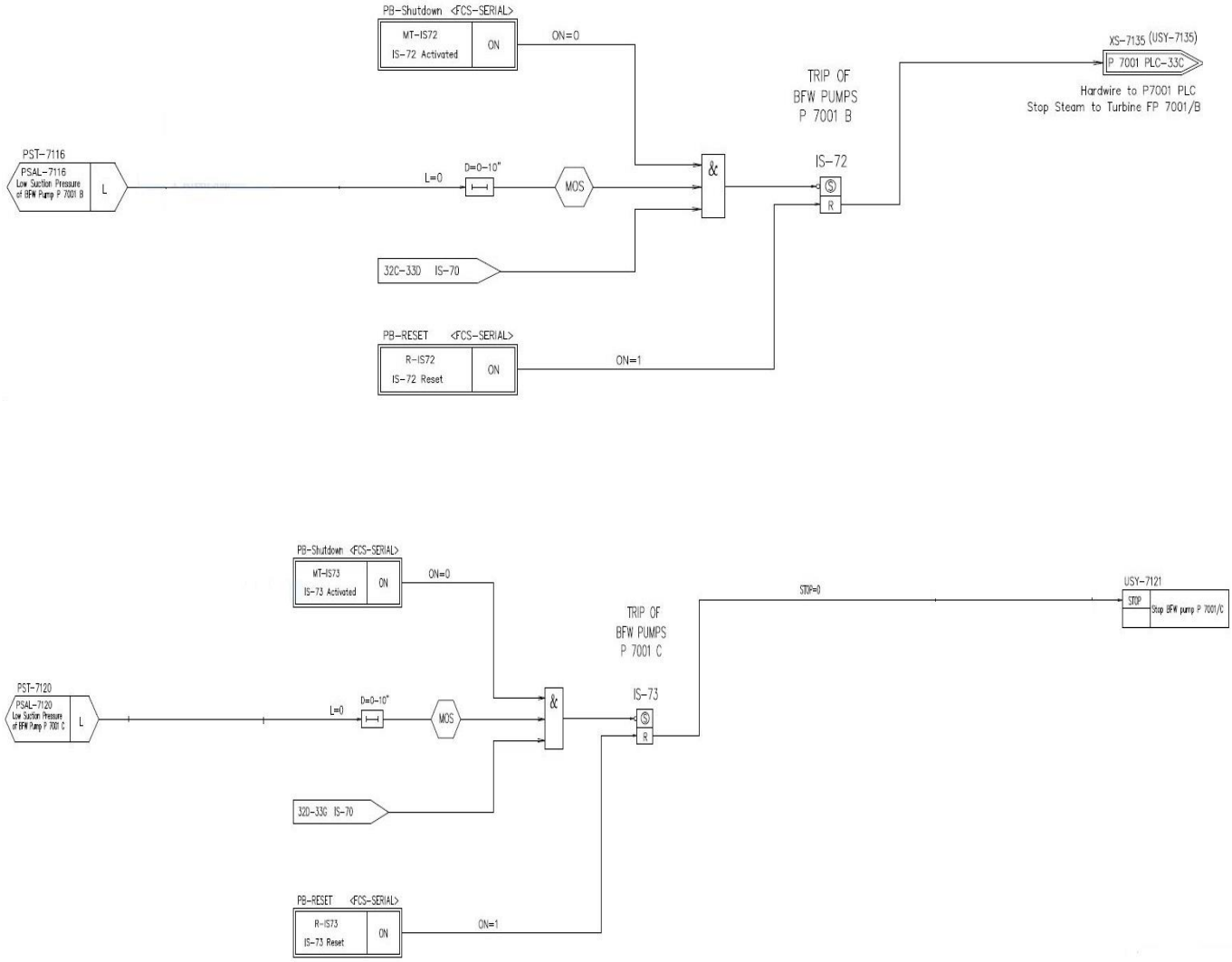
Interlock Diagram



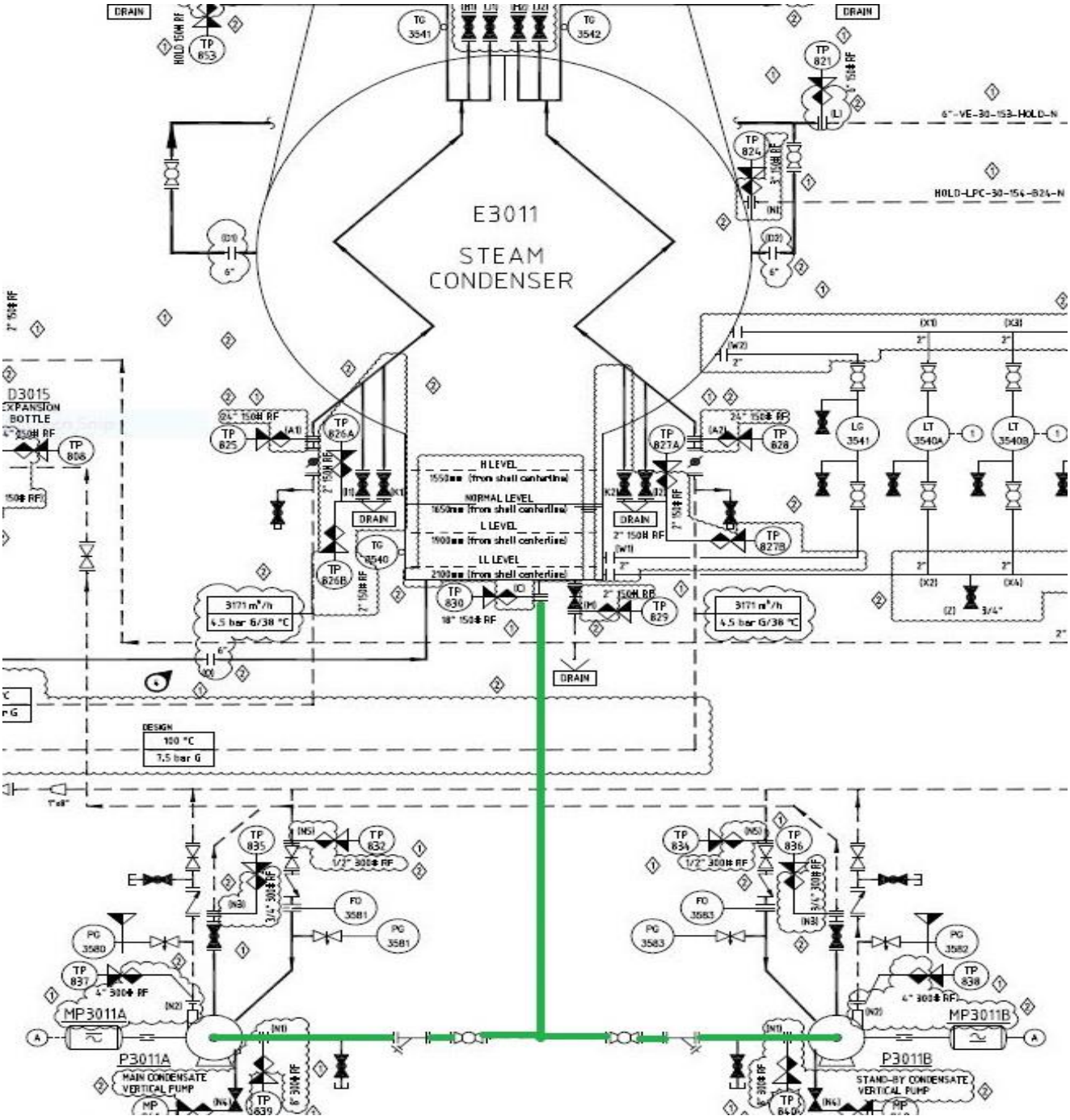
Logic Diagram






PB-Shutdown <FCS-SERIAL>
MT-IS72
IS-72 Activated
ON
ON=0
XS-7135 (USY-7135)
P 7001 PLC-33C
Hardwire to P7001 PLC
Stop Steam to Turbine FP 7001/B
TRIP OF
BFW PUMPS
P 7001 B
PST-7116
PSAL-7116
Low Suction Pressure
of BFW Pump P 7001 B
L
L=0
D=0-10"
MOS
&
IS-72
S
R
32C-33D IS-70
PB-RESET <FCS-SERIAL>
R-IS72
IS-72 Reset
ON
ON=1
PB-Shutdown <FCS-SERIAL>
MT-IS73
IS-73 Activated
ON
ON=0
STOP=0
USY-7121
STOP
Stop BFW pump P 7001/C
TRIP OF
BFW PUMPS
P 7001 C
PST-7120
PSAL-7120
Low Suction Pressure
of BFW Pump P 7001 C
L
L=0
D=0-10"
MOS
&
IS-73
S
R
32D-33G IS-70
PB-RESET <FCS-SERIAL>
R-IS73
IS-73 Reset
ON
ON=1

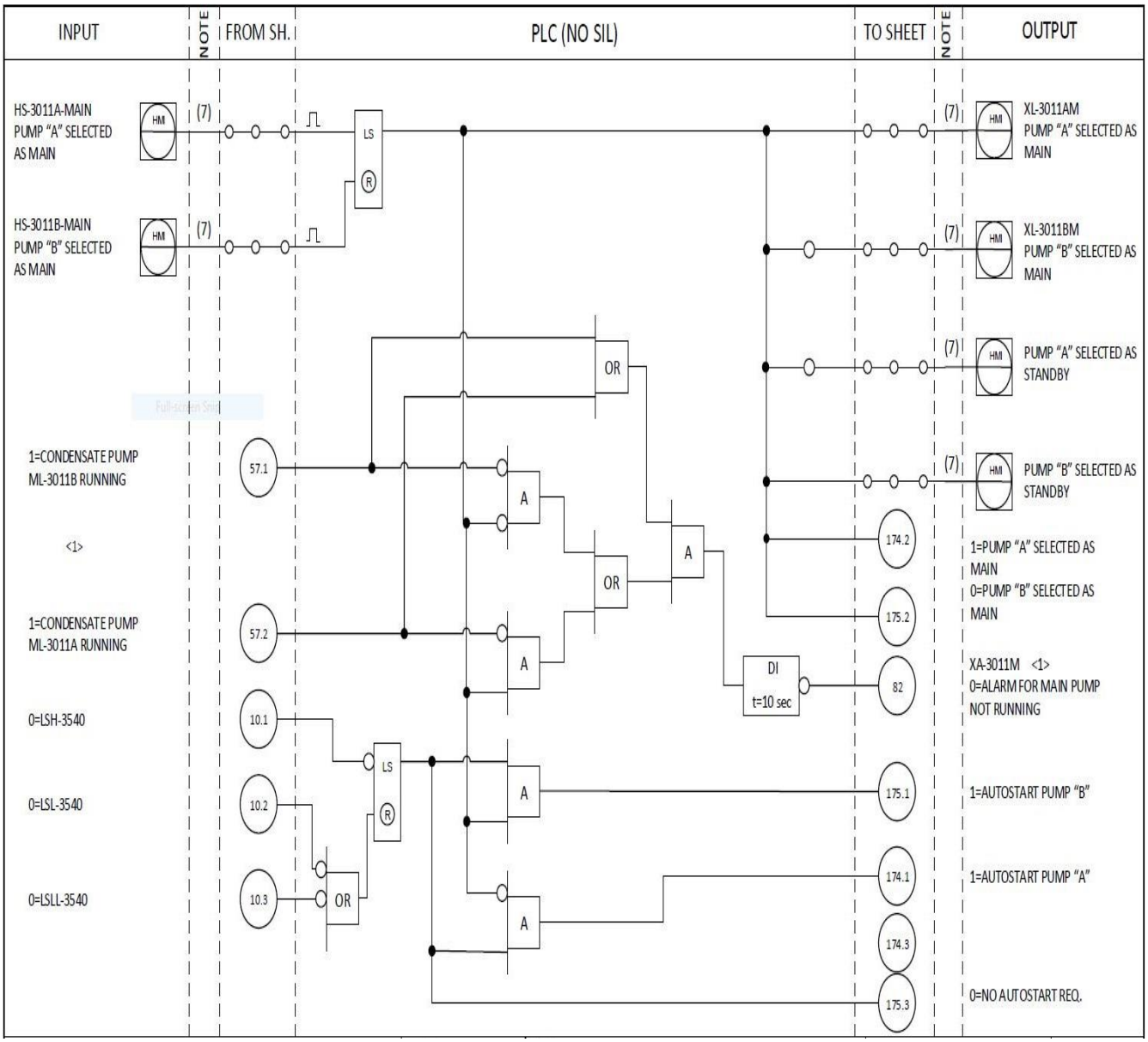
3. Steam condensate pump

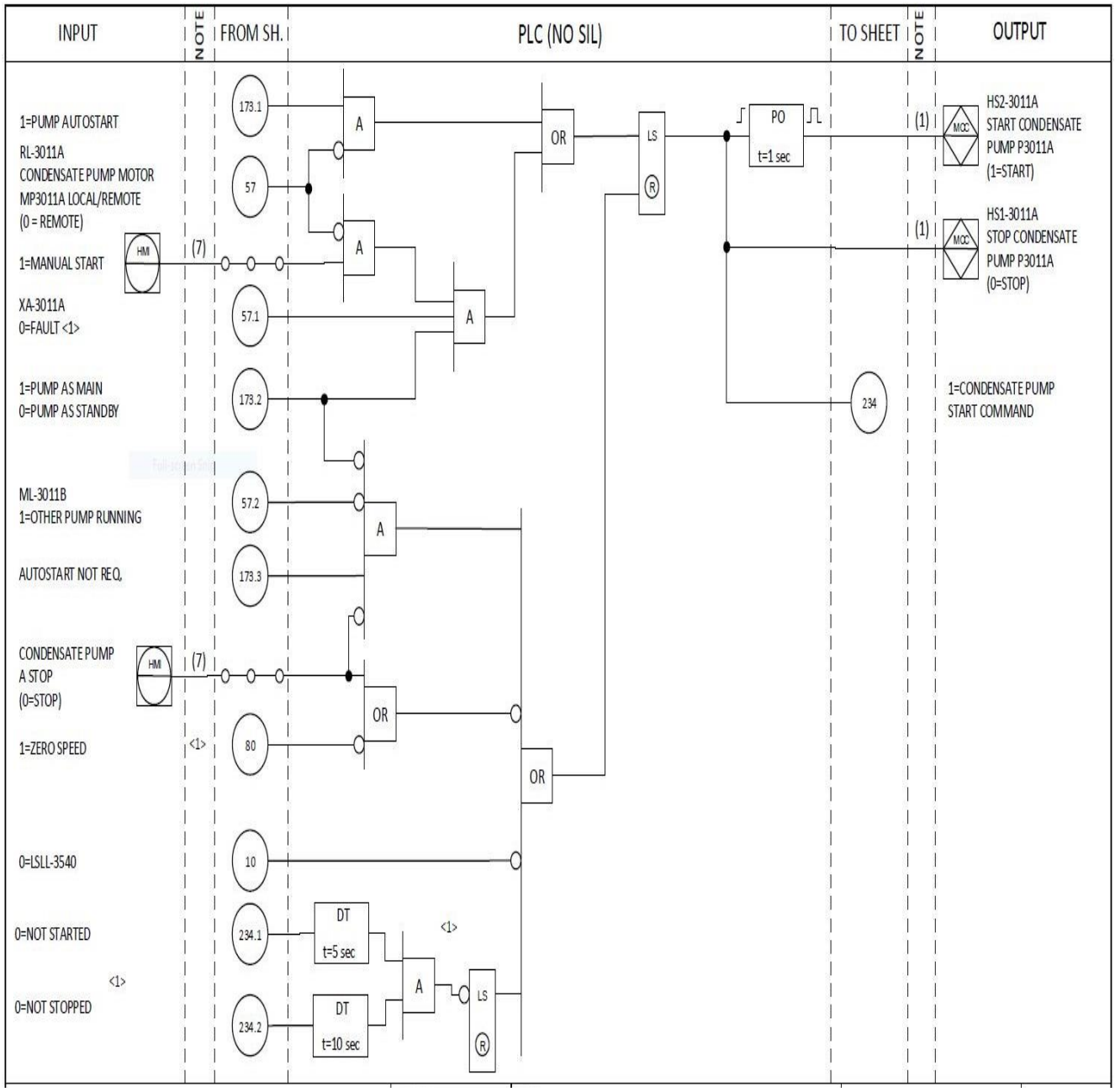


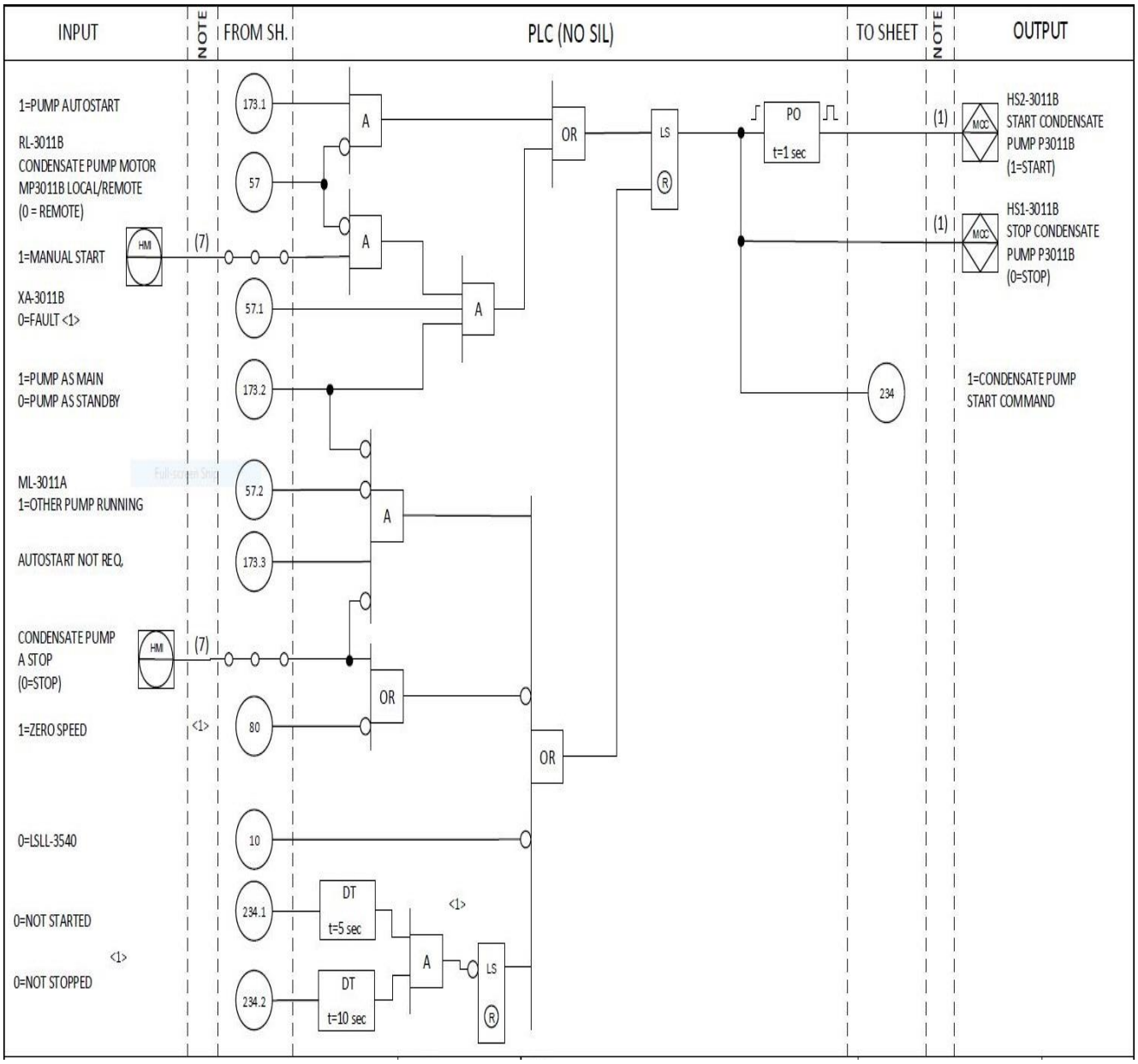
Saturated steam from the outlet of the steam turbine is recovered in the condenser and maintained by means of a split range controller (**LIC-3540**) that operates the condensate discharge valve (**LCV-3540A**) and the condensate recycle valve (**LCV-3540B**) to maintain the liquid level constant in order to avoid eventual air to backflow inside the condenser causing high pressure.

Two level thresholds on the condenser level transmitters (**LSH-3540** and **LSL-3540)** start and stop the stand- by condensate pump if necessary, while another threshold of minimum level (**LSLL-3540**) stops both the pumps.

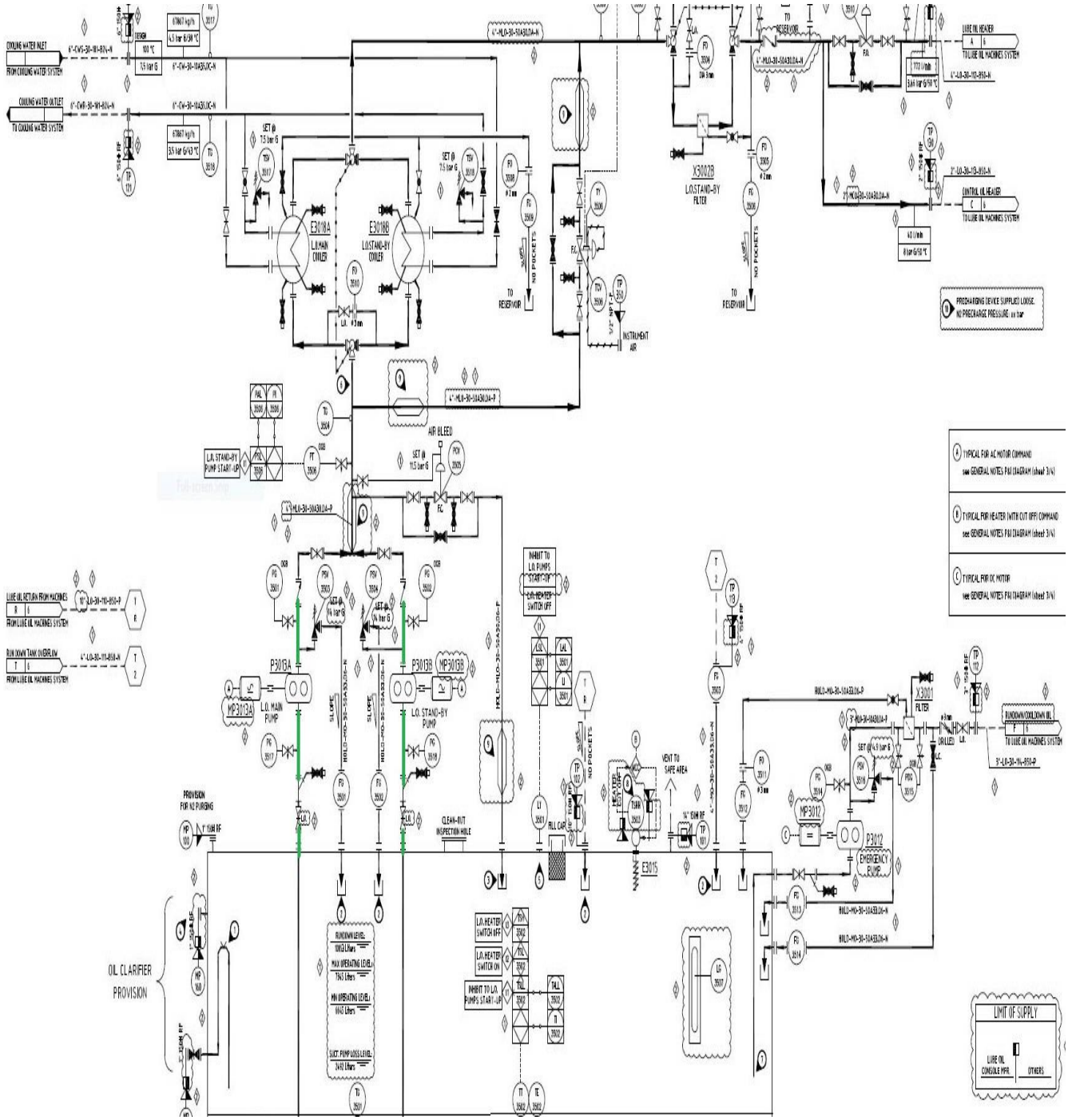
Instrumentation for protection in case of high high exhaust pressure (**PSHH-3547**) is provided on condenser steam inlet.


INPUT
NOTE
FROM SH.
PLC (NO SIL)
TO SHEET
NOTE
OUTPUT
HS-3011A-MAIN PUMP "A" SELECTED AS MAIN
HS-3011B-MAIN PUMP "B" SELECTED AS MAIN
HM
(7)
LS
R
XL-3011AM PUMP "A" SELECTED AS MAIN
XL-3011BM PUMP "B" SELECTED AS MAIN
PUMP "A" SELECTED AS STANDBY
PUMP "B" SELECTED AS STANDBY
OR
A
1=CONDENSATE PUMP ML-3011B RUNNING
<1>
1=CONDENSATE PUMP ML-3011A RUNNING
0=LSH-3540
0=LSL-3540
0=LSLL-3540
57.1
57.2
10.1
10.2
10.3
DI
t=10 sec
82
174.2
175.2
175.1
174.1
174.3
175.3
1=PUMP "A" SELECTED AS MAIN
0=PUMP "B" SELECTED AS MAIN
XA-3011M <1>
0=ALARM FOR MAIN PUMP NOT RUNNING
1=AUTOSTART PUMP "B"
1=AUTOSTART PUMP "A"
0=NO AUTOSTART REQ.


INPUT
NOTE
FROM SH.
PLC (NO SIL)
TO SHEET
NOTE
OUTPUT
1=PUMP AUTOSTART
RL-3011A
CONDENSATE PUMP MOTOR
MP3011A LOCAL/REMOTE
(0 = REMOTE)
1=MANUAL START
XA-3011A
0=FAULT <1>
1=PUMP AS MAIN
0=PUMP AS STANDBY
ML-3011B
1=OTHER PUMP RUNNING
AUTOSTART NOT REQ.
CONDENSATE PUMP
A STOP
(0=STOP)
1=ZERO SPEED
0=LSLL-3540
0=NOT STARTED
<1>
0=NOT STOPPED
HMI
(7)
173.1
57
57.1
173.2
57.2
173.3
80
10
234.1
234.2
A
OR
LS
R
PO
t=1 sec
DT
t=5 sec
t=10 sec
234
(1)
MCC
HS2-3011A
START CONDENSATE
PUMP P3011A
(1=START)
HS1-3011A
STOP CONDENSATE
PUMP P3011A
(0=STOP)
1=CONDENSATE PUMP
START COMMAND


INPUT
NOTE
FROM SH.
PLC (NO SIL)
TO SHEET
NOTE
OUTPUT
1=PUMP AUTOSTART
RL-3011B
CONDENSATE PUMP MOTOR
MP3011B LOCAL/REMOTE
(0 = REMOTE)
1=MANUAL START
XA-3011B
0=FAULT <1>
1=PUMP AS MAIN
0=PUMP AS STANDBY
ML-3011A
1=OTHER PUMP RUNNING
AUTOSTART NOT REQ.
CONDENSATE PUMP
A STOP
(0=STOP)
1=ZERO SPEED
0=LSLL-3540
0=NOT STARTED
<1>
0=NOT STOPPED
HMI
(7)
173.1
57
57.1
173.2
57.2
173.3
80
10
234.1
234.2
A
OR
LS
R
PO
t=1 sec
DT
t=5 sec
DT
t=10 sec
234
(1)
MCC
HS2-3011B
START CONDENSATE
PUMP P3011B
(1=START)
HS1-3011B
STOP CONDENSATE
PUMP P3011B
(0=STOP)
1=CONDENSATE PUMP
START COMMAND

4. Lube oil pump



Lube oil system

Lube oil is used to create lift by forming a film of oil between the shaft and bearing and to cool the bearings to keep them at an optimum temperature as power is dissipated in the bearings, causing them to heat up.

The oil is drawn from a lube oil reservoir (**TK3002**), equipped with an electric heater (**E3015**) to give the oil the right viscosity for start-up, and sent to the system by two pumps (**P3013A** and **P3013B**), one main and the other stand-by.

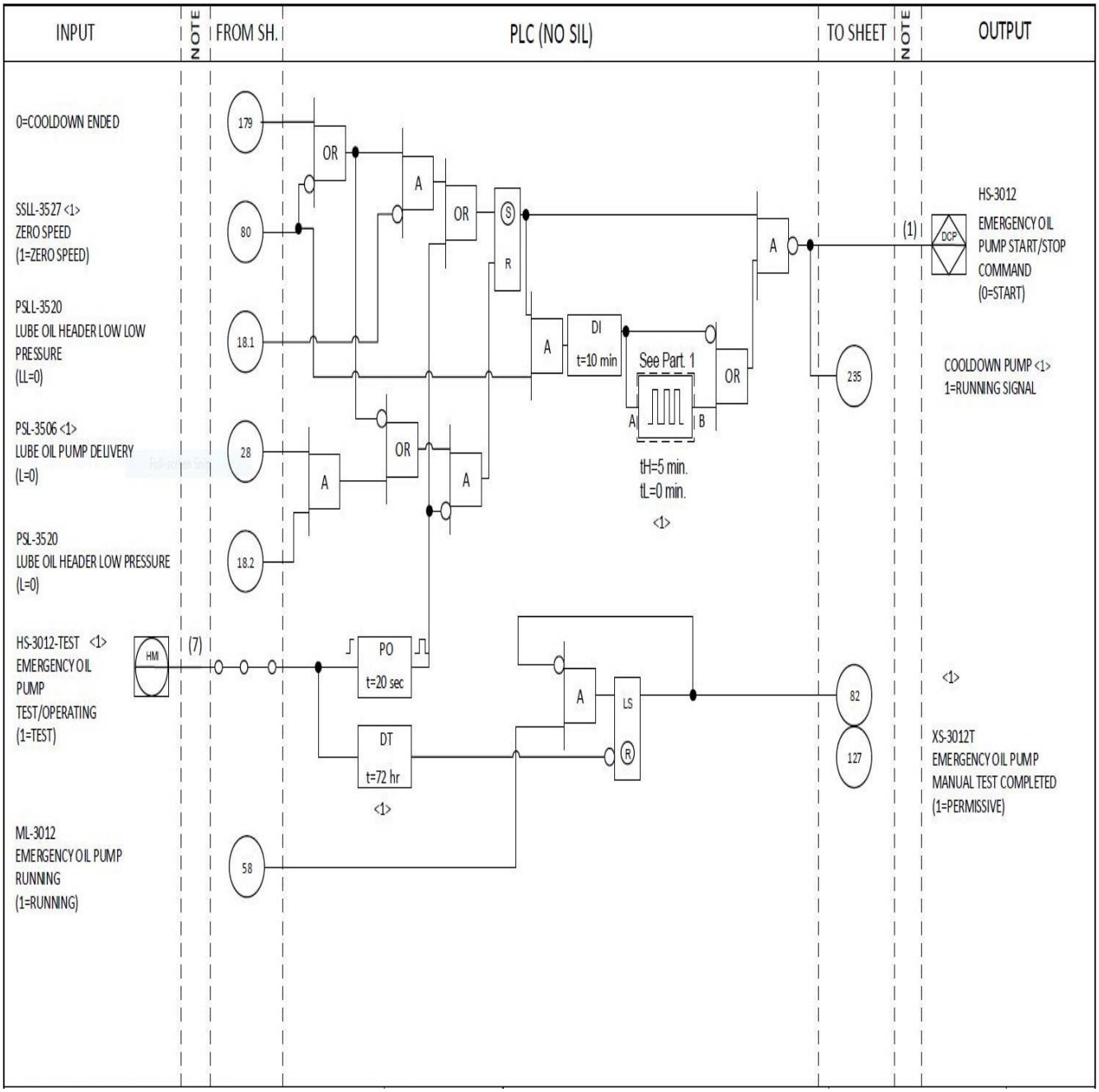
If main lube oil pump is running, stand-by pump is automatically started from the logic in case of the following alarms:

PSL-3506 Low lube oil pressure at the delivery of the pumps;

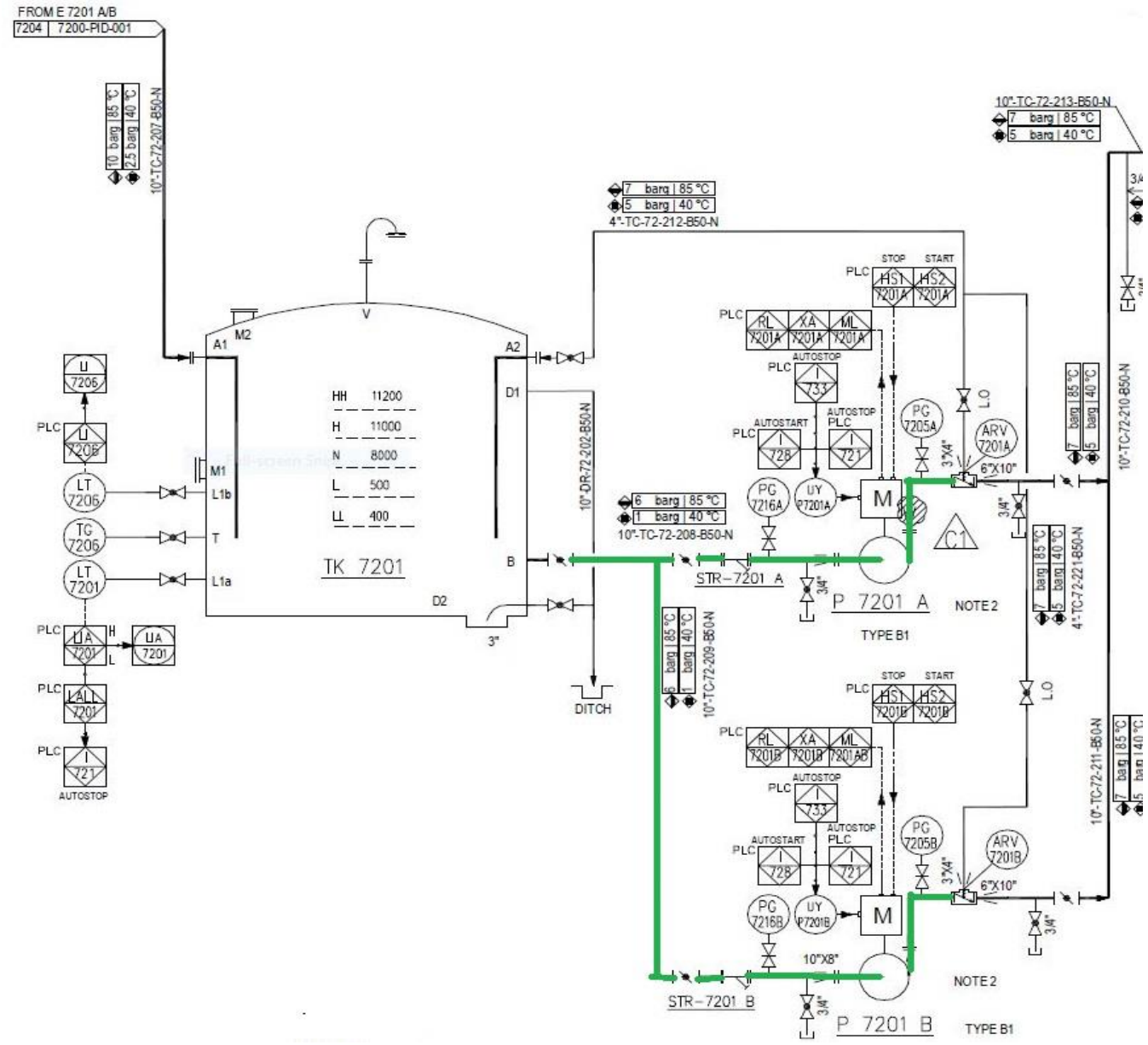
PSL-3520 Low lube oil pressure at the end of lube oil header – this signal is also an inhibit to start the compressor;

PSL-3528 Low control oil pressure – this signal is also an inhibit to start the compressor.

At the end of the lube oil header is provided also a shutdown signal of the compressor in case of low low lube oil pressure (**PSLL-3520**).


INPUT
NOTE
FROM SH.
PLC (NO SIL)
TO SHEET
NOTE
OUTPUT
0=COOLDOWN ENDED
SSLL-3527 <1>
ZERO SPEED
(1=ZERO SPEED)
PSLL-3520
LUBE OIL HEADER LOW LOW
PRESSURE
(LL=0)
PSL-3506 <1>
LUBE OIL PUMP DELIVERY
(L=0)
PSL-3520
LUBE OIL HEADER LOW PRESSURE
(L=0)
HS-3012-TEST <1>
EMERGENCY OIL
PUMP
TEST/OPERATING
(1=TEST)
ML-3012
EMERGENCY OIL PUMP
RUNNING
(1=RUNNING)
179
80
18.1
28
18.2
58
(7)
HMI
OR
A
S
R
DI
t=10 min
See Part. 1
A
B
tH=5 min.
tL=0 min.
<1>
PO
t=20 sec
DT
t=72 hr
LS
(1)
DCP
235
82
127
HS-3012
EMERGENCY OIL
PUMP START/STOP
COMMAND
(0=START)
COOLDOWN PUMP <1>
1=RUNNING SIGNAL
XS-3012T
EMERGENCY OIL PUMP
MANUAL TEST COMPLETED
(1=PERMISSIVE)

Polishing pump



Two Intermediate pumps (P7201A/B), one in running and one on standby. P7201A is operated at normal condition. When the pump (P7201A) is failure or the pump pressure drops to 1 bar, the standby pump P7201B is running. When P7201A is continuously running for 48 hours, switch to P7201B. In the same way, when P7201B is continuously running for 48 hours, switch to P7201A. When the pressure value of PT7209 is greater than or equal to 5 bars, shut off the standby pump.

When the liquid level of intermediate water tank rises to the set value (2m, adjustable), open the intermediate pump (P7201A/B).

When the liquid level of intermediate water tank rises to the high level (11m, adjustable), alarm at the high liquid level.

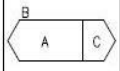
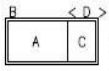
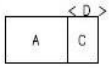
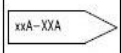
When the liquid level of intermediate water tank drops to the low liquid level (0.5m, adjustable), alarm at the low liquid level.

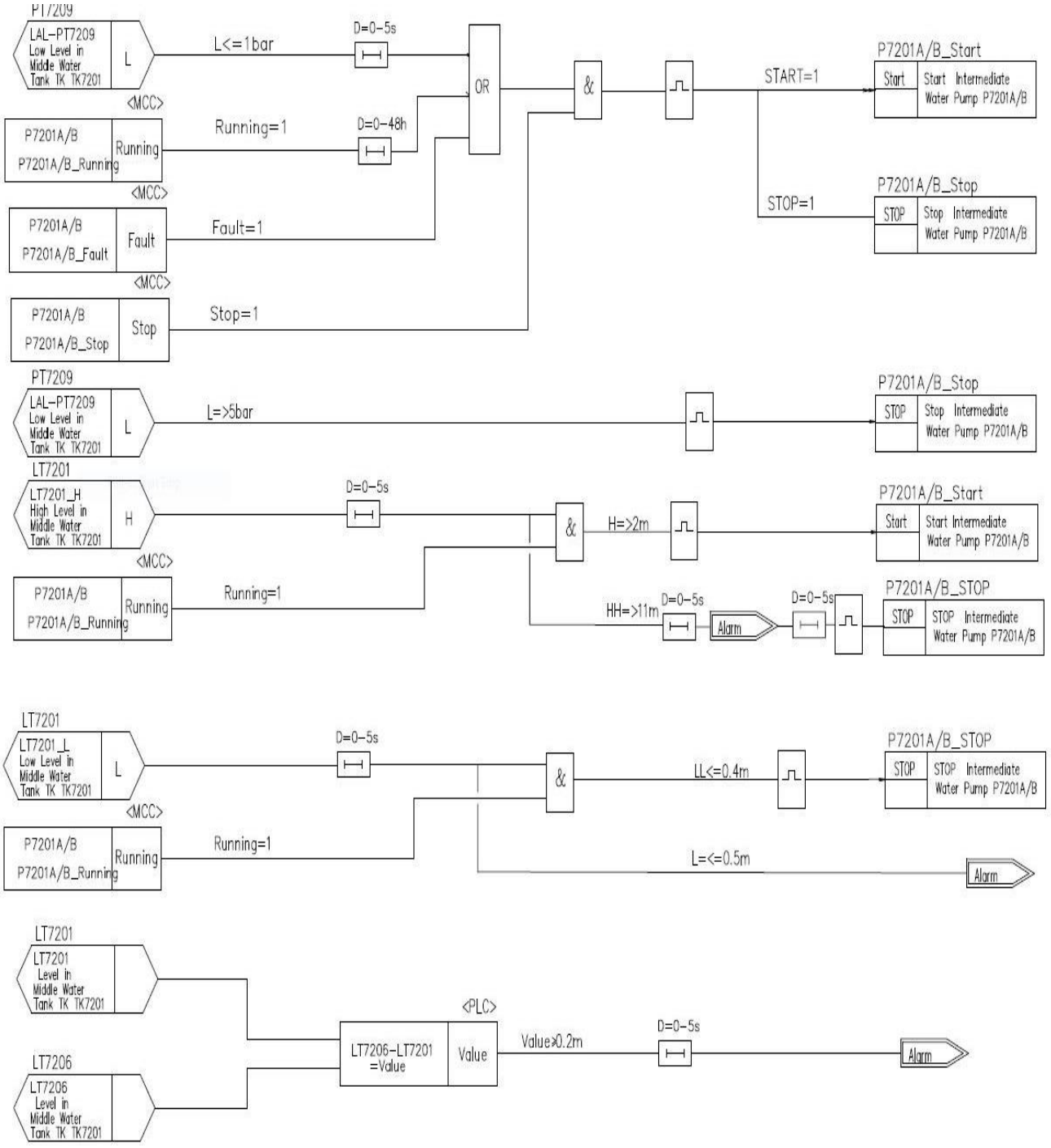
When the liquid level of intermediate water tank continuously drops to the low- low liquid level (0.4m, adjustable), automatically shut off the intermediate water pump (P7201A/B).

The LT7206 value is used for checking, when the difference value between LT7206 and LT7201 is greater than or equal to 0.2m (adjustable) and delay for 5 seconds, the system will be alarm and operators will be disposing it.

Adopt protective measures as overloaded, short of phase, short circuit, electric leakage, etc. for the pump.

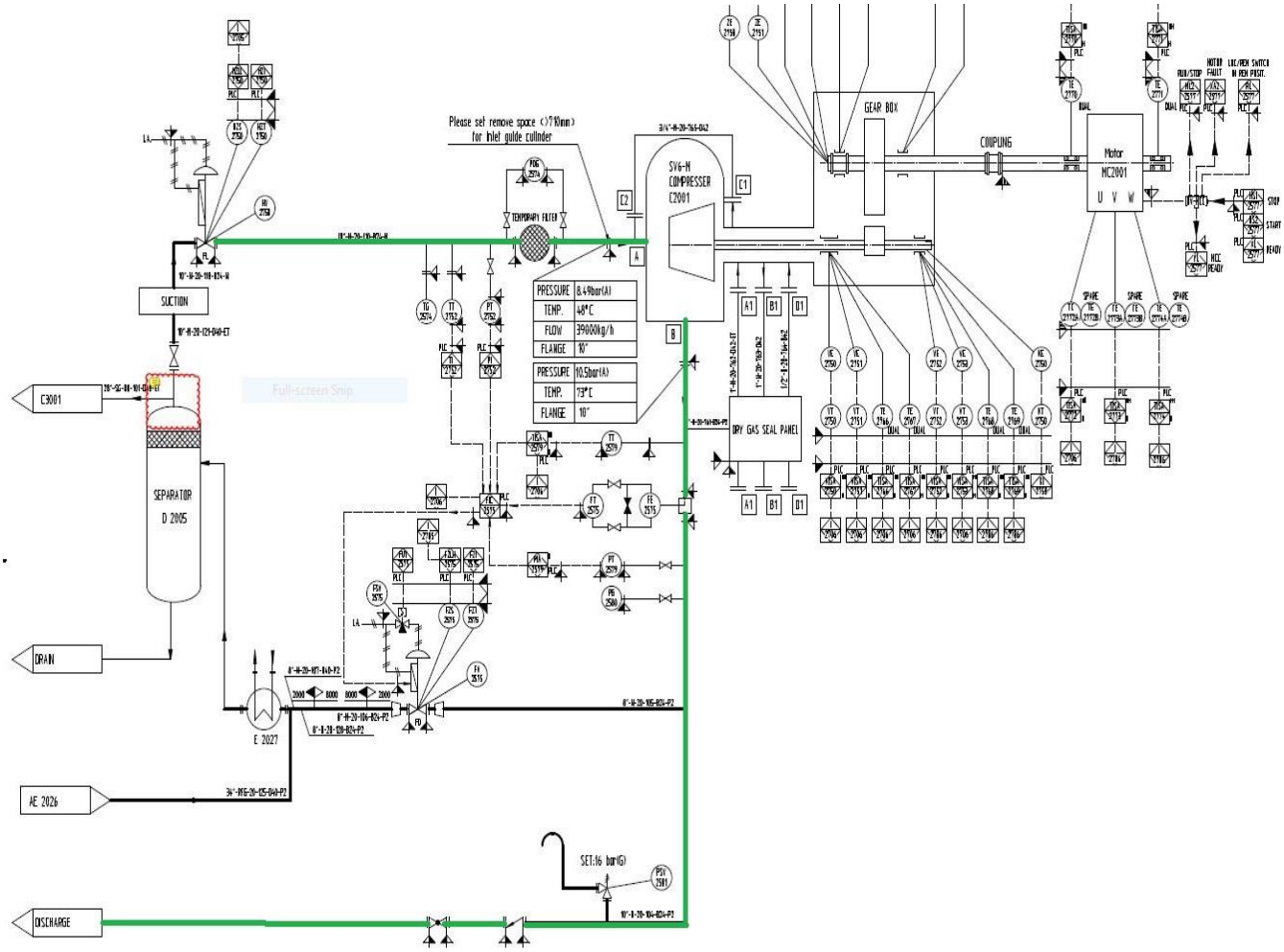
Logic Diagram

NO.	SYMBOL	DESCRIPTION	NO.	SYMBOL	DESCRIPTION	NO.	SYMBOL	DESCRIPTION
1		Process Condition A: Process Variable B: Instrument NO. C: Condition, H/HH/L/LL	9		BRANCH	16		DELAY INITIATION OF OUTPUT Action B Delayed after A Adjustable T Seconds
2		Operation Device A: Signal TAG NO. & Name B: Device Function, POS/MOS C: Operation ON/OFF D: Signal Location and Type	10		CROSS	17		PULSE OUTPUT The Continuous Existence of Logic input Causes Logic output B to Exist When T Expires B Terminates.
3		Calculation Condition A: Process Variable C: Condition, H/HH/L/LL D: Signal Location	11		FLOW DIRECTION			
4		Final Element--Solenoid Valve A: Service and Valve Tag No. B: Solenoid Tag No. C: Energize / Non-Energize D: Energize / Non-Energize E: Action Type, Open/Close/Cont. F: Action Type, Open/Close/Cont.	12		MEMORY 1.Outputs [C] and [D] are always opposite. 2.If input [A] equals (1) then output [C] equals (1). 3.If input [A] changes to (0) output [C] remains (1) until input [B] equals (1) then output [C] equals (1). 4.If input [B] equals (1) then output [D] equals (1). 5.If input [B] changes to (0) output [D] remains (1) until input [A] equals (1), then output [D] equals (1). 6.If inputs [A] and [B] are simultaneously equal to (1) then output [C] equals (1) ISA 5.1 Table 5.7 - Binary logic symbols - 13			
5		Final Element--Control Valve A: Service and Valve Tag No. B: Function Tag No. C: Action Type, Open/Close/Cont. D: Action Type, Open/Close/Cont.						
6		Final Element--Pump & others A: Service and Pump Tag No. B: Signal Tag No. C: Action Type, Stop/Start/Action D: Action Type, Stop/Start/Action	13		AND			
7		Signal Transfer without Hardwire xx: Signal Destination Page A: Row Location in Each Page XX: Signal Origin Page	14		OR			
8		Signal Transfer with Hardwire	15		INPUT NEGATION OUTPUT NEGATION			

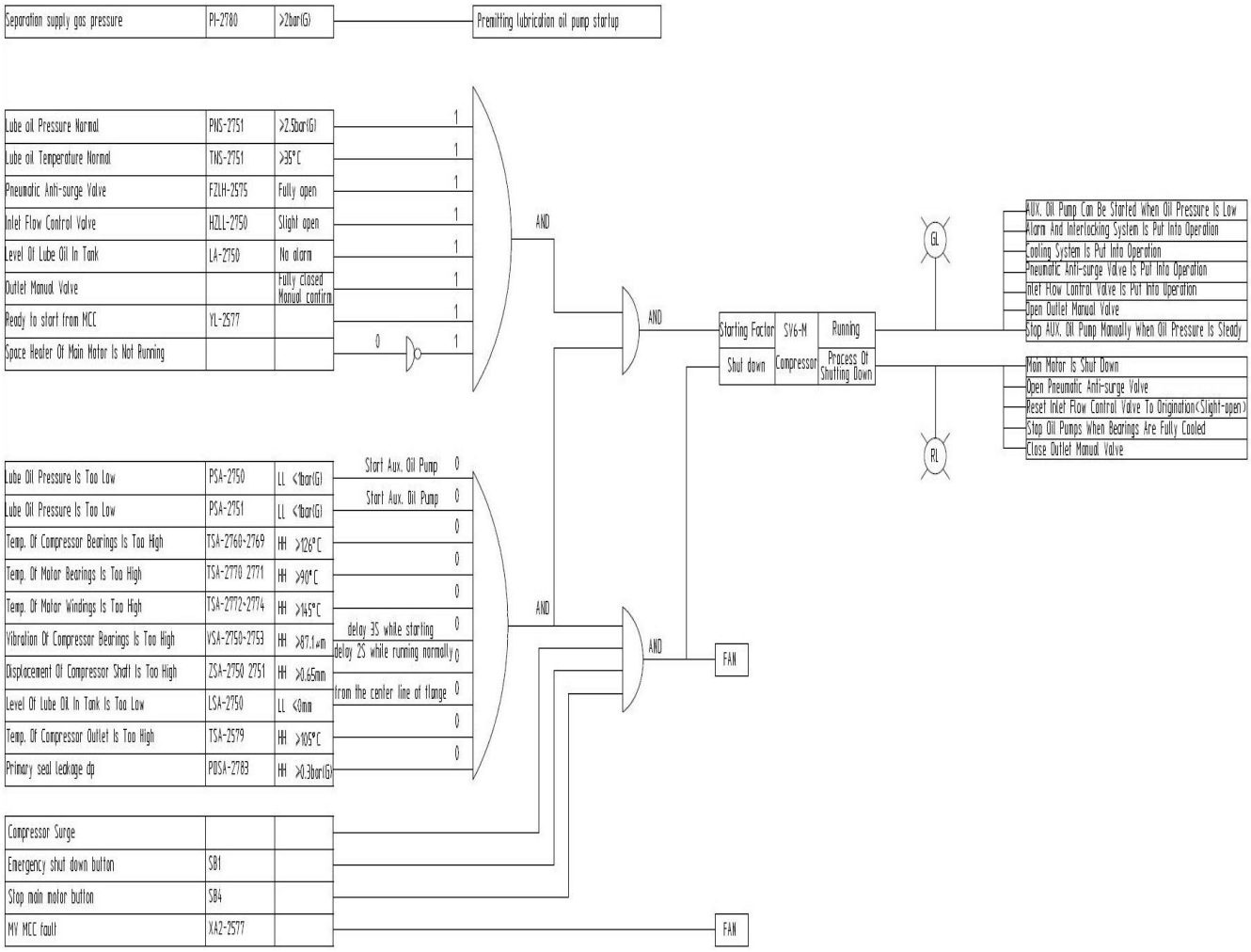

PT7209
LAL-PT7209
Low Level in
Middle Water
Tank TK TK7201
L
L<=1bar
D=0-5s
OR
&
START=1
P7201A/B_Start
Start
Start Intermediate
Water Pump P7201A/B
<MCC>
P7201A/B
P7201A/B_Running
Running
Running=1
D=0-48h
STOP=1
P7201A/B_Stop
STOP
Stop Intermediate
Water Pump P7201A/B
P7201A/B
P7201A/B_Fault
Fault
Fault=1
P7201A/B
P7201A/B_Stop
Stop
Stop=1
PT7209
LAL-PT7209
Low Level in
Middle Water
Tank TK TK7201
L
L=>5bar
P7201A/B_Stop
STOP
Stop Intermediate
Water Pump P7201A/B
LT7201
LT7201_H
High Level in
Middle Water
Tank TK TK7201
H
D=0-5s
&
H=>2m
P7201A/B_Start
Start
Start Intermediate
Water Pump P7201A/B
<MCC>
P7201A/B
P7201A/B_Running
Running
Running=1
HH=>11m
D=0-5s
Alarm
D=0-5s
P7201A/B_STOP
STOP
STOP Intermediate
Water Pump P7201A/B
LT7201
LT7201_L
Low Level in
Middle Water
Tank TK TK7201
L
D=0-5s
&
LL<=0.4m
P7201A/B_STOP
STOP
STOP Intermediate
Water Pump P7201A/B
<MCC>
P7201A/B
P7201A/B_Running
Running
Running=1
L=<=0.5m
Alarm
LT7201
LT7201
Level in
Middle Water
Tank TK TK7201
LT7206
LT7206
Level in
Middle Water
Tank TK TK7201
<PLC>
LT7206-LT7201
=Value
Value
Value≥0.2m
D=0-5s
Alarm

Compressor

1.Nitrogen Compressor



Logic Diagram



Oil Filter Differential Pressure Is High	PDA-2750	H >1.5bar		AN
Temp. After Oil Cooler Is High	TA-2751	H >55℃		AN
Temp. After Oil Cooler Is Low	TA-2751	L <20℃		AN
Lube Oil Pressure Is Low	PA-2751	L <1.5bar(G)	Start Aux. Oil Pump	AN
Lube Oil Pressure Is High	PA-2751	H >3bar(G)		AN
Temp. Of Compressor Bearings Is High	TA-2760~2769	H >115℃		AN
Temp. Of Motor Bearings Is High	TA-2770 2771	H >85℃		AN
Temp. Of Motor Windings Is High	TA-2772~2774	H >140℃		AN
Vibration Of Compressor Bearings Is High	VA-2750~2753	H >62.2㎜		AN
Displacement Of Compressor Shaft Is High	ZA-2750 2751	H >0.5mm		AN
Temp. Of Compressor Outlet Is High	TA-2579	H >100℃		AN
Compressor Outlet Pressor Is High	PA-2579	H >11.15bar(G)		AN
Nitrogen seal filter dp	PDA-2782	H >0.5bar		AN
Primary seal gas supply filter dp	PDA-2780	H >0.3bar		AN
Dp between primary seal gas & reference line	PDA-2781	L <0.1bar		AN
Dp between primary seal gas & reference line	PDA-2781	LL <0.05bar		AN
Separation seal gas supply pressure	PA-2780	L <1bar(G)		AN
Primary seal leakage pressure	PA-2781	H >0.22bar(G)		AN
Booster seal leakage pressure	PA-2782	H >0.5bar(G)		AN
MV MCC fault	XA2-2577			AN

BOOSTER ACTION CONDITIONS

Dp between primary seal gas & reference line	PDCA-2781	<0.05bar	0	SV-2780 DE-ENERGIZED & CLOSE,XV-2780 OPEN,Booster start
Dp between primary seal gas & reference line	PDCA-2781	N 0.15bar	1	AND: SV-2780 ENERGIZED & OPEN,XV-2780 CLOSE,Booster stop
Press touch screen "Booster stop"soft button	OFF		1	

	AND
	OR
	NOT
	RED LIGHT(RL) GREEN LIGHT(GL)

Trip of primary reformer, H 2001

Trip of primary reformer H2001 is caused by the following:

- Manual panel trip

- Trip of the interlock sequence IS-12 of the flue gas blower (F 2001). If the flue gas blower shuts down, flue gas will accumulate in the furnace and create excessive over pressure.

- Trip of the interlock sequence IS-10 of the combustion air blower (F 2002). If the combustion air blower shuts down, the burners may extinguish and natural gas leaks to the re-former furnace leading to explosion risk. Stop of combustion air blower may also create excessive vacuum in the furnace.

- Too high temperature of HHP steam from E 2021 1, (TSAH-2355) may overheat the downstream turbines or damage E 2021 1.

- Too high temperature of HHP steam from E 2021 2, (TSAH-2356) may overheat the downstream turbines or damage E 2021 2.

- Too high level in the natural gas KO drum, D 1001 (LSAH-1004). Liquid from D 1001 is of unknown composition and is as such a potential hazard to the prereformer catalyst; furthermore, liquid must be avoided in fuel piping.

- Too low natural gas flow to reformer (FSAL-6070). If the natural gas flow decreases, the heat absorbed by the endothermic reforming reaction will drop correspondingly. As a result, the tubes in the primary reformer and the primary reformer outlet system could overheat.

- Too high level in feed gas scrubber separator, D 6001, (LSAH-6051). Liquid may not be evaporated in the prereformer feed preheat coil due to the high wall temperatures. Any liquid entering the prereformer will cause damage to the catalyst.

- Low total flow of steam to feed gas, FSAL-2062

too low steam/carbon ratio (FFSAL-2064). If the steam/carbon ratio is too low, carbon may form on the pre-reformer/reformer' catalyst.

- Too low combustion air pressure (PSAL-2163). If the combustion air pressure is too low, the burners may extinguish and natural gas leaks to the reformer furnace leading to explosion risk.

- Too low draught in furnace of H 2001 (PSAH-2224). If the pressure in the furnace in-creases above ambient pressure, hot flue gas (up to approximately 1200ºC) will leak out in numerous places. This presents a potential danger to personnel and/or damage to the steel casing of the reformer.

- Too high draught in the furnace of H 2001 (PSAL-2224). Too high vacuum may damage the furnace casing and refractory.

- Too high temperature of flue gas inlet H 2001 waste heat section (TSAH-2221) may damage coils.

- Too high temperature of reformed gas exit H 2001 (TSAH-2305). If the reformer outlet temperature is too high, the reformer tubes and outlet collector may be damaged due to overheating.

- To high temperature in the chamber between the waste heat boiler and steam super heater may damage the steam super heater, E 2021 1/ E 2021 2, (TSAH-2335/TSAH- 2336).

- Too low level in the HHP steam drum, D 2001, (LSAL-2372). If the level in the steam drum is too low the boilers could run dry and thus be exposed to excessive temperatures.

- Too high fuel gas pressure to H 2001 (PSAH-2554), if the pressure in the fuel header gets too high, the furnace and the reforming tubes may overheat.

- Too low fuel gas pressure to H 2001 (PSAL-2556), if the pressure in the fuel header gets too low the burners may extinguish. Unburned natural gas may create an explosive mixture inside the furnace.

- Too low flow of start-up nitrogen to E 2002 (FSAL-2582), if the nitrogen flow is too low during heating the reforming tubes may overheat.

The following actions are carried out automatically:

- Trip of secondary reformer, IS-2

- Trip of methanol synthesis, IS-3

- Stop emergency methanol to reformer, IS-6

- Trip of combustion air blower F 2002, IS-10

- Trip of flue gas blower F 2001, IS-12

- Trip of purge gas to H 2001 burners, IS-14

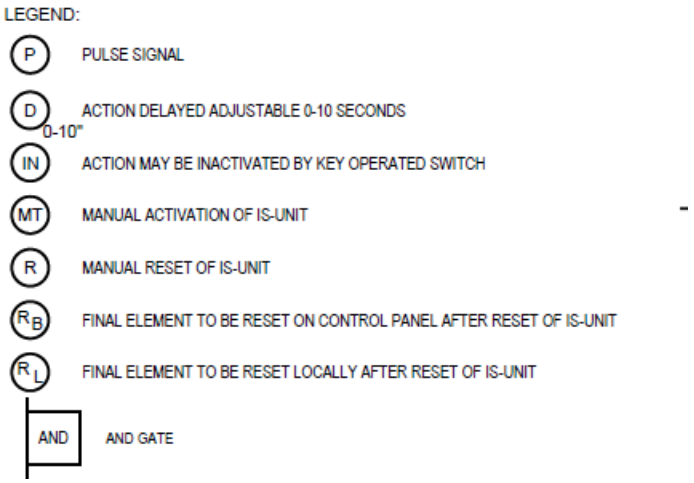
- High pressure in reformer furnace box, I-15

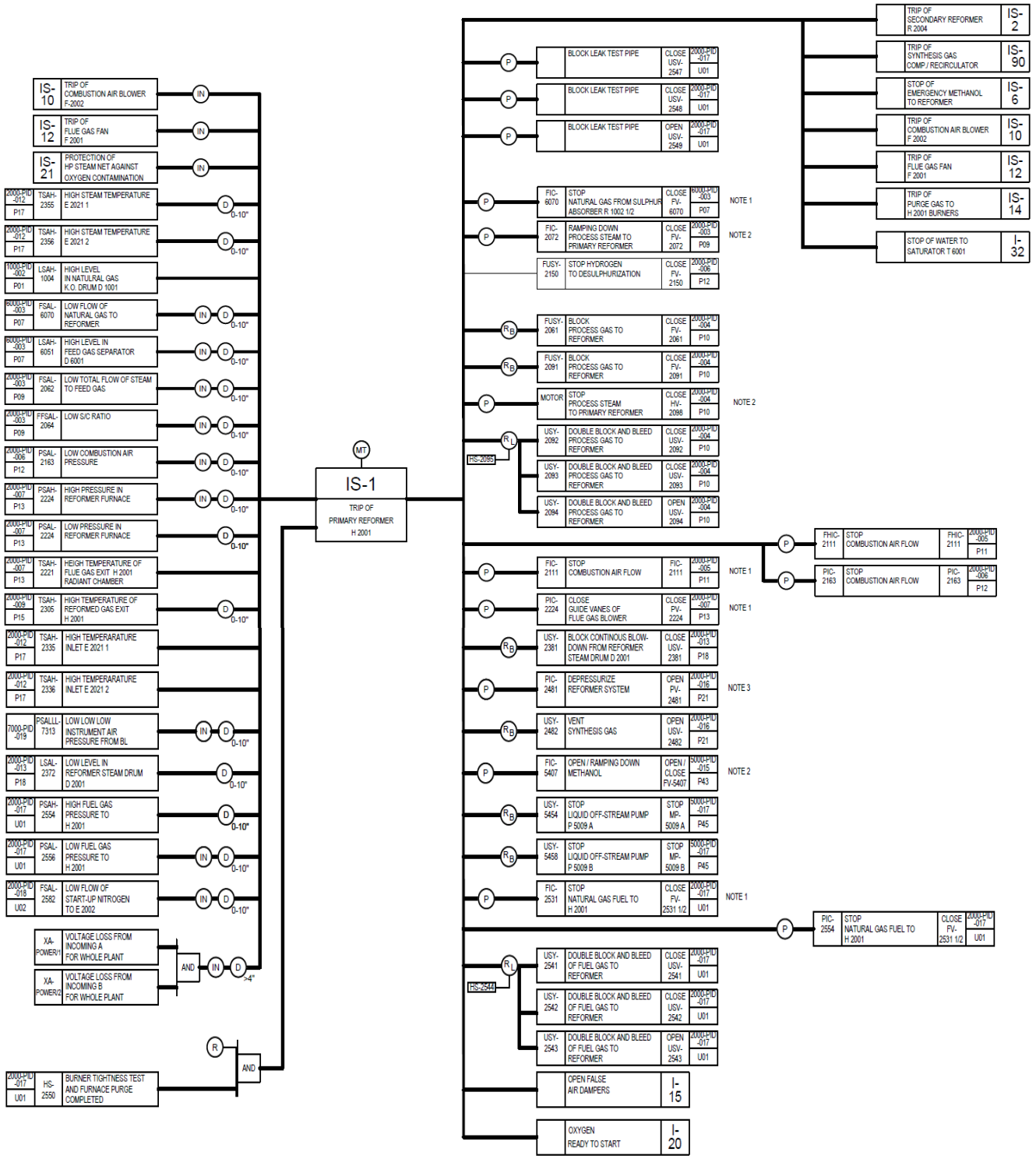
- Oxygen ready to start, I-20

- Stop water to saturator T 6001, I-32

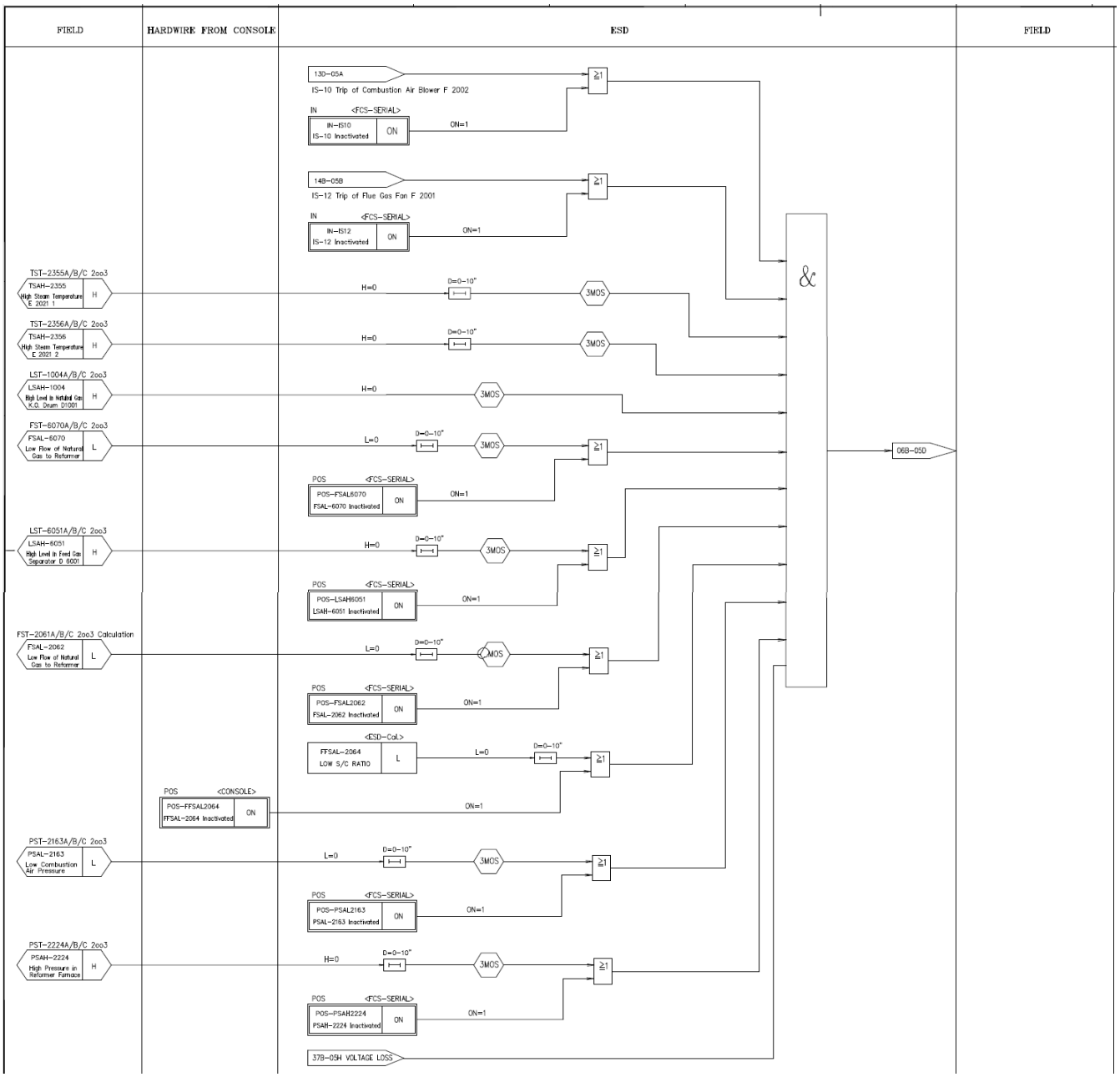
- Trip of synthesis gas compressor/recirculator C 3001/C 3002, IS-40

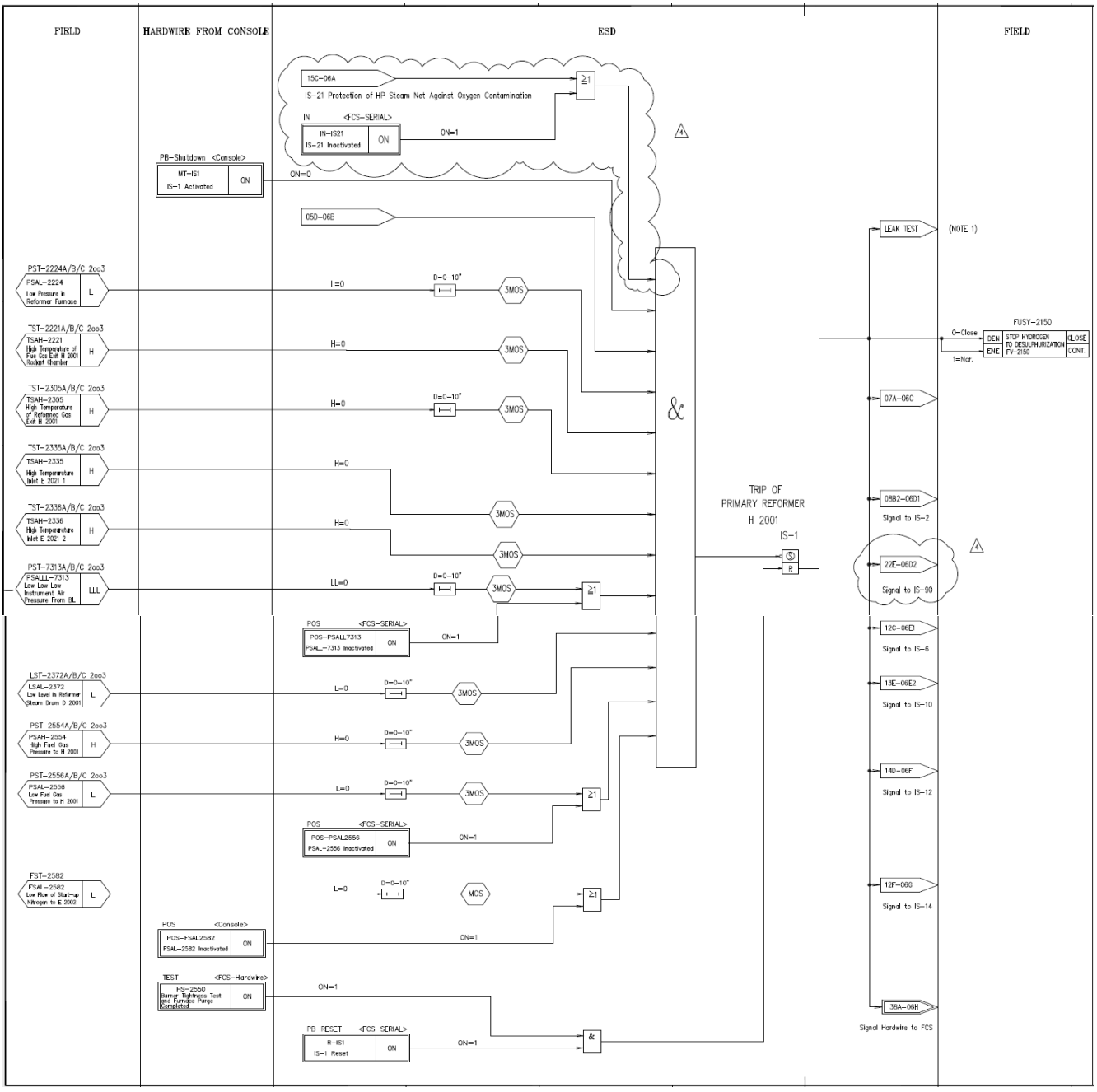
Interlock Diagram

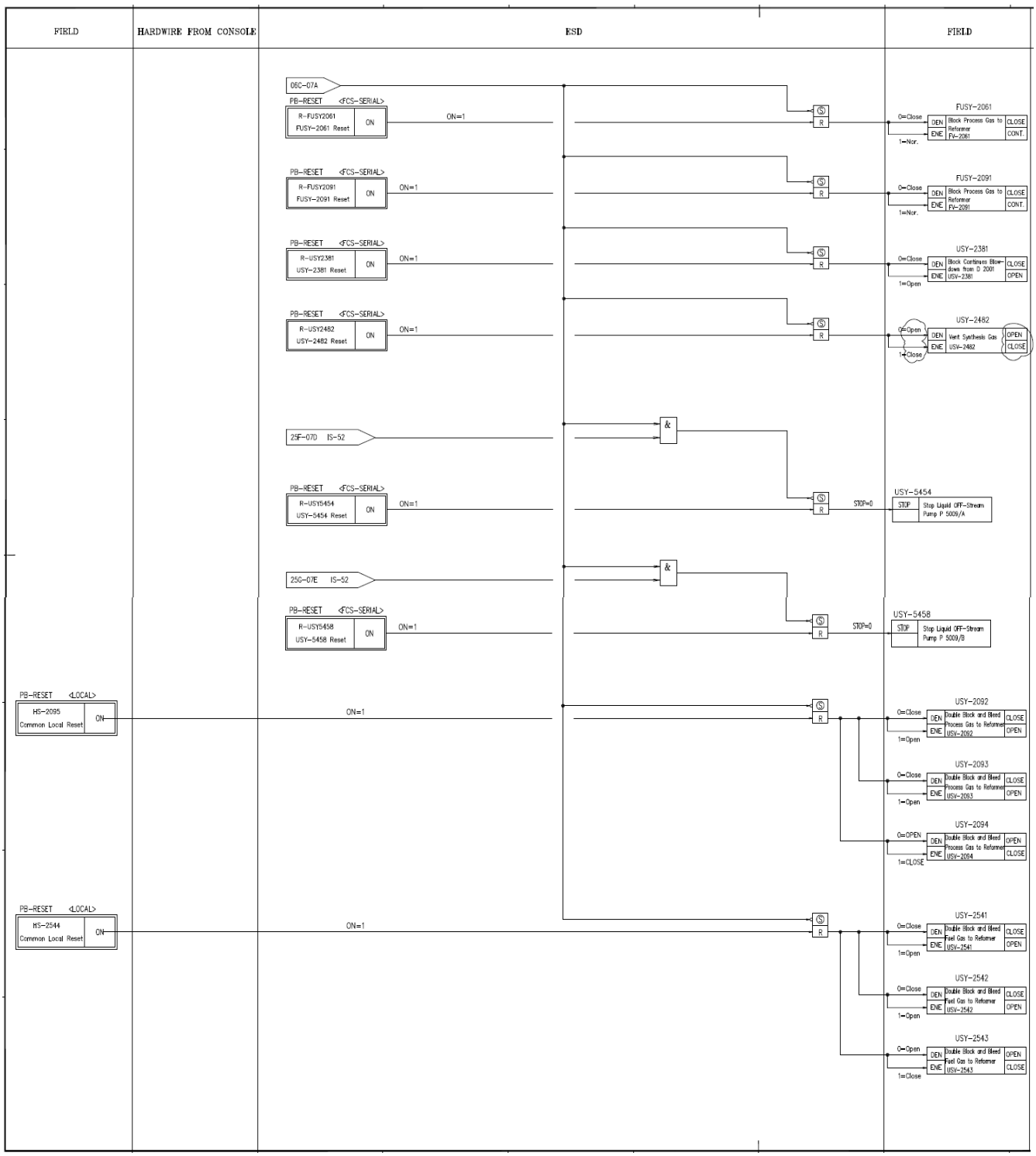



IS-1
TRIP OF PRIMARY REFORMER H 2001
MT
IS-10 TRIP OF COMBUSTION AIR BLOWER F-2002
IS-12 TRIP OF FLUE GAS FAN F 2001
IS-21 PROTECTION OF HP STEAM NET AGAINST OXYGEN CONTAMINATION
2000-PID-012 P17 TSAH-2355 HIGH STEAM TEMPERATURE E 2021 1
2000-PID-012 P17 TSAH-2356 HIGH STEAM TEMPERATURE E 2021 2
1000-PID-002 P01 LSAH-1004 HIGH LEVEL IN NATURAL GAS K.O. DRUM D 1001
6000-PID-003 P07 FSAL-6070 LOW FLOW OF NATURAL GAS TO REFORMER
6000-PID-003 P07 LSAH-6051 HIGH LEVEL IN FEED GAS SEPARATOR D 6001
2000-PID-003 P09 FSAL-2062 LOW TOTAL FLOW OF STEAM TO FEED GAS
2000-PID-003 P09 FFSAL-2064 LOW S/C RATIO
2000-PID-006 P12 PSAL-2163 LOW COMBUSTION AIR PRESSURE
2000-PID-007 P13 PSAH-2224 HIGH PRESSURE IN REFORMER FURNACE
2000-PID-007 P13 PSAL-2224 LOW PRESSURE IN REFORMER FURNACE
2000-PID-007 P13 TSAH-2221 HEIGH TEMPERATURE OF FLUE GAS EXIT H 2001 RADIANT CHAMBER
2000-PID-009 P15 TSAH-2305 HIGH TEMPERATURE OF REFORMED GAS EXIT H 2001
2000-PID-012 P17 TSAH-2335 HIGH TEMPERARATURE INLET E 2021 1
2000-PID-012 P17 TSAH-2336 HIGH TEMPERARATURE INLET E 2021 2
7000-PID-019 PSALLL-7313 LOW LOW LOW INSTRUMENT AIR PRESSURE FROM BL
2000-PID-013 P18 LSAL-2372 LOW LEVEL IN REFORMER STEAM DRUM D 2001
2000-PID-017 U01 PSAH-2554 HIGH FUEL GAS PRESSURE TO H 2001
2000-PID-017 U01 PSAL-2556 LOW FUEL GAS PRESSURE TO H 2001
2000-PID-018 U02 FSAL-2582 LOW FLOW OF START-UP NITROGEN TO E 2002
XA-POWER/1 VOLTAGE LOSS FROM INCOMING A FOR WHOLE PLANT
XA-POWER/2 VOLTAGE LOSS FROM INCOMING B FOR WHOLE PLANT
AND
2000-PID-017 U01 HS-2550 BURNER TIGHTNESS TEST AND FURNACE PURGE COMPLETED
BLOCK LEAK TEST PIPE CLOSE USV-2547 2000-PID-017 U01
BLOCK LEAK TEST PIPE CLOSE USV-2548 2000-PID-017 U01
BLOCK LEAK TEST PIPE OPEN USV-2549 2000-PID-017 U01
FIC-6070 STOP NATURAL GAS FROM SULPHUR ABSORBER R 1002 1/2 CLOSE FV-6070 6000-PID-003 P07 NOTE 1
FIC-2072 RAMPING DOWN PROCESS STEAM TO PRIMARY REFORMER CLOSE FV-2072 2000-PID-003 P09 NOTE 2
FUSY-2150 STOP HYDROGEN TO DESULPHURIZATION CLOSE FV-2150 2000-PID-006 P12
FUSY-2061 BLOCK PROCESS GAS TO REFORMER CLOSE FV-2061 2000-PID-004 P10
FUSY-2091 BLOCK PROCESS GAS TO REFORMER CLOSE FV-2091 2000-PID-004 P10
MOTOR STOP PROCESS STEAM TO PRIMARY REFORMER CLOSE HV-2086 2000-PID-004 P10 NOTE 2
HS-2085
USY-2092 DOUBLE BLOCK AND BLEED PROCESS GAS TO REFORMER CLOSE USV-2092 2000-PID-004 P10
USY-2093 DOUBLE BLOCK AND BLEED PROCESS GAS TO REFORMER CLOSE USV-2093 2000-PID-004 P10
USY-2094 DOUBLE BLOCK AND BLEED PROCESS GAS TO REFORMER OPEN USV-2094 2000-PID-004 P10
FHIC-2111 STOP COMBUSTION AIR FLOW FHIC-2111 2000-PID-005 P11
PIC-2163 STOP COMBUSTION AIR FLOW PIC-2163 2000-PID-006 P12
FIC-2111 STOP COMBUSTION AIR FLOW FIC-2111 2000-PID-005 P11 NOTE 1
PIC-2224 CLOSE GUIDE VANES OF FLUE GAS BLOWER CLOSE PV-2224 2000-PID-007 P13 NOTE 1
USY-2381 BLOCK CONTINOUS BLOW-DOWN FROM REFORMER STEAM DRUM D 2001 CLOSE USV-2381 2000-PID-013 P18
PIC-2481 DEPRESSURIZE REFORMER SYSTEM OPEN PV-2481 2000-PID-016 P21 NOTE 3
USY-2482 VENT SYNTHESIS GAS OPEN USV-2482 2000-PID-016 P21
FIC-5407 OPEN / RAMPING DOWN METHANOL OPEN / CLOSE FV-5407 5000-PID-015 P43 NOTE 2
USY-5454 STOP LIQUID OFF-STREAM PUMP P 5009 A STOP MP-5009 A 5000-PID-017 P45
USY-5458 STOP LIQUID OFF-STREAM PUMP P 5009 B STOP MP-5009 B 5000-PID-017 P45
FIC-2531 STOP NATURAL GAS FUEL TO H 2001 CLOSE FV-2531 1/2 2000-PID-017 U01 NOTE 1
PIC-2564 STOP NATURAL GAS FUEL TO H 2001 CLOSE FV-2531 1/2 2000-PID-017 U01
HS-2544
USY-2541 DOUBLE BLOCK AND BLEED OF FUEL GAS TO REFORMER CLOSE USV-2541 2000-PID-017 U01
USY-2542 DOUBLE BLOCK AND BLEED OF FUEL GAS TO REFORMER CLOSE USV-2542 2000-PID-017 U01
USY-2543 DOUBLE BLOCK AND BLEED OF FUEL GAS TO REFORMER OPEN USV-2543 2000-PID-017 U01
OPEN FALSE AIR DAMPERS I-15
OXYGEN READY TO START I-20
TRIP OF SECONDARY REFORMER R 2004 IS-2
TRIP OF SYNTHESIS GAS COMP / RECIRCULATOR IS-90
STOP OF EMERGENCY METHANOL TO REFORMER IS-6
TRIP OF COMBUSTION AIR BLOWER F 2002 IS-10
TRIP OF FLUE GAS FAN F 2001 IS-12
TRIP OF PURGE GAS TO H 2001 BURNERS IS-14
STOP OF WATER TO SATURATOR T 6001 I-32

Logic Diagram




FIELD
HARDWIRE FROM CONSOLE
ESD
FIELD
15C-06A
IS-21 Protection of HP Steam Net Against Oxygen Contamination
IN
<FCS-SERIAL>
IN-IS21
IS-21 Inactivated
ON
ON=1
PB-Shutdown
<Console>
MT-IS1
IS-1 Activated
ON
ON=0
050-06B
LEAK TEST
(NOTE 1)
FUSY-2150
0=Close
1=Nor.
DEN
ENE
STOP HYDROGEN TO DESUH/PHURIZATION FV-2150
CLOSE CONT.
PST-2224A/B/C 2oo3
PSAL-2224
Low Pressure in Reformer Furnace
L
L=0
D=0-10"
3MOS
TST-2221A/B/C 2oo3
TSAH-2221
High Temperature of Flue Gas Exit H 2001 Radiant Chamber
H
H=0
07A-06C
TST-2305A/B/C 2oo3
TSAH-2305
High Temperature of Reformed Gas Exit H 2001
TST-2335A/B/C 2oo3
TSAH-2335
High Temperature Inlet E 2021 1
TST-2336A/B/C 2oo3
TSAH-2336
High Temperature Inlet E 2021 2
PST-7313A/B/C 2oo3
PSALLL-7313
Low Low Low Instrument Air Pressure From BL
LLL
LL=0
TRIP OF PRIMARY REFORMER H 2001 IS-1
08B2-06D1
Signal to IS-2
22E-06D2
Signal to IS-90
POS
<FCS-SERIAL>
POS-PSALL7313
PSALL-7313 Inactivated
LST-2372A/B/C 2oo3
LSAL-2372
Low Level in Reformer Steam Drum D 2001
PST-2554A/B/C 2oo3
PSAH-2554
High Fuel Gas Pressure to H 2001
PST-2556A/B/C 2oo3
PSAL-2556
Low Fuel Gas Pressure to H 2001
POS-PSAL2556
PSAL-2556 Inactivated
12C-06E1
Signal to IS-6
13E-06E2
Signal to IS-10
14D-06F
Signal to IS-12
FST-2582
PSAL-2582
Low Flow of Start-up Nitrogen to E 2002
MOS
POS-PSAL2582
PSAL-2582 Inactivated
12F-06G
Signal to IS-14
TEST
<FCS-Hardwire>
HS-2550
Burner Tightness Test and Furnace Purge Completed
38A-06H
Signal Hardwire to FCS
PB-RESET
R-IS1
IS-1 Reset


FIELD
HARDWIRE FROM CONSOLE
ESD
FIELD
06C-07A
PB-RESET <FCS-SERIAL>
R-FUSY2061 FUSY-2061 Reset
ON
ON=1
FUSY-2061
0=Close
1=Nor.
DEN
ENE
Block Process Gas to Reformer FV-2061
CLOSE
CONT.
R-FUSY2091 FUSY-2091 Reset
FUSY-2091
Block Process Gas to Reformer FV-2091
R-USY2381 USY-2381 Reset
USY-2381
1=Open
Block Continues Blow-down from D 2001 USY-2381
OPEN
R-USY2482 USY-2482 Reset
USY-2482
0=Open
1=Close
Vent Synthesis Gas USY-2482
25F-07D IS-52
&
R-USY5454 USY-5454 Reset
USY-5454
STOP=0
STOP
Stop Liquid OFF-Stream Pump P 5009/A
25C-07E IS-52
R-USY5458 USY-5458 Reset
USY-5458
Stop Liquid OFF-Stream Pump P 5009/B
PB-RESET <LOCAL>
HS-2095 Common Local Reset
USY-2092
Double Block and Bleed Process Gas to Reformer USY-2092
USY-2093
Double Block and Bleed Process Gas to Reformer USY-2093
USY-2094
0=OPEN
1=CLOSE
Double Block and Bleed Process Gas to Reformer USY-2094
HS-2544 Common Local Reset
USY-2541
Double Block and Bleed Fuel Gas to Reformer USY-2541
USY-2542
Double Block and Bleed Fuel Gas to Reformer USY-2542
USY-2543
Double Block and Bleed Fuel Gas to Reformer USY-2543

IS-10: Trip of combustion air blower

The causes for IS-10 trip are:

- Manual panel trip
- Trip of primary reformer H 2001, IS-1
- Trip of turbine FT-2002, IS-11 AND trip of motor MF 2002 for combustion air blower
- Trip signal from combustion air blower, F 2002

The following actions are carried out automatically:

- Trip of primary reformer H 2001, IS-1
- Trip of turbine for combustion air blower FT 2002, IS-11
- Trip of vent gas to reformer, I-61
- Stop motor MF 2002 for combustion air blower

It is possible to inactivate the IS-1 trip in order to perform the burner tightness test and furnace purge.

8.11 IS-12: Trip of flue gas blower, F 2001

The causes for trip are:

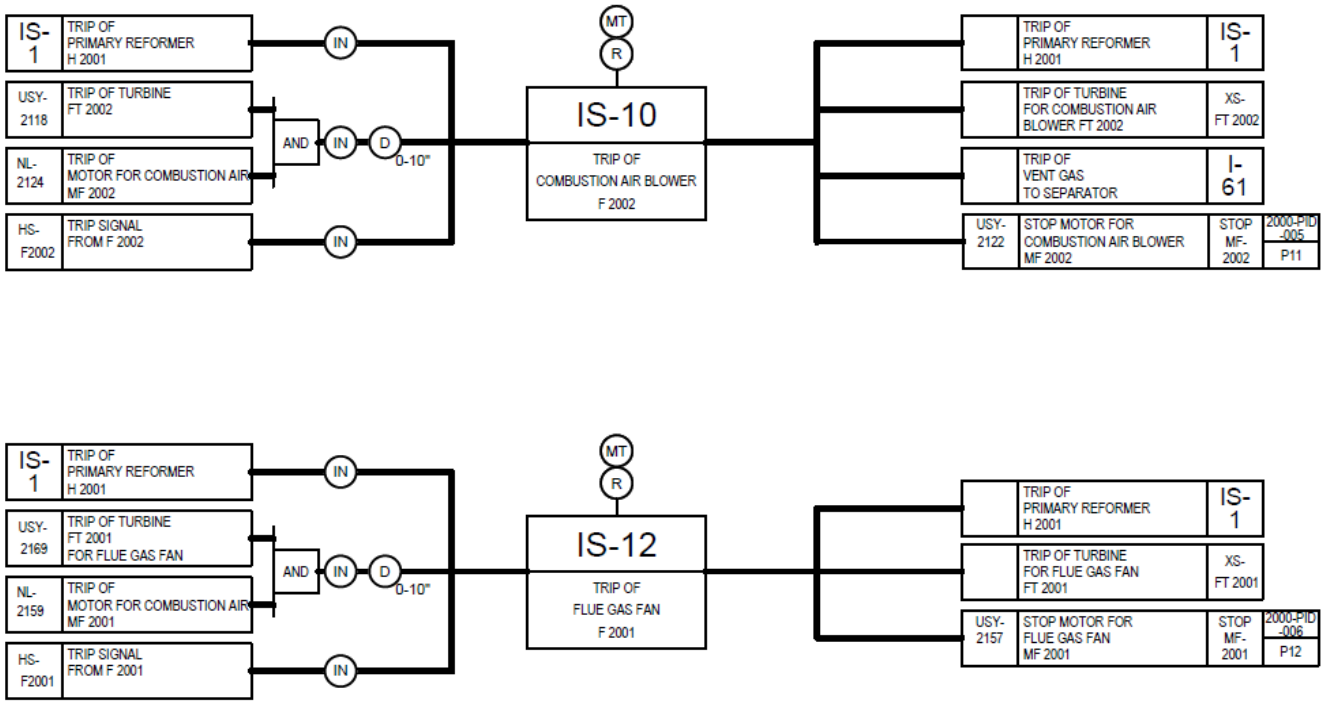
- Manual panel trip
- Trip of primary reformer H 2001, IS-1
- Trip of turbine FT-2001, IS-13 AND trip of motor MF 2001 for flue gas fan
- Trip signal from flue gas fan, F 2001

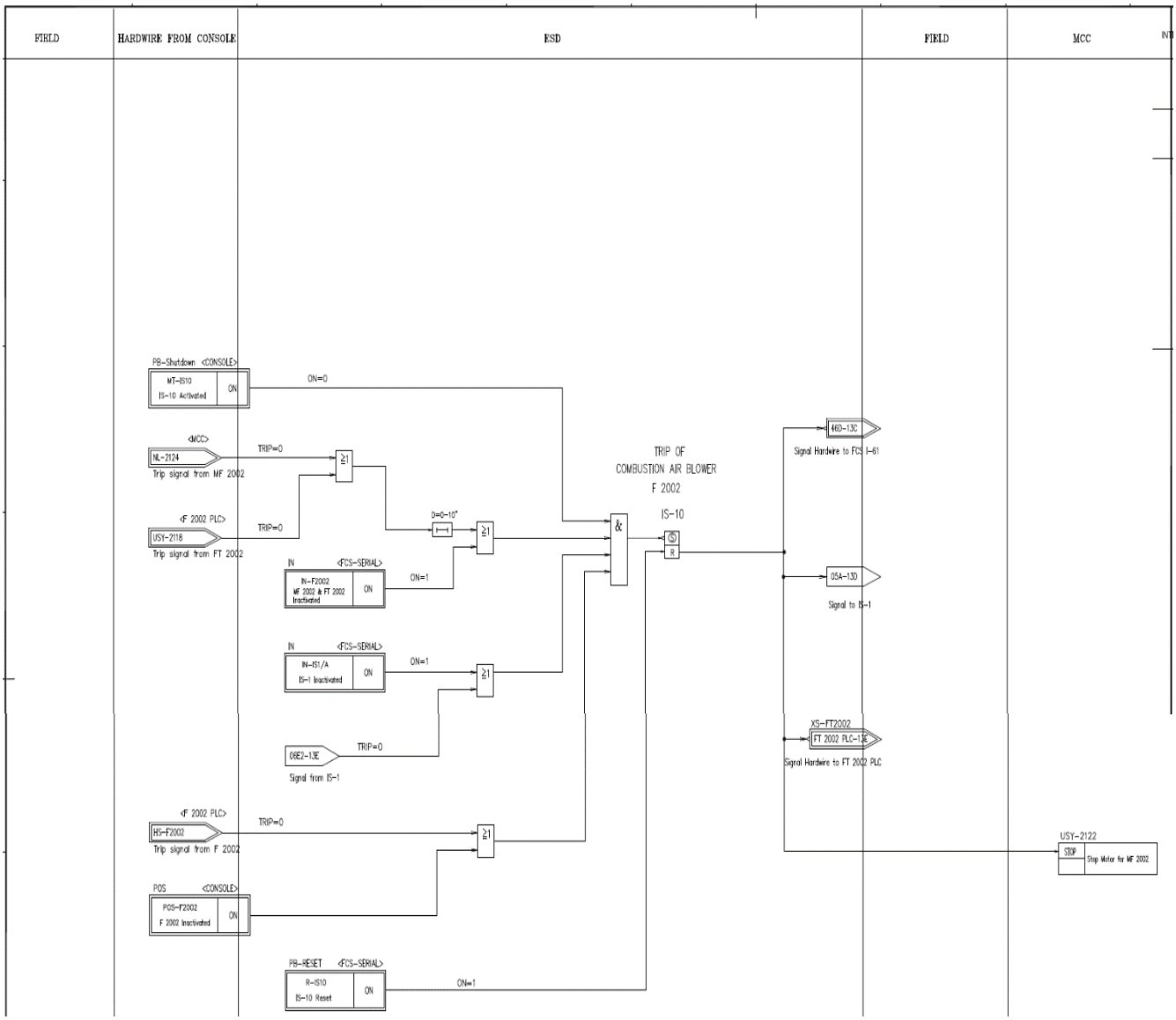
The following actions are carried out automatically:

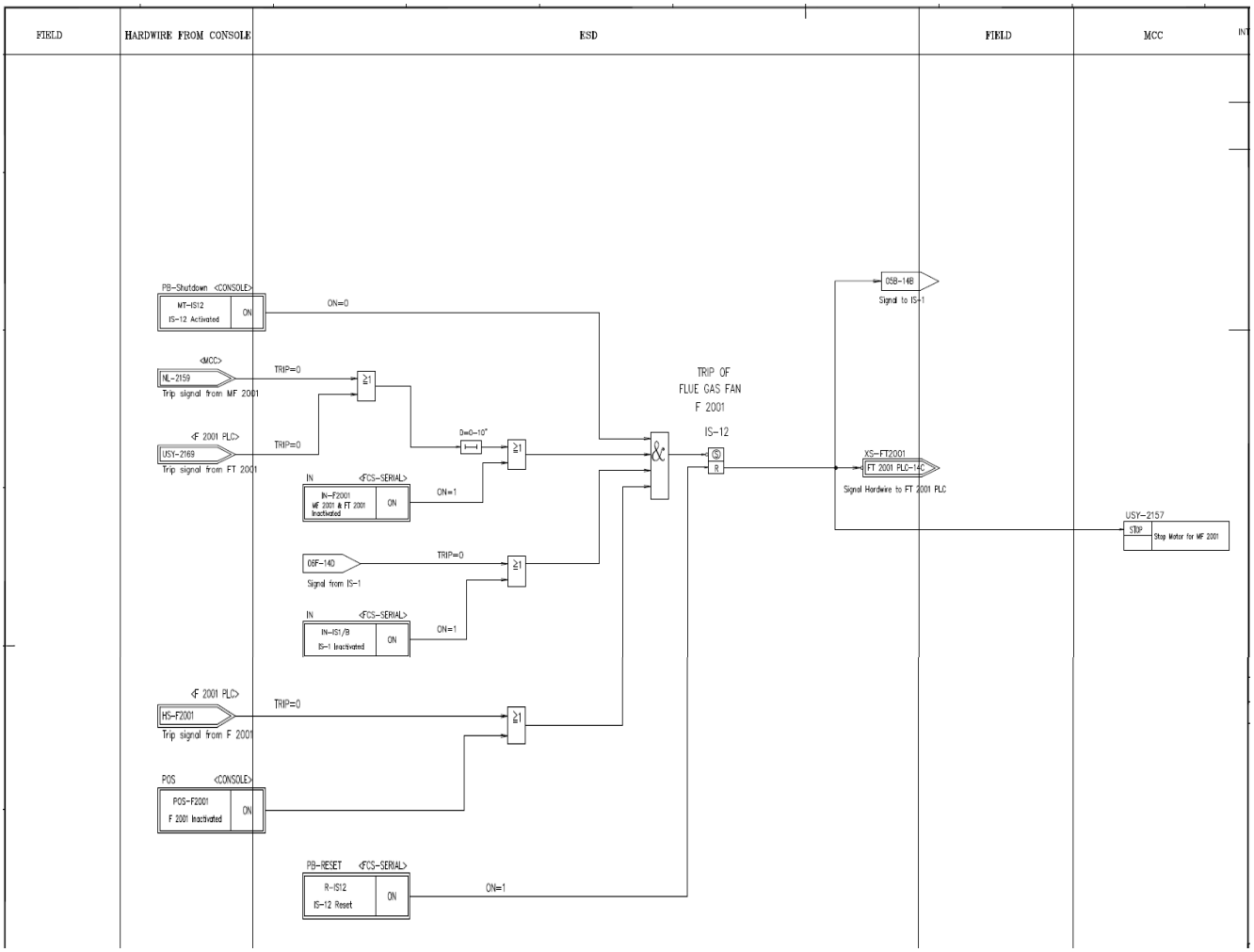
- Trip of primary reformer H 2001, IS-1
- Trip of turbine FT 2001 for flue gas fan, IS-13
- Stop motor MF 2001 for flue gas fan

It is possible to inactivate the IS-1 trip in order to perform the burner tightness test and furnace purge.

Interlock Diagram




FIELD
HARDWIRE FROM CONSOLE
ESD
FIELD
MCC
PB-Shutdown <CONSOLE>
MT-IS10
IS-10 Activated
ON
ON=0
<MCC>
NL-2124
Trip signal from MF 2002
TRIP=0
≥1
<F 2002 PLC>
USY-2118
Trip signal from FT 2002
TRIP=0
0=0-10"
IN <FCS-SERIAL>
IN-F2002
MF 2002 & FT 2002 Inactivated
ON
ON=1
IN <FCS-SERIAL>
IN-IS1/A
IS-1 Inactivated
ON
ON=1
08E2-13E
Signal from IS-1
TRIP=0
<F 2002 PLC>
HS-F2002
Trip signal from F 2002
TRIP=0
POS <CONSOLE>
POS-F2002
F 2002 Inactivated
ON
PB-RESET <FCS-SERIAL>
R-IS10
IS-10 Reset
ON
ON=1
TRIP OF
COMBUSTION AIR BLOWER
F 2002
IS-10
&
S
R
46D-13C
Signal Hardwire to FCS I-61
05A-13D
Signal to IS-1
XS-FT2002
FT 2002 PLC-13E
Signal Hardwire to FT 2002 PLC
USY-2122
STOP
Stop Motor for MF 2002


FIELD
HARDWIRE FROM CONSOLE
ESD
FIELD
MCC
PB-Shutdown <CONSOLE>
MT-IS12
IS-12 Activated
ON
ON=0
<MCC>
NL-2159
Trip signal from MF 2001
TRIP=0
≥1
<F 2001 PLC>
USY-2169
Trip signal from FT 2001
TRIP=0
0s<0<10"
≥1
IN
<FCS-SERIAL>
IN-F2001
MF 2001 & FT 2001 Inactivated
ON
ON=1
08F-140
Signal from IS-1
TRIP=0
≥1
IN
<FCS-SERIAL>
IN-IS1/8
IS-1 Inactivated
ON
ON=1
<F 2001 PLC>
HS-F2001
Trip signal from F 2001
TRIP=0
≥1
POS
<CONSOLE>
POS-F2001
F 2001 Inactivated
ON
PB-RESET
<FCS-SERIAL>
R-IS12
IS-12 Reset
ON
ON=1
TRIP OF
FLUE GAS FAN
F 2001
IS-12
&
S
05B-148
Signal to IS-1
XS-FT2001
FT 2001 PLC-14C
Signal Hardwire to FT 2001 PLC
USY-2157
STOP
Stop Motor for MF 2001

8.13 IS-14: Trip of purge gas to H 2001 burners

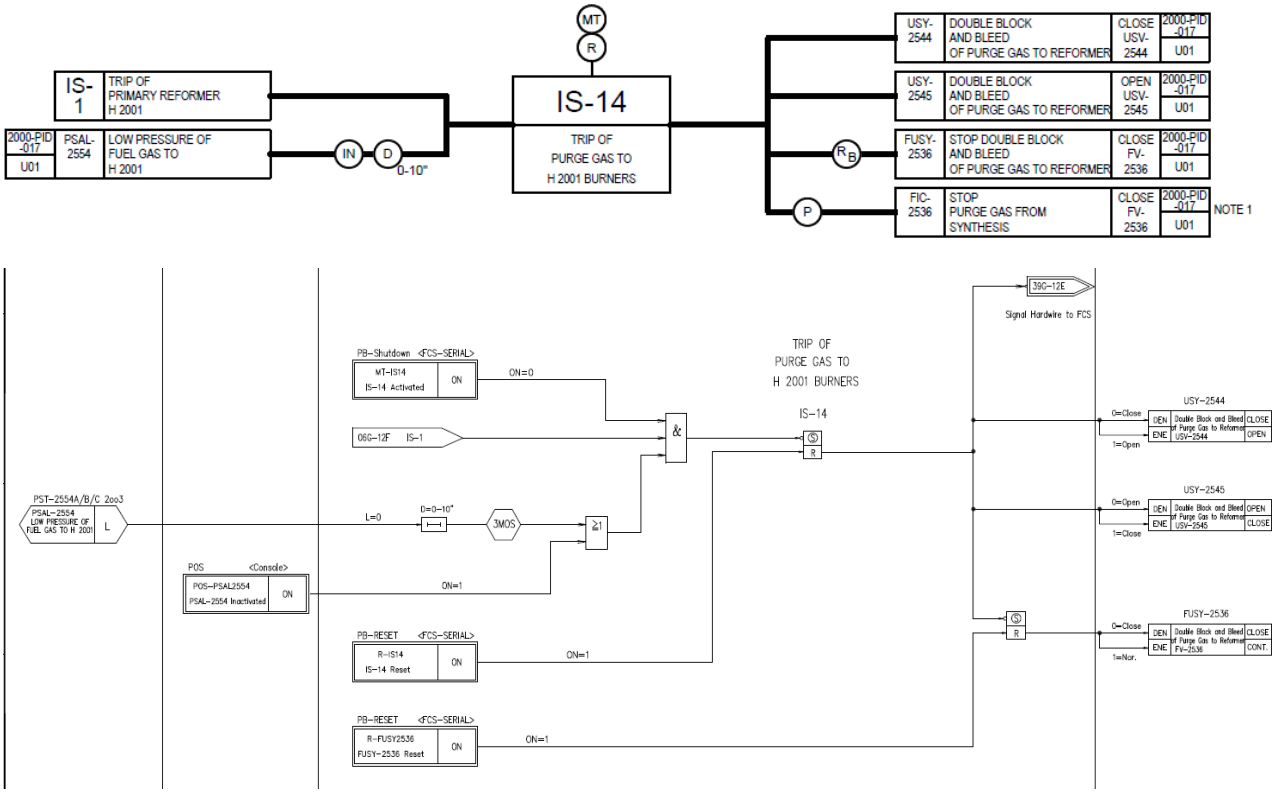
The causes for IS-14 trip are:

- Manual panel trip
- Trip of primary reformer H 2001, IS-1
- Low pressure of fuel gas to H 2001, PSAL-2554

The following actions are carried out automatically:

- Enable double block and bleed of purge gas to reformer, close USV-2544
- Enable double block and bleed of purge gas to reformer, open USV-2545
- Enable double block and bleed of purge gas to reformer, close FV-2536 - solenoid FUSY-2536 is de-energized
- Stop purge gas from synthesis, close FV-2536 - controller FIC-2536 is switched to manual mode with 0% output

Interlock Diagram



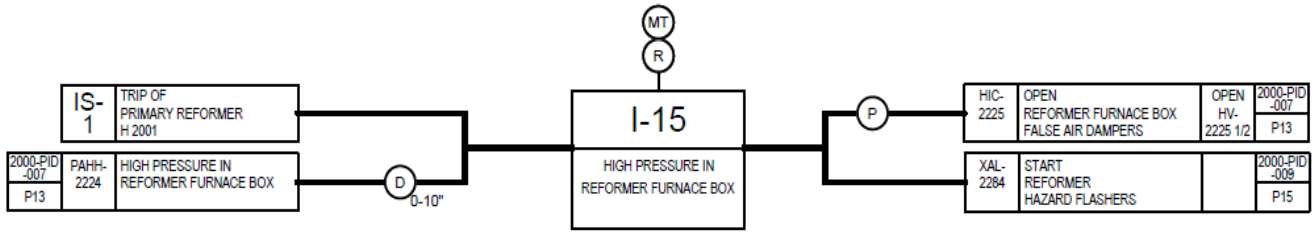
8.14 I-15: High pressure in reformer furnace box

The causes for I-15 trip are:

- Manual panel trip
- Trip of primary reformer H 2001, IS-1
- High pressure in reformer furnace box, PAHH-2224

The following actions are carried out automatically:

- Deleted
- Start reformer hazard flashers, XAL-2284



IS-5: Trip of draining of D 1001

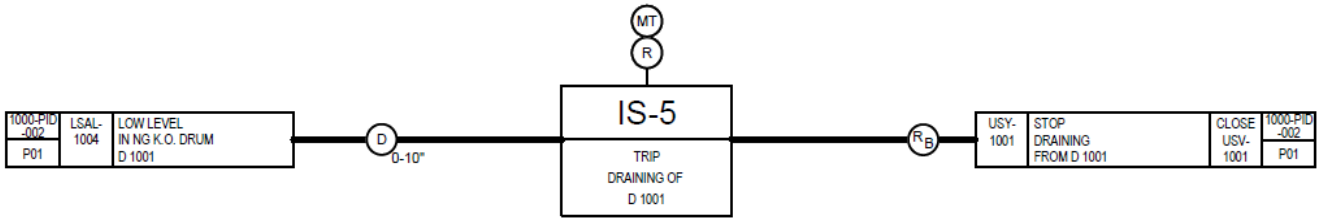
The causes for IS-5 trip are:

- Manual panel trip
- Low level in natural gas K.O. drum D 1001, LSAL-1004

The following actions are carried out automatically:

- Stop draining from D 1001, close USV-1001

Interlock Diagram



Logic Diagram